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Fossil Creek Wild and Scenic River

Draft Environmental Impact Statement for the Comprehensive River Management Plan



Forest Service

Coconino and Tonto National Forests

Red Rock and Payson Ranger Districts

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Fossil Creek Wild and Scenic River

Draft Environmental Impact Statement for the Comprehensive River Management Plan

Coconino and Tonto National Forests
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Abstract: This draft environmental impact statement (DEIS) documents the environmental effects analysis of six alternatives (including a "no action" alternative) that were developed for the draft Comprehensive River Management Plan (CRMP) for the Fossil Creek Wild and Scenic River. To meet the requirements of the Wild and Scenic Rivers Act, this project proposes a CRMP that formally designates the boundaries of the Fossil Creek Wild and Scenic River; describes Fossil Creek's river values (free flow, water quality, and outstandingly remarkable values); addresses user capacities; provides programmatic direction to guide management of Fossil Creek under the CRMP; proposes management actions that would support implementation of the CRMP; and outlines a monitoring and adaptive management program, all with the purpose of protecting and enhancing Fossil Creek's river values. The alternatives analyzed in this DEIS are the outcome of the public engagement and planning process that has followed designation of Fossil Creek as a Wild and Scenic River in 2009, and consist of Alternative A (No Action), Alternative B (Enhanced Protections), Alternative C (Non-motorized experience), Alternative D (Motorized Use and Refugia), Alternative E (Enhanced Recreation Opportunity with Phased Implementation), and Alternative F (Demand-based Access). These alternatives consider varying amounts of recreation and transportation infrastructure, amenities, and user capacities, but also hold many elements in common, such as river values, management direction, monitoring and adaptive management, and the overall goal of protecting and enhancing river values. All alternatives propose programmatic amendments of the Coconino and Tonto forest plans.

Please submit comments on the DEIS and draft CRMP by February 28, 2019 by email, mail, fax, or in person (8am-4:30pm M-F). E-mail electronic comments, including attachments, in Word (.doc), portable document format (.pdf), rich text format (.rtf), text (.txt), and hypertext markup language (.html) to comments-southwestern-coconino-redrock@fs.fed.us. Mail to: Fossil Creek CRMP, P.O. Box 20429, Sedona, AZ 86341. Fax to: (928) 203-7539. In Person: Red Rock Ranger District Office, 8375 State Route 179, Sedona, AZ 86351.

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Summary

The Fossil Creek Wild and Scenic River (WSR) was designated by Congress in 2009. Because of this designation, the Forest Service must establish a Comprehensive River Management Plan (CRMP) to guide management of the 17-mile river corridor and protect and enhance its free flow, water quality, and outstandingly remarkable values. This Draft Environmental Impact Statement (DEIS) discloses the direct, indirect, and cumulative environmental impacts that would potentially result from implementing the CRMP for the Fossil Creek WSR and alternatives to that proposal. The CRMP is a separate document that accompanies this EIS. The CRMP would include both programmatic management direction and site-specific actions, so both levels of analysis are completed in this DEIS.

The Fossil Creek WSR is located within the administrative boundaries of the Coconino and Tonto national forests (NFs) in central Arizona (figures 1 and 2). On the Coconino NF, the WSR is accessed from State Route 260 on Forest Road (FR) 708, approximately five miles east of Camp Verde. On the Tonto NF, the WSR is accessed from the community of Strawberry, via FR 708. The Coconino National Forest is overseeing the planning effort. The Responsible Officials are the Coconino and Tonto National Forest Supervisors.



Figure 1. Fossil Creek Wild and Scenic River vicinity map

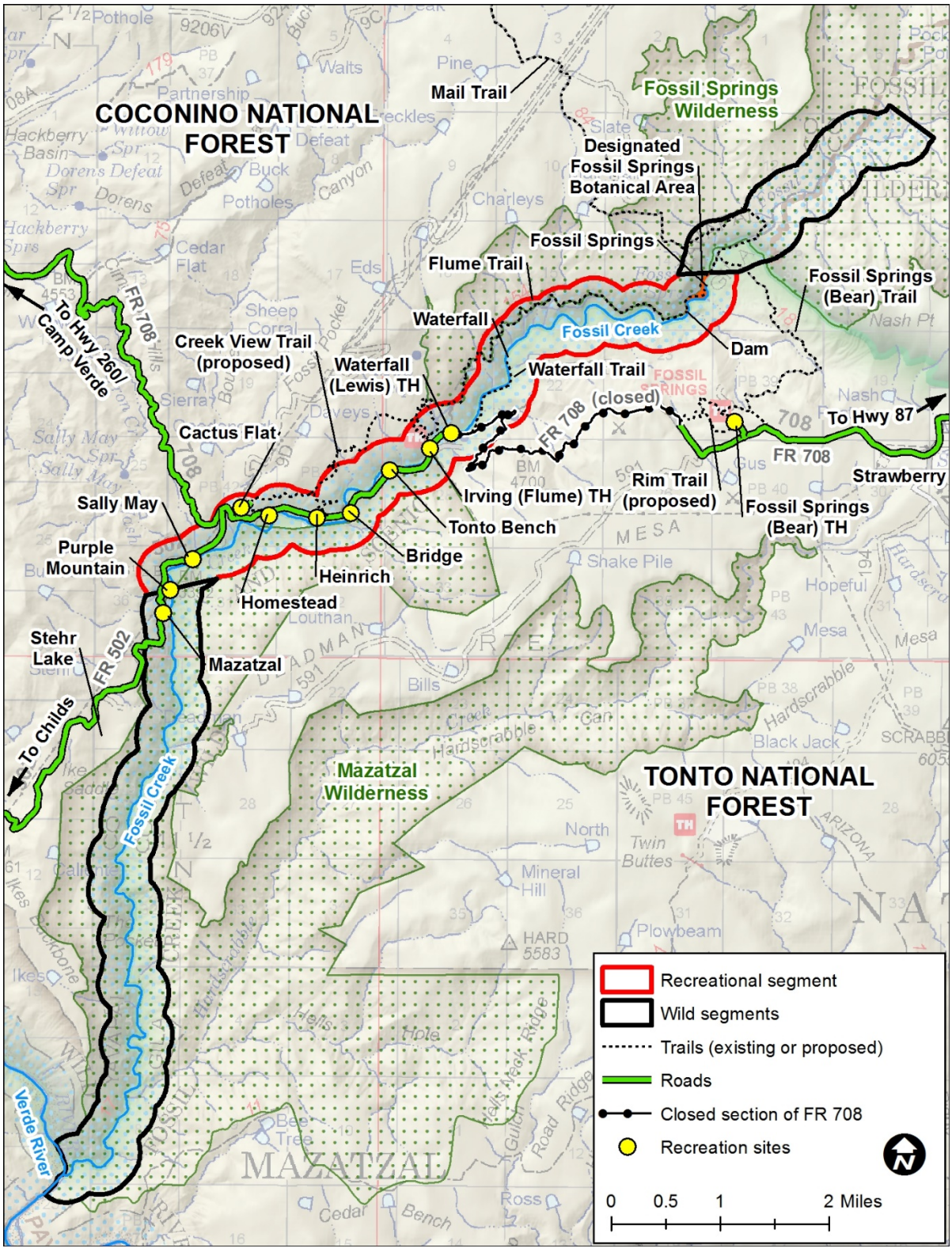


Figure 2. Map of key locations in the Fossil Creek Wild and Scenic River Corridor

Purpose and Need

The purpose of this project is to prepare a Comprehensive River Management Plan for the Fossil Creek Wild and Scenic River to meet the requirements of Section 3(d)(1) of the Wild and Scenic Rivers Act (WSRA). To meet these requirements, there is a need to develop management direction to provide for the protection and

enhancement of Fossil Creek's river values for the benefit and enjoyment of present and future generations. In accordance with WSRA Section 3(d), "the plan shall address resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of this Act." There is a need to amend the Land and Resource Management Plan for the Coconino National Forest (USDA FS 2018) and the Land and Resource Management Plan for the Tonto National Forest (USDA FS 1985, as amended and under revision) to incorporate the management direction provided by the CRMP and modify the boundaries of the Fossil Springs Botanical Area. Currently, neither plan has sufficient guidance that would protect river values, and the Botanical Area is described inconsistently between the two forest plans.

Following removal of a dam and restoration of full water flows to Fossil Creek in 2005, public use of the river corridor has increased substantially. Recreational use during the summer season grew from an estimated 20,000 visitors in 2006 (Rotert 2013) to approximately 86,000 visitors in 2015 (DeSutter 2015). That same year, over 43,000 additional visitors were turned away because of lack of parking space in the corridor. Recreational use in Fossil Creek after restoration of full flows was essentially unconstrained, and although capacity management and some facilities have been expanded in recent years the amenities present in Fossil Creek remain limited in their ability to accommodate recreational demands and protect river values. Impacts to water quality, vegetation, wildlife, and heritage resources have been observed in recent years as a result of this unconstrained recreation. An interim management reservation/permit system was implemented in 2016, which limited the number of vehicles accessing the corridor per day during the seasons of highest use. There is a need for a long-term management plan and site-specific actions that protect river values and other biological, physical and social resources while managing recreational access, use, and amenities at levels that strive to meet demand but are consistent with the protection of river values.

Natural and Cultural Setting

Fossil Creek is one of Arizona's rare warm water perennial streams, flowing from a complex of springs known as Fossil Springs. Its water is a constant 72 degrees Fahrenheit at the springs, which discharge 20,000 gallons per hour. Specifically, Fossil Creek originates from springs below the confluence of Sand Rock and Calf Pen canyons and flows in a southwesterly direction through a deep, isolated and rugged canyon for approximately 14 miles before entering the Verde River, three miles below the historic Childs Power Plant. Along the way, Fossil Creek flows through the Fossil Springs Wilderness and the Mazatzal Wilderness.

Fossil Creek is prized for its interrelated parts, including its length, continuous and abundant flow, elevation gradient, unfragmented nature, and presence of extensive travertine deposits. Fossil Creek is a principal tributary to the Verde River, Arizona's only other wild and scenic river. As the only intact perennial system with continuous flow without any water diversions in Arizona, Fossil Creek is the only uninterrupted system between the Verde River and the Mogollon Rim, spanning and connecting a number of biotic communities. This results in highly diverse terrestrial and aquatic habitat, and Fossil Creek supports numerous plant and animal species, many of which are rare. High in calcium carbonate, the waters continually lay down large deposits of travertine. That rock-like substance encases whatever happens to fall into the streambed, forming the fossil-like formations for which the area is named. The water also forms spectacular clear pools that range from aquamarine to deep blue.

Human occupation and use of Fossil Creek has been ongoing since prehistoric times. There is evidence of use by native peoples from as long as 10,000 to 12,000 years ago, and various groups of native peoples have lived in the area over the centuries. Fossil Creek is a traditional territory for the Western Apache and Yavapai, and was critical in maintaining cultural continuity in these groups through the period of forced relocation in the late 19th and early 20th centuries. In fact, for its important role in American Indian traditional practices and spiritual wellbeing, Fossil Creek is separately in the process of being nominated to the National Register of Historic Places as a Traditional Cultural Property (TCP). More recently, concurrent occupations of Fossil Creek by the indigenous Apache and Yavapai and Anglo engineers and workers occurred in association with the Childs-Irving hydroelectric power system, Arizona's first such system.

Fossil Creek's natural and cultural setting are described in detail in chapters 1 and 2 of the CRMP and throughout this DEIS.

River Values

Fossil Creek's unique natural and cultural attributes contribute to the values for which it was designated a Wild and Scenic River. These are referred to as "outstandingly remarkable values" (ORVs). The specific ORVs identified for Fossil Creek are:

- Geology (specifically its travertine system)
- Biological (defined as both wildlife and fisheries populations and habitats)
- Western Apache and Yavapai Traditional and Contemporary Cultural Values
- Recreation

These ORVs, combined with Fossil Creek's free flow and water quality, comprise what is referred to as the river values. Management of Fossil Creek is required to protect and enhance its river values, and analysis in this DEIS is focused on these river values. The river values are described in detail in Chapter 2 of the CRMP.

Public Involvement and Issues

Collaboration with interested publics, agencies, tribes, and other organizations has been critical to shaping the planning process and alternatives analyzed in this EIS. Collaboration and public involvement have occurred consistently throughout the development of the Fossil Creek CRMP through informal and formal opportunities. Though development of the Fossil Creek CRMP began in 2009, management of and planning for Fossil Creek has occurred for far longer.

The following themes emerged from comments received during comment periods prior to 2016. These earlier comment opportunities took place before implementation of the reservation system in 2016, so they reflect observations of pre-reservation system visitation levels and patterns.

1. **Recreation opportunities and resource/traditional use impacts:** Most commenters supported providing a full range of recreation opportunities, such as swimming, kayaking, hiking, camping, biking, motorized access, and horseback riding. However, a majority of commenters stated the impacts associated with recreation use at the time were not acceptable or sustainable, particularly to the river and fisheries resource. The Yavapai and Western Apache tribes have indicated that unmanaged recreation use impacts traditional and contemporary cultural sites and practices.

   Regarding visitor capacity, many commenters stated the Fossil Creek area was receiving too many daily visitors and recommended limiting the number of cars and people. Others did not want limitations that would reduce access to the area, specifically to the Childs recreation area on the Verde River (south on Forest Road 502 outside of the Fossil Creek Wild and Scenic River Corridor) and the community of Strawberry. Most commenters supported access for administrative uses, fire and emergency response, and search and rescue. Most commenters also supported access for people with disabilities.

2. **Level of recreation development:** Some commenters were supportive of improving existing and providing additional developed facilities, such as paved parking, trailheads, restrooms, interpretation kiosks, trash receptacles, hosts or site-stewards, helispots, picnic and shade shelters, and education programs. Other commenters preferred that development be limited or decreased to maintain a more primitive experience. Several commenters wanted implementation, including phases of development, to be clearly identified and described.

3. **Public health and safety:** Prior to the 2016 seasonal reservation system, visitors could access the WSR corridor from Highway 260 after hours and on days when Forest Service personnel were not present. This resulted in unmanaged parking and blocked access as visitors parked haphazardly in undesignated spots along the roadway. Due to blocked roads, critical personnel and visitors could be prevented from entering or exiting the corridor in the event of an emergency. Local government agencies, including Gila County, indicated a need to improve public preparedness, particularly for those visitors who access the WSR

corridor from Strawberry and hike to Fossil Springs. Over time, the numbers of search and rescue operations increased as visitation to Fossil Creek increased.

4. **Recreation use fees**: Some commenters expressed concern that charging a fee to access Fossil Creek would prohibit some groups from enjoying the area. Other commenters suggested that a "reasonable fee" was appropriate, especially if it supported protection of the area. Comments were mixed in terms of how recreation fees and overall recreation use would benefit or impact local communities.

These themes informed the range of management alternatives and activities included in alternative concepts that were released for comment in late 2016. Issues raised in comments on the alternative concepts were used to modify the preliminary alternatives and inform effects analyses in this EIS.

Key Issues for Analysis

The following key issues form the basis for modifications of the preliminary alternatives and help frame the effects analysis in Chapter 3 of this EIS.

Recreation Use and Visitor Capacities

Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.

Noise and crowding from high levels of recreational use in Fossil Creek may negatively impact recreation experience.

Recreation Management

Restricting swimming, particularly at the Waterfall, may negatively impact the diversity of recreation opportunities Fossil Creek provides and the recreation experience of its visitors by limiting the primary reason many visitors go to Fossil Creek.

Restricting boating (kayaking, packrafting) may negatively impact the diversity of recreation opportunities Fossil Creek provides and would limit access to a boating opportunity that is unique in the U.S. due to its travertine and, in Arizona, due to its year-round navigability.

Restricting access to the Fossil Springs area eliminates a popular backcountry recreation opportunity in the wild and scenic river corridor.

Allowing camping in the Fossil Creek corridor, including in the Fossil Springs area, increases the diversity of available recreation opportunities.

Allowing camping may increase impacts to natural and heritage resources and result in additional trash in the Fossil Creek corridor.

Managing entry into the Fossil Creek corridor with a reservation system or similar tool may exclude potential visitors due to technical challenges posed by using the reservation system or financial burden of paying a fee.

Infrastructure Development

Additional infrastructure development may reduce the wild character and scenic integrity of Fossil Creek.

Additional infrastructure, such as toilets, trash facilities, improved parking, informational signage, and designated creek access, may reduce the impacts of recreational use on corridor resources and improve visitor behavior.

Motorized Access

Increasing motorized access to the Fossil Creek corridor from the Strawberry side would provide an opportunity for motorized recreation in the Fossil Creek area, particularly for those from the Strawberry area who may be unable to hike into Fossil Creek, and may decrease emergency response times for the Gila County Sheriff's Office and Pine-Strawberry Fire District.

Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.

Economic and Commercial Opportunities

Limiting public use of and/or access to Fossil Creek may negatively impact local economies by reducing visitors who may patronize local businesses.

Commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may increase local economic opportunity, increase recreation opportunities, and limit impacts of recreation on corridor resources by improving visitor behavior.

Authorizing commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may detract from the wild and scenic character of the area and privilege access for those who are able to pay for services.

Alternatives

A range of alternatives has been developed for the draft CRMP / EIS. These alternatives are the result of public and partner engagement since 2009 and lessons learned through interim management of the river corridor.

The alternatives include Alternative A (No Action) and five action alternatives: Alternative B (Enhanced Protections), Alternative C (Non-motorized Experience), Alternative D (Motorized Use and Refugia), Alternative E (Enhanced Recreation Opportunities with Phased Implementation), and Alternative F (Demand-based Access). Alternative E is the proposed action. The action alternatives, representing possible management scenarios that would be reflected through the CRMP, vary in the amount of visitor use, the level of recreation facility development, and the types of access that would be accommodated. The alternatives also include a variety of restoration actions. Key points of the alternatives are:

- Alternatives B-F provide management direction and a monitoring and adaptive management strategy for protecting Fossil Creek's river values.
- Alternatives A-E continue the reservation system during the high-use season, as established through the 2016 interim management, unless determined to no longer be necessary. Alternative F does not require a reservation to park within the river corridor.
- Restoration activities would occur across all action alternatives to improve watershed condition. Amounts of restoration vary between 35 to 38 acres.
- Visitor capacity allowed within the Fossil Creek river corridor increases within the action alternatives between Alternative B at 560 people at one time (PAOT) or 112 vehicles and Alternative F at 2,500 PAOT or 500 vehicles.

The alternatives are described in detail in Chapter 2 of the EIS.

Alternative A – Current Management (No Action)

Alternative A, as the "no action" alternative, serves as the basis of comparison for analyzing the environmental impacts of implementing the action alternatives. Alternative A represents a continuation of current management of the Fossil Creek and the surrounding area. Interim management, such as capacity control and restoration activities, would continue as needed.

- Visitor use would continue to be managed via a seasonal reservation system effective when vehicle capacity control is needed (approximately April 1 to Oct. 1).
- Parking capacity would remain at 148 vehicles and 780 people at one time (PAOT).
- Forest Service personnel would continue to provide visitor information at temporary entry booths during reservation system.
- No camping would be allowed during the reservation system but would be allowed during the winter season within specified areas.

Alternative B – Enhanced Protections

Alternative B would provide a more primitive visitor experience in Fossil Creek and emphasize protection of natural and cultural resources with minimal development of new facilities and infrastructure and a lower user capacity. Existing recreation sites, roads, and trails would be retained but not expanded, and a minimal amount of facility and infrastructure improvements would support the sustainability of the recreation sites and transportation infrastructure.

- Additional development would be minimal.
- No camping would be allowed within the permit area during the reservation system, but a limited amount would be allowed during the winter season within specified areas.
- Visitor capacity in this alternative would be reduced to 112 vehicles and 560 PAOT.

Alternative C – Non-Motorized Experience

Alternative C would establish a non-motorized experience where visitors explore Fossil Creek primarily by foot, by bicycle, or by horse and develop additional trails for hiking, bicycling, and equestrian use. A lower user capacity would support a quieter recreation experience. Trail access to the historic dam and Fossil Springs would be eliminated to minimize the effects of human presence. Additional parking and visitor facilities would be developed at Cactus Flat and Homestead to serve as the primary entry points into the river corridor. Outside of the reservation system, visitors would drive into the river corridor to park in existing parking lots.

- Some existing recreation sites would be closed.
- Addition to the non-motorized trail system would occur in Middle Fossil and on the Strawberry side.
- Limited year-round camping would be allowed at Cactus Flat within the river corridor and at the proposed Rim Trailhead on the east side.
- Visitor capacity in this alternative would be reduced to 132 vehicles and 660 PAOT.

Alternative D – Motorized Use and Refugia

Alternative D would expand motorized access to Middle Fossil by increasing road connectivity and providing for scenic driving. The currently closed portion of Forest Road (FR) 708 would be re-opened to all motor vehicles, after completed road repairs. Some trail access to Fossil Springs and the Waterfall would be eliminated in order to maximize relatively undisturbed habitat (refugia) areas. New facility and infrastructure development would be focused on facilitating motorized access and supporting increased use at and sustainability of recreation sites.

- This alternative allows maximum motor vehicle access to the corridor, allowing people to drive through one entrance and out the other.
- Some recreation sites and the Fossil Spring Trail would be closed.
- Scenic drive-through permit would be issued for those not needing a full-day parking permit.
- No camping would be allowed year-round.

- Visitor capacity, over time, could be increased to a maximum of approximately 169 vehicles and 845 PAOT, including the scenic drive-through component.

Alternative E – Enhanced Recreation Opportunities with Phased Implementation (Proposed Action)

Alternative E is designated as the "proposed action" because it includes the most flexibility to increase capacity and recreation infrastructure in the future, if appropriate. This alternative would maximize recreation opportunities while providing protection for river values. Phased addition of parking and visitor facilities could occur at Cactus Flat, Heinrich, and Irving to support increased user capacity. Additional trails for hiking, bicycling, and equestrian use would be constructed. The currently closed portion of FR 708 would be re-opened to motor vehicles less than 62 inches wide, after completed road repairs.

- Additional trail and infrastructure development would occur to support all existing recreation sites.
- A limited amount of year-round camping would be allowed at designated sites.
- Motorized trail permit would be issued for those with vehicles less than 62 inches wide.
- Initially, capacity would reflect current management (154 vehicles and 780 PAOT). Over time, adaptive management could increase capacity to a maximum of 1,350 PAOT and 270 vehicles contingent on funding availability and establishing facilities and infrastructure that are able to support higher amounts of use.

Alternative F – Demand-based Access

Alternative F would meet anticipated demand for recreational use in Fossil Creek through 2030 in order to prevent the need for a reservation system. Cactus Flat and Homestead would serve as the primary entry point into the river corridor during the high-use season. A large parking area at Cactus Flat, with parking at several other recreation sites, would exist. Like in Alternative C, emphasis would be on non-motorized use where visitors explore much of Middle Fossil by foot, bicycle, or horse during the high-use season to prevent traffic congestion. New trails for hiking, bicycling, and equestrian use would be constructed. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots.

- Does not require a reservation to park or camp within the river corridor.
- Limited year-round camping would be at designated campsites in Homestead.
- Additional trail and infrastructure development would occur to support all existing recreation sites; however, the Fossil Springs trail would be removed.
- Visitor capacity would be increased to a maximum of 500 vehicles and 2,500 PAOT contingent on funding availability and establishing facilities and infrastructure that are able to support higher amounts of use.

Analysis and Conclusions

Detailed environmental impact analysis is located in Chapter 3 of the EIS. Topics analyzed in detail are:

- Free flow, water quality, water quantity, riparian function, soil condition, and air quality
- Geology
- Wildlife, vegetation, and rare plants
- Fish and other aquatic species
- Heritage resources (including Western Apache and Yavapai traditional and contemporary cultural values)
- Recreation
- Socioeconomics
- Scenery

Overall, it is anticipated that implementation of the CRMP, which would include applying management direction (desired conditions, standards, and guidelines) to activities in the WSR corridor and implementing a monitoring and adaptive management strategy, would contribute to protection and enhancement of river values. Analysis was primarily focused on the amount of ground disturbance possible in the WSR corridor and potential impacts of human presence on natural and cultural resources and visitor experience. Differences in amounts of ground disturbance among alternatives are small and measures such as recreation site and trail design and adaptive management would reduce potential for disturbance adversely impacting corridor resources. Thus, although ground disturbance has potential for impacts, it is not anticipated that the alternatives would degrade river values as a result of ground disturbance.

The number of visitors differs more substantially among alternatives. The analysis indicates that alternatives with more visitors have greater potential for impacts such as perceived crowding (potentially resulting in “creep” of recreational use out of established recreation sites) and vegetation trampling and wildlife disturbance. However, it is anticipated that application of management prescribed by the CRMP (e.g. recreation site design, managing the timing and location of visitor use, and visitor education) would reduce the potential for negative impacts. Further, the monitoring strategy (described in Chapter 6 of the CRMP) would allow for detection of potential negative impacts and adaptive management would provide for corrective actions to be taken to ensure that river values are not adversely impacted or degraded.

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Chapter 1. Purpose of and Need for Action

Introduction

The Forest Service has prepared this environmental impact statement (EIS) to comply with the National Environmental Policy Act[1] (NEPA), the Wild and Scenic Rivers Act[2] (WSRA), and other Federal and State laws and regulations. This DEIS discloses the direct, indirect, and cumulative environmental impacts that would potentially result from implementing the proposed comprehensive river management plan (CRMP) for the Fossil Creek Wild and Scenic River and alternatives to that proposal. The CRMP is a separate document that accompanies this EIS. The CRMP would include both programmatic management direction and site-specific actions, so both levels of analysis are completed in this DEIS.

This document is organized into four chapters and other additional material:

Chapter 1. Purpose of and Need for Action: This chapter describes the background of the Fossil Creek CRMP, the purpose of and need for the project, the framework for the decision to be made, the collaboration and public involvement that has occurred throughout the development of the project, and permits necessary to implement the CRMP.

Chapter 2. Alternatives, Including the Proposed Action: This chapter describes in detail the proposed action and the alternative scenarios for managing the Fossil Creek Wild and Scenic River (collectively, the alternatives). These alternatives were developed based on key issues raised by the public and other agencies, themes that emerged through public and partner engagement, and the unique resources and management needs of Fossil Creek. This chapter also describes actions considered but eliminated from detailed study, and provides a summary table of environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the predicted environmental effects of implementing the proposed action or other alternatives. This analysis is organized by resource area.

Chapter 4. Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during development of the environmental impact statement.

References: This section provides a list of literature used to inform the analysis in the EIS.

Glossary and Acronyms: This section provides a glossary of key terms and acronyms used in the EIS.

Index: The index provides a list of topics by page number.

Appendices: The appendices provide more detailed information to support the analysis presented in the EIS. The appendices are contained in a separate document.

Additional documentation, including the complete analysis for each resource, may be found in the project record located at the Red Rock Ranger District Office, 8379 State Route 179, Sedona, Arizona. Key project documents, including this EIS, the draft CRMP, and all specialist reports, are available on the project website at http://tinyurl.com/FossilCreekCRMP.

Project Overview and Background

Fossil Creek is a perennial creek in central Arizona (figures 1-1 and 1-2) and is located on National Forest System lands managed by the Coconino and Tonto national forests. Because of its year-round water flow in an otherwise

[1] 42 U.S. Code 4321, Public Law 91-190 (Jan. 1, 1970), as amended.
[2] 16 U.S. Code 1271-1278, Public Law 90-542 (Oct. 2, 1968), as amended.

arid region, Fossil Creek possesses a rich ecosystem and a long history of human occupation and use, and has undergone numerous management changes in recent years.

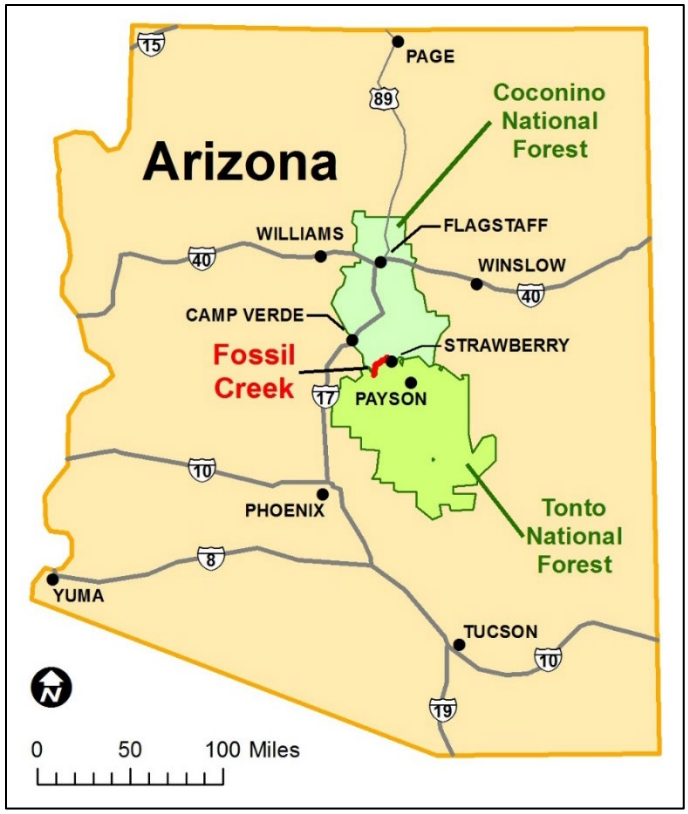


Figure 1-1. Location of Fossil Creek in central Arizona

Human occupation and use of Fossil Creek has been ongoing since prehistoric times. There is evidence of use by native peoples from as long as 10,000 to 12,000 years ago, and various groups of native peoples have lived in the area over the centuries. Fossil Creek is a traditional territory for the Western Apache and Yavapai, and was critical in maintaining cultural continuity in these groups through the period of forced relocation in the late 19th and early 20th centuries. In fact, for its important role in American Indian traditional practices and spiritual wellbeing, Fossil Creek is separately in the process of being nominated to the National Register of Historic Places as a Traditional Cultural Property (TCP). More recently, concurrent occupations of Fossil Creek by the indigenous Apache and Yavapai and Anglo engineers and workers occurred in association with the Childs-Irving hydroelectric power system, Arizona's first such system.

The rough topography of Fossil Creek has always made Fossil Creek an isolated place, even to this day, but the construction of the Childs-Irving hydropower system brought with it the bustle of activity. The first water rights claim in Fossil Creek was filed in 1900, which led to the development of the hydropower system and diverted Fossil Creek's waters from 1909 to 2005, which facilitated development of mines in the Prescott, Jerome, and Humboldt areas and power delivery to Phoenix.

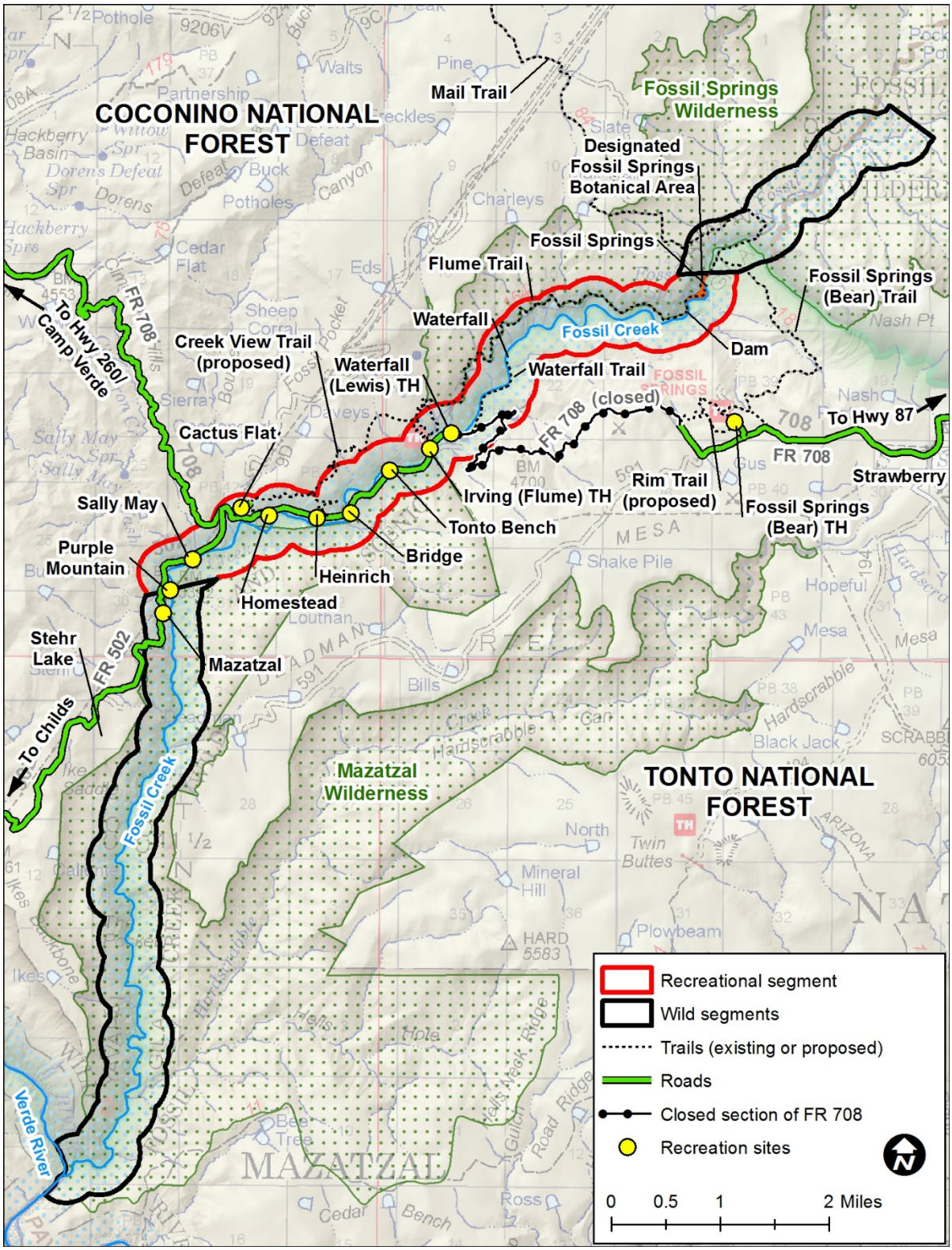


Figure 1-2. Map of key locations in the Fossil Creek Wild and Scenic River Corridor

Fossil Creek is said to represent one of the largest river recovery efforts in the Southwest. Federal and state agencies and restoration groups embarked on restoration in 1999, a decade before Fossil Creek was designated as a wild and scenic river. The Federal Energy Regulatory Energy Commission (FERC) authorized the decommissioning of the Childs-Irving hydropower system, operated by Arizona Public Service (APS), in its 2004 Environmental Assessment for Surrender of License-Childs Irving Project-FERC Project No. 2069-007.

Decommissioning and restoration actions began in 2004 and continued until the project's completion in 2010. Within that timeframe, multiple actions occurred.

- 2004: Installation of a permanent fish barrier in the Mazatzal Wilderness and removal of non-native fish.
- June 2005: Fossil Creek waters were no longer re-directed into flume, which resulted in full flows restored to Fossil Creek. A ceremony on June 18, 2005 recognized the free-flowing waters.
- April 2009: Completion of historic dam lowering, which began in 2008.
- 2010: Childs-Irving power plant infrastructure removal completed, except at Childs and a few remnants along the corridor including foundations at Irving and segments of the flume.
- 2010: The Flume Road, an administrative road driven by APS and the Forest Service, was decommissioned and narrowed, as part of APS decommissioning efforts. This included the removal of multiple side drainage crossings, including a trestle bridge. The Flume Road is now used as a non-motorized trail.
- 2010: After Stehr Lake no longer received water from the hydropower system, it was anticipated that it would dry naturally. By 2010, it was completely dry and re-shaped, with its dam removed by 2010. Previously, in 2006, salvaged razorback suckers were relocated to the Verde River followed by piscicide application in Stehr Lake to exterminate the non-native fish that threatened Fossil Creek.

Restoration actions continued after decommissioning of the Childs-Irving system. After non-native fish were discovered above the permanent barrier, a temporary fish barrier was installed in 2011 upstream of the permanent barrier. Repairs to the permanent fish barrier were completed in two stages in 2012. Throughout this time, piscicide treatments were used to limit the non-native fish. The temporary barrier was removed in May 2013 after repair of the permanent barrier. Additionally, restoration of sensitive areas impacted by parking and recreational use in the riparian area have occurred since 2011.

These restoration actions elevated Fossil Creek's ability to be designated as a Wild and Scenic River in 2009 and enhanced its attractiveness to recreationists. Fossil Creek provides opportunities for a variety of recreational activities, particularly in Middle Fossil[3] where visitors are able to easily access the creek from adjacent parking lots. Recreational activities include swimming, hiking, backpacking, kayaking and pack rafting, wildlife viewing, bird watching, photography, picnicking, and learning about natural and cultural resources. Opportunities for fishing and hunting also exist.

Within the Fossil Creek river corridor, designated wilderness areas are accessible to those seeking a more primitive experience. Northeast of the recreational segment is the Fossil Springs Wilderness, which overlaps with the Fossil Springs wild segment, and southwest of the recreational is the Mazatzal Wilderness, which overlaps with the Mazatzal wild segment. The most common access into the Mazatzal Wilderness is via the Mazatzal recreation site in Middle Fossil, but visitor use of this wilderness is fairly light. Most visitors access the Fossil Springs Wilderness via the Fossil Springs Trail. It is also possible to access the Fossil Springs wilderness via the Mail Trail.

Visitor use studies over the past decade have attempted to document participation in recreational activities. Sightseeing was noted as the primary activity, followed by walking, swimming, hiking, wading, and watching wildlife, amongst others, according to a multi-year Fossil Creek visitor survey by Northern Arizona University (NAU) in 2007. Following the NAU study, the Forest Service collected information on recreational use from 2009-2013, with the most popular activities during the high-use season being swimming, camping, and hiking.

Visitor use increased dramatically after restoration of full flows. Social media and television and magazine articles encouraged visitors to seek out this unique Arizona environment, likely resulting in escalated use. Further, rapid

[3] "Middle Fossil" consists of the reach of Fossil Creek between the Mazatzal recreation site upstream to 1/4-mile above the Waterfall at the end of the Lewis (Waterfall) Trail.

population growth in Arizona likely contributed to increasing visitation. Visitation during the summer season increased from an estimated 20,000 visitors in 2006 to 80,000 visitors in 2013. As visitation to Fossil Creek first began to increase, recreational use was generally unmanaged in that access to the river corridor was unrestricted and few amenities such as toilets or designated parking areas were present.[4] In particular, visitation demand on holidays and weekends began to overwhelm the entrances, far exceed available parking, and create gridlock on the narrow FR 708. On the July 4 holiday weekend in 2015, for example, approximately 1,000 people were in the river corridor per day and almost 3,000 people were turned away at the entrance barricade over a three-day period.

Additionally, impacts to natural, cultural, and social values resulted from uncontrolled dispersed camping, creation of unplanned trails, excessive littering, and human and pet waste near the creek. The amount of area in the river corridor denuded by camping, unplanned trails, and vehicle parking increased from 2002 to 2011 (Rotert 2014). These impacts necessitated implementation of measures to manage visitor use and protect river values prior to the CRMP's completion. Measures included visitor capacity management, gates, delineated parking areas, improved signage, armored creek access, stabilization and rehabilitation of impacted areas, and targeted restrictions, such as of camping in certain areas, to reduce soil and vegetation disturbance. Additionally, a parking permit reservation system was implemented in 2016. The reservation system established a daily capacity of 148 vehicles (approximately 740 people) per day between April 1 and October 1 within the permit area. Monitoring indicated a decrease in denuded area beginning in 2012 (Rotert 2014).

In 2011, a four-mile portion of FR 708 between the Waterfall Trailhead and Strawberry was closed to public motor vehicle use because of safety concerns caused by rock falls and landslides presenting a hazard and damaging the road. This closure eliminated direct public access to Fossil Creek from the town of Strawberry. Prior to the partial FR 708 closure, recreational motor vehicle use on FR 708 between Strawberry and Fossil Creek was fairly common, although similar rock falls and landslides forced closure of the road in the past (Sergent, Hauskins, & Beckwith 1988).

Fossil Creek is remote and only accessible by primitive roads. On the Coconino National Forest, the Fossil Creek area is approximately 22 miles from the town of Camp Verde and accessed from State Route 260 and then FR 708. The 14-mile FR 708 is a rough dirt road. On the Tonto National Forest, Fossil Creek is either accessed by hiking four miles from the Bear (Fossil Springs) Trailhead off of FR 708 five miles west of the town of Strawberry or by a 45-mile drive via state routes 87 and 260 and FR 708 (figure 1-3). Though FR 708 passes through the Fossil Creek WSR corridor connecting the Camp Verde side to the Strawberry side, the four-mile section of road closed since 2011 prevents through traffic. Many Fossil Creek visitors come from the Phoenix metropolitan area, which is approximately 2.5 hours from Fossil Creek by road.

[4] The field of recreation ecology (e.g. Marion 2016; Marion et al. 2016) suggests that the impacts of recreational use can be mitigated through careful management and the provision of recreation infrastructure; therefore, high recreational use in a relatively unmanaged setting has greater potential to result in greater impacts to natural, cultural, and social values.

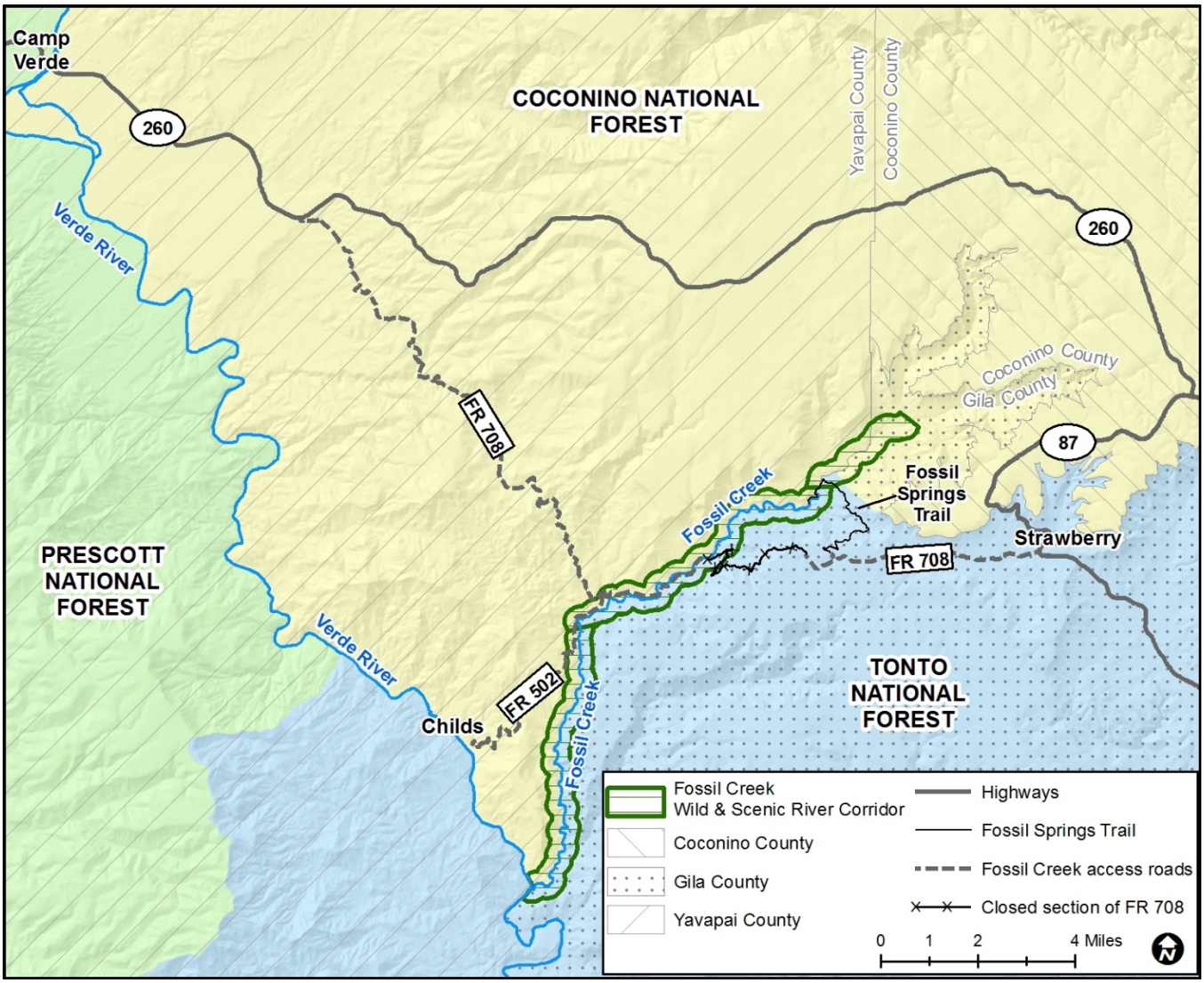


Figure 1-3. Access to Fossil Creek Wild and Scenic River

In September 2016, the Western Rivers Conservancy conveyed a 19-acre private land parcel within Fossil Creek's recreational segment, referred to as Heinrich, to the Forest Service in September 2016. Acquisition of this parcel resulted in contiguous federally managed land in the river corridor, ensuring the Forest Service's ability to manage the entire river corridor under the CRMP and providing additional management opportunities.

In recognition of Fossil Creek's unique characteristics, Congress designated[5] approximately 16.8 miles of Fossil Creek as a wild and scenic river in 2009. See chapters 1 and 2 of the CRMP additional detail on project background, a description of the boundaries of the wild and scenic river corridor, and information about Fossil Creek's river values.

WSRA requires the U.S. Forest Service, Fossil Creek's administering agency, to develop a CRMP for Fossil Creek. The overall purpose of the CRMP is to ensure protection and enhancement of Fossil Creek's river values (defined as its free-flowing condition, water quality, and outstandingly remarkable values (ORVs)—recreation, geology, biological characteristics, and Western Apache and Yavapai traditional and contemporary cultural values). The plan must address resource protection and the development of lands and facilities, establish user

[5] Public Law 111-11, March 30, 2009; 123 Stat.1147, §5001.

capacities, and develop other management direction and practices necessary to achieve the purposes of WSRA (§3(d)(1)). As such, the CRMP contains the following sections:

Chapter 1. Description of river setting: Describes Fossil Creek's history, the boundaries and classification of the wild and scenic river corridor, and the regulatory and planning context of the CRMP.

Chapter 2. River corridor resources: Provides detailed descriptions of Fossil Creek's river values, including their baseline and existing conditions, and summarizes other resource conditions.

Chapter 3. Management direction: Provides the desired conditions, standards, guidelines, and objectives for management of Fossil Creek.

Chapter 4. Visitor use and user capacity: Describes the existing and future kinds and amounts of public use in Fossil Creek and existing facilities and infrastructure, and estimates the maximum kinds and amounts of use Fossil Creek can sustain without degrading river values.

Chapter 5. Implementation of management actions: Describes management actions that may be implemented in and around the Fossil Creek corridor based on the analysis in this EIS, including any phased implementation.

Chapter 6. Monitoring and Adaptive Management: Describes monitoring that would be conducted in the Fossil Creek corridor to ensure protection and enhancement of the river values and adaptive management actions that could be taken to prevent river value degradation.

The Coconino National Forest has been leading development of the CRMP.[6] Development of the CRMP began in 2009 and has involved a substantial amount of public involvement (described in detail later in this chapter). While development of the plan has been underway, the Forest Service has implemented a series of interim management measures to protect Fossil Creek's river values. These have included recreation site improvements, visitor capacity management, and restoration actions.

Purpose of and Need for Action

The purpose of this project is to prepare a Comprehensive River Management Plan for the Fossil Creek Wild and Scenic River to meet the requirements of Section 3(d)(1) of the Wild and Scenic Rivers Act (WSRA). To meet these requirements, there is a need to develop management direction to provide for the protection and enhancement of Fossil Creek's river values for the benefit and enjoyment of present and future generations. In accordance with WSRA Section 3(d), "the plan shall address resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of this Act." There is a need to amend the Land and Resource Management Plan for the Coconino National Forest (USDA FS 2018) and the Land and Resource Management Plan for the Tonto National Forest (USDA FS 1985, as amended and under revision) to incorporate the management direction provided by the CRMP and modify the boundaries of the Fossil Springs Botanical Area. Currently, neither plan has sufficient guidance that would protect river values, and the Botanical Area is described inconsistently between the two forest plans.

Following removal of a dam and restoration of full water flows to Fossil Creek in 2005, public use of the river corridor has increased substantially. Recreational use during the summer season grew from an estimated 20,000 visitors in 2006 (Rotert 2013) to approximately 86,000 visitors in 2015 (DeSutter 2015). That same year, over 43,000 additional visitors were turned away because of lack of parking space in the corridor. Recreational use in Fossil Creek after restoration of full flows was essentially unconstrained, and although capacity management and some facilities have been expanded in recent years the amenities present in Fossil Creek remain limited in their ability to accommodate recreational demands and protect river values. Impacts to water quality, vegetation, wildlife, and heritage resources have been observed in recent years as a result of this unconstrained recreation. An

[6] Authority and management responsibility for the Fossil Creek Wild & Scenic River, including lands on the Tonto National Forest, was delegated to the Coconino National Forest Supervisor via letter dated June 3, 2013.

interim management reservation/permit system was implemented in 2016, which limited the number of vehicles accessing the corridor per day during the seasons of highest use. There is a need for a long-term management plan and site-specific actions that protect river values and other biological, physical and social resources while managing recreational access, use, and amenities at levels that strive to meet demand but are consistent with the protection of river values.

Decision Framework

The forest supervisors for the Coconino and Tonto national forests are the Responsible Officials for this project. The Responsible Officials' decision will:

- Finalize Fossil Creek's ORVs;
- Establish a final boundary for the wild and scenic river corridor;
- Establish the programmatic management direction (desired conditions, standards, guidelines, and objectives) that will guide future management of Fossil Creek and amend the Coconino and Tonto forest plans to incorporate this direction;
- Establish a monitoring and adaptive management program;
- Establish a numerical user capacity for the wild and scenic river corridor; and
- Establish which alternative (or combination of alternative components, if a combination can be made without changing effects disclosed in this EIS), including site-specific actions and any associated resource protection measures, will be incorporated into the CRMP.

The Responsible Official's decision will be based on compliance with law, regulation, and policy; consultation with cooperating and regulatory agencies and interested tribes; review of public input received throughout the planning process; review of the environmental consequences disclosed in this EIS and associated documentation; and the outcome of any administrative review process.[7]

Forest Plan Consistency

This project was reviewed for consistency with the Coconino and Tonto forest plans, and the following plan amendments were determined to be necessary.

The Land and Resource Management Plan (LRMP) for the Coconino National Forest (USDA FS 2018) would be amended to:

- Decrease the area of the Fossil Creek Designated Wild and Scenic River Special Area by four acres at T21N, R7E, E 1/2 Section 21 in order to comply with the requirements of Section 3(b) of the Wild and Scenic Rivers Act, which states, "boundaries shall include an average of not more than 320 acres of land per mile.…"
- Include the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the 2,892 acres within the Fossil Creek Designated Wild and Scenic River Special Area on the Coconino National Forest.
- Recommend an 11.6-acre addition to the Designated Fossil Springs Botanical Area in order to better incorporate the diverse vegetation community in the vicinity of Fossil Springs.

The LRMP for the Tonto National Forest (USDA FS 1985) would be amended to:

- Establish Management Area 4G, Payson Ranger District Fossil Creek Wild and Scenic River Management Area. This area would encompass approximately 2,170 acres and consist of the Wild and Scenic River

[7] This decision is subject to the project-level pre-decisional administrative review process set forth at 36 CFR 218, subparts A and B. Additionally, the plan amendments are subject to the pre-decisional administrative review process set forth at 36 CFR 219, subpart B.

Corridor established by Congress and modified by the CRMP to include a spring in the vicinity of Forest Road 708. Establishing this new Management Area would reduce the area of Management Area 4A (Mazatzal Wilderness) by approximately 1,509 acres, Management Area 4E (Proposed Fossil Springs Natural Area) by approximately 132 acres, and Management Area 4F (Payson Ranger District General Management Area) by approximately 529 acres.

- Incorporate (by reference) the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the Fossil Creek Wild and Scenic River Management Area mentioned above.
- Recommend designation of 9.4 acres of the Fossil Springs Botanical Area adjacent to and part of the Fossil Springs Botanical Area on the Coconino National Forest within the Fossil Creek Wild and Scenic River corridor. This recommended botanical area and associated plan direction would be incorporated into Management Area 4E and the new Management Area 4G (Fossil Creek Wild and Scenic River Management Area).

The forest plan amendments would be completed pursuant to the 2012 Planning Rule at 36 CFR 219.13. Appendix E details compliance with these requirements.

Collaboration and Public Involvement

Collaboration with interested publics, agencies, tribes, and other organizations has been critical to shaping the planning process and alternatives analyzed in this EIS. Collaboration and public involvement have occurred consistently throughout the development of the Fossil Creek CRMP through informal and formal opportunities. Informal opportunities have consisted of Fossil Creek stakeholder and Working Group meetings, field trips, contacts with visitors in Fossil Creek, and feedback provided to the Forest Service. Formal opportunities have consisted of public meetings, workshops, assessments, and comment periods. The following is an overview of these formal opportunities.

2010: "Rapid assessments" were conducted to engage with people recreating in Fossil Creek and a series of public workshops was held in Phoenix, Payson, and Flagstaff to discuss river values, desired conditions, the level of development desired, how to protect natural and cultural resources, education and information needs, and partnering opportunities.

2011: Scoping news releases were sent to media outlets in northern and central Arizona on March 27, 2011 and March 29, 2011 and the initial proposed action was made available on the Coconino and Tonto National Forest websites for a 30-day review and comment period. Open houses were held in Payson, Flagstaff, Camp Verde, and Phoenix. In response, the Forest Service received 340 comment letters, of which 62 were unique and one was a form letter generating 278 responses. Later in the year, additional design workshops were held in Payson, Phoenix, and Flagstaff.

2013: Seven management concepts were developed in collaboration with the Forest Service Region 3 Regional Office and scoped for public feedback. Open houses were held in Camp Verde and the Pine-Strawberry-Payson area.

2014: Based on public and internal feedback, and incorporating elements of previous alternatives and concepts, the Forest Service developed three new alternatives. These alternatives were scoped via targeted stakeholder engagement.

2015-2017: Based on public and internal feedback, and building on the alternatives developed in 2014, the Forest Service continued to update and expand the range of alternatives. The Forest Service re-scoped its proposed action and other alternative concepts on Nov. 29, 2016 with a Notice of Intent in the Federal Register to elevate environmental analysis from an environmental assessment to an EIS. In response to the 59-day comment period, the Forest Service received 305 comment letters, of which approximately 265 were unique and the others included a form letter generating 40 responses. Public open houses in

Payson and Camp Verde and other opportunities for engagement, including a telephone "town hall" and stakeholder meeting in Phoenix, accompanied the comment period.

2018: An additional alternative was developed based on further development of issues identified from public comments and other public input to expand the range of alternatives considered in the analysis. This alternative, plus the alternatives finalized based on feedback received during the 2016-2017 scoping period, are available for public review in this DEIS.

Chapter 4 of this EIS lists specific agencies consulted throughout development of the CRMP and summarizes government-to-government consultation with interested tribes. Arizona Game and Fish Department is a cooperating agency in this project.

The following themes emerged from comments received during comment periods prior to 2016. These earlier comment opportunities took place before implementation of the reservation system in 2016, so they reflect observations of pre-reservation system visitation levels and patterns.

5. **Recreation opportunities and resource/traditional use impacts:** Most commenters supported providing a full range of recreation opportunities, such as swimming, kayaking, hiking, camping, biking, motorized access, and horseback riding. However, a majority of commenters stated the impacts associated with recreation use at the time were not acceptable or sustainable, particularly to the river and fisheries resource. The Yavapai and Western Apache tribes have indicated that unmanaged recreation use impacts traditional and contemporary cultural sites and practices.

   Regarding visitor capacity, many commenters stated the Fossil Creek area was receiving too many daily visitors and recommended limiting the number of cars and people. Others did not want limitations that would reduce access to the area, specifically to the Childs recreation area on the Verde River (south on Forest Road 502 outside of the Fossil Creek Wild and Scenic River Corridor) and the community of Strawberry. Most commenters supported access for administrative uses, fire and emergency response, and search and rescue. Most commenters also supported access for people with disabilities.

6. **Level of recreation development:** Some commenters were supportive of improving existing and providing additional developed facilities, such as paved parking, trailheads, restrooms, interpretation kiosks, trash receptacles, hosts or site-stewards, helispots, picnic and shade shelters, and education programs. Other commenters preferred that development be limited or decreased to maintain a more primitive experience. Several commenters wanted implementation, including phases of development, to be clearly identified and described.

7. **Public health and safety:** Prior to the 2016 seasonal reservation system, visitors could access the WSR corridor from Highway 260 after hours and on days when Forest Service personnel were not present. This resulted in unmanaged parking and blocked access as visitors parked haphazardly in undesignated spots along the roadway. Due to blocked roads, critical personnel and visitors could be prevented from entering or exiting the corridor in the event of an emergency. Local government agencies, including Gila County, indicated a need to improve public preparedness, particularly for those visitors who access the WSR corridor from Strawberry and hike to Fossil Springs. Over time, the numbers of search and rescue operations increased as visitation to Fossil Creek increased.

8. **Recreation use fees**: Some commenters expressed concern that charging a fee to access Fossil Creek would prohibit some groups from enjoying the area. Other commenters suggested that a "reasonable fee" was appropriate, especially if it supported protection of the area. Comments were mixed in terms of how recreation fees and overall recreation use would benefit or impact local communities.

The above themes informed the range of management alternatives and activities included in the alternative concepts released for comment in late 2016. Issues raised in comments on the alternative concepts were used to

modify the preliminary alternatives and inform effects analyses in this EIS. These issues are described in the next section. Many of the comment letters expressed support for the reservation system implemented in 2016.

Key Issues for Analysis

Issues serve to identify effects or unintended consequences that may occur from the proposed action and alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues raised during scoping are critical in developing alternatives to the proposed action and informing the effects analysis, but issues may arise at any time during the planning phase of a project. Issues are framed as cause-effect relationships brought about by implementing elements of the project. The following key issues raised in comment letters received in response to the NOI form the basis for modifications of the preliminary alternatives and will help frame the effects analysis in Chapter 3 of this EIS. A crosswalk between the alternatives and key issues is provided in Chapter 2 in table 2-1.

Recreation Use and Visitor Capacities

Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.

Noise and crowding from high levels of recreational use in Fossil Creek may negatively impact recreation experience.

Recreation Management

Restricting swimming, particularly at the Waterfall, may negatively impact the diversity of recreation opportunities Fossil Creek provides and the recreation experience of its visitors by limiting the primary reason many visitors go to Fossil Creek.

Restricting boating (kayaking, packrafting) may negatively impact the diversity of recreation opportunities Fossil Creek provides and would limit access to a boating opportunity that is unique in the U.S. due to its travertine and, in Arizona, due to its year-round navigability.

Restricting access to the Fossil Springs area eliminates a popular backcountry recreation opportunity in the wild and scenic river corridor.

Allowing camping in the Fossil Creek corridor, including in the Fossil Springs area, increases the diversity of available recreation opportunities.

Allowing camping may increase impacts to natural and heritage resources and result in additional trash in the Fossil Creek corridor.

Managing entry into the Fossil Creek corridor with a reservation system or similar tool may exclude potential visitors due to technical challenges posed by using the reservation system or financial burden of paying a fee.

Infrastructure Development

Additional infrastructure development may reduce the wild character and scenic integrity of Fossil Creek.

Additional infrastructure, such as toilets, trash facilities, improved parking, informational signage, and designated creek access, may reduce the impacts of recreational use on corridor resources and improve visitor behavior.

Motorized Access

Increasing motorized access to the Fossil Creek corridor from the Strawberry side would provide an opportunity for motorized recreation in the Fossil Creek area, particularly for those from the Strawberry area who may be

unable to hike into Fossil Creek, and may decrease emergency response times for the Gila County Sheriff's Office and Pine-Strawberry Fire District.

Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.

Economic and Commercial Opportunities

Limiting public use of and/or access to Fossil Creek may negatively impact local economies by reducing visitors who may patronize local businesses.

Commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may increase local economic opportunity, increase recreation opportunities, and limit impacts of recreation on corridor resources by improving visitor behavior.

Authorizing commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may detract from the wild and scenic character of the area and privilege access for those who are able to pay for services.

Permits Necessary to Implement the CRMP

The following permits would be necessary to implement certain actions proposed in the CRMP. The need for other permits not listed here should be verified prior to implementation of specific actions.

Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States. An example of a project that may occur within the Fossil Creek WSR corridor requiring a 404 permit would be the construction of new bridges or repair of the existing gabion structure.

Any construction activities that disturb one or more acres of land would need to be permitted under the Arizona Pollutant Discharge Elimination System (AZPDES) Construction Activity General Permit for Stormwater. AZPDES permits are issued by the Arizona Department of Environmental Quality (see http://www.azdeq.gov/node/524) and would entail development and implementation of a stormwater pollution prevention plan (SWPP) consistent with ADEQ requirements. An example of a construction activity that may need to be permitted under the AZPDES program would be the construction of new parking areas that are an acre or more in size.

Development of a parking lot within the U.S. Department of Energy's Western Area Power Administration (WAPA) transmission line easement (**Alternative F**) would require a license agreement. This license agreement would describe the proposed use of the WAPA right of way, set forth the responsibilities of the parties to the agreement, and document WAPA's concurrence in the use of the right of way.

Chapter 2. Alternatives

This chapter describes the alternatives considered for the Fossil Creek Wild and Scenic River (WSR) Comprehensive River Management Plan (CRMP). It first summarizes the process used to develop the alternatives. Next it presents the alternatives in comparative form, highlighting the differences between the components of each alternative. Finally, it summarizes alternatives considered but eliminated from detailed study.

Alternative Development Process

Development of the CRMP began in 2009 after designation of Fossil Creek (FC) as a wild and scenic river. The planning process has evolved through numerous sets of alternatives and has been informed by multiple opportunities for stakeholders, partners, and the public to comment through meetings, workshops, and formal comment periods (as described in more detail in Chapter 1). The following is a general timeline of the CRMP planning history, including summaries of past versions of alternatives and management concepts. The final alternatives considered in this EIS are the outcome of this process; these final alternatives are described in detail in the "Components of Alternatives Considered in Detail" section below.

2009: Initial visioning for CRMP development was conducted with the FS planning team and stakeholder group.

2010: Public workshops were held to design future management scenarios and define river values. An initial group of alternative concepts was developed but not specifically scoped. These concepts consisted of:

- **Highly accessible**: Maximum visitation and high encounter levels; increased development. Concerns were expressed about impacts to resources and recreation experience.
- **Moderate access**: Visitor numbers limited by available designated parking and entry gate/shuttle system; fewer encounters; increased development; "compromise between some development and resource protection."
- **Limited access**: Few visitors; few encounters; minimal facilities; focus on resource protection and primitive recreational opportunities.

2011: Two alternatives were publicly scoped for 30 days and with several open houses. Additional public design workshops were held later in the year. These alternatives consisted of:

- **Proposed action**: Protect or enhance outstandingly remarkable values (ORVs) primarily by managing recreation impacts. Manage these impacts by controlling access, implementing limits on the number of users at one time, placing seasonal limits on the type of recreational opportunities available in the corridor, and developing and hardening specifically identified recreation sites. Day use only in summer and access via shuttle system; winter access via private vehicles. "Guess" at capacity under shuttle system of 500-1,200 people per day.
- **Stakeholder alternative**: Alternative proposed by group of conservation-oriented stakeholders. Focus on enhancement of natural resource ORVs by limiting the number of people and focusing use in certain areas. Some facility development or enhancement. Estimated limit of 300 persons at one time (PAOT).

2012: Further alternative development was completed based on comments received during the first round of scoping. Specifically, the shuttle system was removed from detailed consideration due to internal and external concerns expressed about the feasibility and economic sustainability of a shuttle system into the FC corridor.

Early 2013: Forest leadership approved four action alternatives and a no action, but these were not scoped. These alternatives consisted of:

- **No Action**: Continuation of current management; no development of a CRMP.

- **Alternative 1**: Would highlight the day use recreational experience and maximize the number of visitors with a high level of management and infrastructure. Permit would be required for use. Capacity = 2,072 PAOT.
- **Alternative 2**: Would highlight camping opportunities in several developed sites with facilities. FR 708 would be converted to motorized trail open to vehicles <60" wide from Irving to Fossil Springs Trailhead. Development of facilities and infrastructure would protect ORVs. Permit would be required for use. Capacity = 788 PAOT.
- **Alternative 3**: Would respond to tribal concerns related to camping by prohibiting camping in the most heavily used portion of the corridor. Motor vehicle access would be reduced, with FR 708 closed from the Waterfall Trailhead to the Fossil Springs Trailhead. Facilities and infrastructure would be less obvious on the landscape, with a greater emphasis on visitor self-reliance. Permit would be required for use. Capacity = 472 PAOT.
- **Alternative 4**: Would highlight the unique natural values of FC. Protection and enhancement of the ORVs and management of natural resources would occur with minimal human interaction. Emphasis on research opportunity. Public access would be very limited and provide opportunity for a nature-based or reflective experience in a primitive surrounding. Public facilities and management would not be obvious. Limited motor vehicle access. Permit would be required for use. Capacity = 80 PAOT.

Later in 2013, seven management concepts were developed with the Region 3 Regional Office and scoped for public feedback, along with open houses. These concepts consisted of:

- **Concept A (a place of beauty and enjoyment)**: Visitors would enjoy day use recreational offerings while protecting the resources that make FC special. Recreation would be focused at a hub (Irving), with minimal use/impacts outside of the hub.
- **Concept B (foot, hoof, or bike)**: Visitors would enjoy a non-motorized experience by exploring FC's recreation sites by foot, bike, or horse. Family-oriented hiking and biking opportunities would be encouraged, in addition to equestrian use and long hiking or backpacking opportunities.
- **Concept C (land ethic institute)**: FC would be a working research center, with a focus on better understanding, protecting, and enhancing the resources within the FC area. Public access would be limited and focused on internships, camps, assistance in research projects, and tours. Annual program of work would be developed collaboratively by the FS, researchers, tribes, and other partners.
- **Concept D (living learning laboratory)**: Visitors would discover and learn first-hand about the natural processes and cultural features that make FC special. Variety of themed "learning labs" throughout the corridor would be offered. Transportation between labs would be by bicycle or shuttle.
- **Concept E (scenic driving for pleasure)**: Visitors would engage in driving for pleasure with a motorized visit through FC via OHV with limited stops and facilities. The number of visitors and guided tours into the area would be managed to reduce impacts to natural resources, ease potential traffic congestion, and provide a semi-primitive recreational experience.
- **Concept F (refugia)**: Visitors would learn about the birds, wildlife, and aquatic species that make FC special. The reach of Fossil Creek between the waterfall and Fossil Springs would be closed. Facilities would generally be limited.
- **Concept G (tribal cultures)**: Visitors would learn about the tribal culture and history that make FC special, with shared stewardship of the area with the Yavapai-Apache Nation. The Fossil Springs area would be closed. Facilities would generally be limited.

2014: Based on public and internal feedback, and incorporating elements of previous alternatives and concepts, the FS developed three new alternatives. These alternatives were not formally scoped, but were refined through targeted stakeholder outreach. These alternatives consisted of:

- **Alternative A (retention of current character)**: Would be similar to the management configuration at the time; incorporates much of the stakeholder proposal. Most existing recreation sites and facilities would be retained. Permit would be required for use. Capacity = 308 PAOT.
- **Alternative B (non-motorized experience)**: Would provide for exploration of the corridor primarily by foot, horse and bicycle. Non-motorized recreation activities in a semi-primitive setting would be encouraged. Long distance backpacking and equestrian opportunities would be emphasized. Would reduce the number of developed recreation sites, close much of FR 708 in the WSR corridor to motorized traffic, and add several new trails. Permit would be required for use. Capacity = 324 PAOT.
- **Alternative C (motorized use and refugia)**: Would allow maximum access to the corridor by motorized vehicles, concentrate use at the most sustainable locations, and preserve portions of the corridor in their natural state. This alternative would provide the option of driving for pleasure (no extended stopping within the corridor). The closed portion of FR 708 would opened to public use pending funding for completion of capital and safety improvements. People would be concentrated primarily at three of the most naturally protected sites: Bridge, Irving, and Sally May. The Fossil Springs Trail from the rim to Mail Trail would be closed and restored. Permit would be required for use. Capacity = 572 PAOT.

2015-2016: Based on public and internal feedback, and building on the alternatives released in 2014, the FS continued to update the alternatives and expanded the range of alternatives by developing a fourth action alternative focused on river value protection while increasing recreation opportunity with a phased implementation approach. National Environmental Policy Act (NEPA) analysis of the CRMP was elevated from an EA to an EIS. The alternatives were released for scoping in late 2016 for a 59-day comment period. Several public open houses and other opportunities for engagement accompanied the comment period. These alternatives consisted of:

- **Alternative A (no action)**: Current management would continue. A CRMP would not guide management of the Fossil Creek WSR. Visitor use would continue to be managed via a seasonal reservation system effective when vehicle capacity control is needed (during the high-use season, approximately April 1 to Oct. 1). Parking capacity would remain at approximately 154 vehicles and 780 PAOT, including administrative use. No camping would be allowed within the permit area during the high-use season but would be allowed during the winter season within specified areas. Additional measures may continue to be needed to address resource or capacity management issues that arise.
- **Alternative B (enhanced protections)**: The CRMP would retain a full range of recreation opportunities, the current motorized and non-motorized access and the current distribution of recreation sites and non-motorized trails. Additional development would be minimal. A limited amount of camping would be allowed at designated sites. The capacity in this alternative would be reduced to approximately 610 PAOT, including administrative use.
- **Alternative C (non-motorized experience)**: The CRMP would emphasize a non-motorized experience where visitors explore Fossil Creek primarily by foot, by bicycle, or by horse. Some recreation sites would be closed. Some non-motorized trail system modifications would occur. No camping would be allowed within the WSR corridor, but a limited amount of camping would be allowed at a new trailhead established on the rim on the Strawberry side of the WSR corridor. The capacity in this alternative would be approximately 690 PAOT, including administrative use.
- **Alternative D (motorized experience and refugia)**: The CRMP would provide for motorized use and refugia. This alternative would increase motor vehicle access to the corridor while minimizing recreation infrastructure and use of and connectivity between designated recreation sites. Some recreation sites would be closed, and a minimal non-motorized trail system would be maintained. This alternative would include scenic drive-through permits. No camping would be allowed. Initially, capacity would reflect current management. Over time and if appropriate, capacity would increase to a maximum of approximately 930 PAOT (including administrative use), with a portion of this total reflecting a scenic drive-through component.

- **Alternative E (long-term adaptive management; proposed action)**: Alternative E was designated as the proposed action because it would include the most flexibility to increase capacity and recreation infrastructure in the future. The CRMP in this alternative would maximize recreation opportunities while providing protection for sensitive river and tribal values. Initially, capacity would reflect current management. Over time and if appropriate, capacity would increase to a maximum of approximately 1,705 PAOT (including administrative use). A portion of the maximum capacity includes a motorized trail use component. A limited amount of camping would be allowed at designated sites.

2017-2018: The four action alternatives were further refined based on public and internal feedback and an additional alternative was developed to respond to concerns about impacts a reservation system may have on underserved communities' ability to access Fossil Creek. The resulting five action alternatives and a no action alternative are described in detail below and analyzed in this EIS.

Several themes have commonly arisen in public and partner feedback on the various alternatives proposed for the Fossil Creek CRMP. These themes are related to recreational use and access (maintaining access for a variety of opportunities or concern related to recreation impacts to natural and cultural resources); the level of recreational development (some commenters supported additional development, while others did not); public health and safety; economic and commercial opportunities; and fees (some commenters supported fees, while others did not). The analysis in the EIS is informed by feedback related to these themes (described in greater detail in Chapter 1 of the EIS), and the alternatives are designed to address these themes by presenting a range of management scenarios from which to choose in the decision on the CRMP. Additionally, the management direction and monitoring and adaptive management plan that the CRMP would contain are specifically designed to address areas of concern raised through feedback by providing a management framework oriented toward protecting and enhancing all river values, a program for monitoring key indicators to determine management impacts on river values, and a suite of adaptive management actions available for quickly addressing adverse impacts detected through monitoring.

The current alternatives also reflect the evolution of broader management concepts that have been developed during the planning process. For example, many components of the "stakeholder alternative" developed in 2011, particularly those related to natural resource protection, are reflected in the draft CRMP's management direction and monitoring/adaptive management plan. Additionally, the concepts developed in collaboration with the Regional Office in 2013 are incorporated into specific alternatives or represented throughout the current alternatives.

Changes to 2016 Alternative Concepts Based on Scoping

Almost 300 unique comment letters were received on the alternatives released for scoping in 2016. Additionally, the Forest Service received valuable feedback on the alternatives during public and stakeholder meetings. The Key Issues for Analysis (described in Chapter 1) summarize the key points raised in public comments that inform the structure of the alternatives and the analysis in this EIS. A crosswalk between the alternatives and key issues is provided in table 2-1. Additionally, modifications made to the alternatives based on comments and subsequent discussion include:

- Commenters expressed concern that it was not clear how implementation of the alternatives would occur. A better description of how each alternative would be implemented is provided in this chapter. A formal implementation plan will be developed for the alternative selected in the future decision on the CRMP.
- Commenters expressed concern about the ability of the alternatives to protect river values. The monitoring and adaptive management plan was updated to better determine effects to river values and respond to potential adverse impacts or degradation. These updates were based in large part on feedback provided at monitoring/adaptive management workshops held in 2017 and 2018.
- Prohibiting "waterplay" at the waterfall was removed from the alternatives. This prohibition was included in the preliminary alternatives in large part due to perceived tribal concerns. Based on ongoing discussions with the Yavapai Apache Nation, an outright prohibition was determined to be unnecessary to

protect the cultural values ORV. Instead, temporary or long-term closure of *any* portion of Fossil Creek to protect river values may be considered as an adaptive management action if other management efforts (such as education or additional permitting) fail to address adverse effects. A large number of commenters expressed concern over the impacts to the recreation experience the proposed prohibition of "waterplay" at the waterfall may cause.

- In the version of Alternative B that was scoped, the Homestead site was proposed to be closed to the public due to perceived tribal needs. The Tribe subsequently indicated that this closure was unnecessary, so public access and parking was included in Alt. B at Homestead. In all alternatives, a portion of the Homestead site and other locations throughout the corridor would be prioritized for tribal use when requested by the Tribe.
- Some commenters expressed concern about outfitter/guide (O/G) use proposed in several alternatives. Clarifying language was added to the alternatives about how future O/G use would be provided. It was determined a needs assessment is necessary before O/G use was explicitly included in any alternatives, so O/G use was removed from the capacity calculations and any future O/G use would be within the proposed user capacities. An objective to complete an O/G needs assessment was added to the management direction in the CRMP.
- The need for restoration of bare areas and user-created trails outside of recreation sites was re-evaluated and additional restoration actions were incorporated into the alternatives.
- Concern was expressed that the reservation system that was proposed in the alternatives would limit the ability of underserved communities to access Fossil Creek. Alternative F was developed to address this concern by removing reliance on a reservation system to manage access to Fossil Creek.

Table 2-1. Crosswalk between the key issues and the alternatives

Key Issue	How addressed in alternatives
Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.	• The CRMP in all action alternatives would include management direction (desired conditions, standards, guidelines, and objectives) to guide management actions in Fossil Creek to protect river values. • The CRMP in all action alternatives would include a monitoring plan to detect adverse impacts to river values and adaptive management actions that would be implemented if defined thresholds are reached in order to protect river values. • Increases in development and user capacities would be phased in incrementally in alternatives D, E, and F as resource conditions allow. • Alternatives B and C propose a lower user capacity than the No Action alternative and the lowest capacity of the action alternatives.
Noise and crowding from high levels of recreational use in Fossil Creek may negatively impact recreation experience.	• Alternatives B and C propose a lower user capacity than the No Action alternative and the lowest capacities of the action alternatives. • Alternative C emphasizes a non-motorized recreation experience. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings and corresponding adaptive management actions to address adverse impacts to the recreation experience. • Extensive portions of the river corridor would receive minimal recreational use, thereby providing opportunities for solitude in all action alternatives.
Restricting swimming, particularly at the Waterfall, may negatively impact the diversity of recreation opportunities Fossil Creek provides and the recreation experience of its visitors by limiting the primary reason many visitors go to Fossil Creek.	• A prohibition on swimming at the waterfall was removed from the alternatives that maintain access to this location. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings and access to river-based activities in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.
Restricting boating (kayaking, packrafting) may negatively impact the diversity of recreation opportunities Fossil Creek provides and would limit access to a boating opportunity that is unique in the U.S. due to its travertine and, in Arizona, due to its year-round navigability.	• All alternatives would provide for boating opportunities. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings and access to river-based activities in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.
Restricting access to the Fossil Springs area eliminates a popular backcountry recreation opportunity in the wild and scenic river corridor.	• Alternatives B, E, and F would provide access to the Fossil Springs area. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings and access to river-based activities in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.
Allowing camping in the Fossil Creek corridor, including in the Fossil Springs area, increases the diversity of available recreation opportunities.	• Alternatives B, E, and F would provide for camping in Middle Fossil. • Alternatives B and E would provide for camping in the Fossil Springs area. • Alternative C would provide for camping at locations near the Fossil Creek corridor.

Key Issue	How addressed in alternatives
	• All alternatives would provide for dispersed backcountry camping in the wild segments. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings and access to river-based activities in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.
Allowing camping may increase impacts to natural and cultural resources and result in additional trash in the Fossil Creek corridor.	• Alternative D would not allow camping in Middle Fossil or the Fossil Springs area. • Alternatives B, C, E, and F would provide measures to reduce the impacts of camping such as campsite designation and design. • The CRMP in all action alternatives would include a monitoring plan to detect adverse impacts to river values and adaptive management actions that would be implemented if defined thresholds are reached in order to protect river values.
Managing entry into the Fossil Creek corridor with a reservation system or similar tool may exclude potential visitors due to technical challenges posed by using the reservation system or financial burden of paying a fee.	• Alternative F was designed to not be reliant on a reservation system to manage visitor access to Fossil Creek. • All alternatives would retain flexibility to take actions (such as fee-free days and adjusting the timing and locations subject to managed entry) to mitigate impacts of managed entry or fees on underserved communities. • Alternatives B, C, D, and E would require reservations to enter Fossil Creek during part of the year only (unless need for a change in the timing is detected).
Additional infrastructure development may reduce the wild character and scenic integrity of Fossil Creek.	• Alternative B would minimize development of additional infrastructure in the river corridor. • A range of intensities of infrastructure development is considered in the action alternatives. • Infrastructure development would be subject to resource protection measures to mitigate impacts to resources in all action alternatives. • Infrastructure development would be subject to a design process to promote scenic integrity in all action alternatives. • Extensive portions of the corridor would receive little or no infrastructure development in all action alternatives. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience. • Alternative A (no action), which would contain no additional infrastructure, is analyzed in the EIS.
Additional infrastructure, such as toilets, trash facilities, improved parking, informational signage, and designated creek access, may reduce the impacts of recreational use on corridor resources and improve visitor behavior.	• All action alternatives would use infrastructure and site design to reduce the impacts of recreational use on corridor resources and improve visitor behavior.
Increasing motorized access to the Fossil Creek corridor from the Strawberry side would provide an opportunity for motorized recreation in the Fossil Creek area,	• Alternative D proposes repairing and reopening the currently closed segment of FR 708 for use by all motor vehicles.

Key Issue	How addressed in alternatives
particularly for those from the Strawberry area who may be unable to hike into Fossil Creek, and may decrease emergency response times for the Gila County Sheriff's Office and Pine-Strawberry Fire District.	• Alternative E proposes repairing and reopening the currently closed segment of FR 708 for use by motorized trail vehicles less than 62 inches wide. • Alternative F provides for limited administrative motorized (ATV/UTV) access along the Flume Trail between the trailhead and historic dam. • Emergency responders are not precluded from using the currently closed segment of FR 708 in all alternatives. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.
Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.	• Alternative C emphasizes a non-motorized recreation experience. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience. • The CRMP in all action alternatives would include a monitoring plan to detect adverse impacts to river values and adaptive management actions that would be implemented if defined thresholds are reached in order to protect river values.
Limiting public use of and/or access to Fossil Creek may negatively impact local economies by reducing visitors who may patronize local businesses.	• All action alternatives would continue to provide public access to Fossil Creek. • Alternatives D, E, and F consider expanding the river corridor's user capacity beyond current conditions.
Commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may increase local economic opportunity, increase recreation opportunities, and limit impacts of recreation on corridor resources by improving visitor behavior.	• All action alternatives provide flexibility for providing future commercial activities in the river corridor. • All action alternatives include an objective in the CRMP management direction to complete an outfitter and guide needs assessment.
Authorizing commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may detract from the wild and scenic character of the area and privilege access for those who are able to pay for services.	• All action alternatives include CRMP management direction to ensure commercial activities in the river corridor are compatible with the wild and scenic river designation and management goals. • Monitoring in all action alternatives would include visitor satisfaction with environmental, social, and managerial settings in the river corridor and corresponding adaptive management actions to address adverse impacts to the recreation experience.

Summary of Alternatives Considered in Detail

This EIS analyzes five action alternatives in detail. The decision on the CRMP will select one of these alternatives to guide future management of Fossil Creek. A combination of components of more than one alternative may be selected in the final decision so long as the environmental effects from implementing the combination of components of the alternatives are within the scope of effects anticipated in the environmental analysis in this EIS. The five action alternatives are compared to a "no action" alternative, as required by NEPA. The intent underlying each of these alternatives is summarized below. This summary is followed by a narrative description of the components of the alternatives, grouped by topic. The process for implementing components of each alternative is explained in the implementation narrative for each topic. Additionally, adaptive management is critical to ensuring protection and enhancement of river values and providing flexibility to respond to changing conditions or uncertainty about the future effects of management actions. The adaptive management narrative for each topic summarizes adaptive management actions that may be taken to support management goals. More detail about adaptive management, including associated monitoring, is provided in Chapter 6 of the CRMP.

The narrative is followed by table 2-2, which provides general estimates of costs for implementing the alternatives, table 2-3, which provides a side-by-side comparison of the components of the alternatives; table 2-4, which summarizes user capacity by alternative; and table 2-5, which summarizes potential environmental impacts of implementing each alternative in comparative form. Appendix A provides maps of how the WSR corridor would look in each alternative and of recreation sites. [8]

This summary highlights the general purpose of each alternative considered in detail for the Fossil Creek CRMP and how implementation of the alternatives would occur. By considering different visitor capacities, recreation facilities, and transportation infrastructure, the alternatives would provide differing visitor experiences in Fossil Creek. The different scenarios reflected in each alternative are responsive to issues raised during the extensive public scoping conducted throughout the planning process.

While each alternative would support a different visitor experience, many components would be common to all of the action alternatives. These common components result from requirements of the Wild and Scenic Rivers Act to protect and enhance river values and other Forest Service law, regulation and policy. Common components include:

- Management direction (desired conditions, standards, guidelines, objectives, and management approaches) to define management goals and support progress toward those goals (found in Chapter 3 of the CRMP);
- A monitoring and adaptive management plan (found in Chapter 6 of the CRMP);
- Restoration of certain impacted areas to improve watershed and ecosystem function (described below);
- Direction for interpretation and education to facilitate effective management and enhance visitor understanding and stewardship of wild and scenic rivers and the unique Fossil Creek environment, history, and culture (described below and in Chapter 3; and
- Opportunities for research.

Additionally, In all alternatives, areas outside of recreation sites and away from trails and roads would serve as refugia for wildlife, fish, and plants where the effects of visitor use are so minor as to be negligible and use of heavy machinery or development of infrastructure will not occur.

[8] The term "**recreation sites**" includes both developed recreation footprints and recreation dispersal footprints. **Developed recreation footprints** are areas within the Fossil Creek WSR corridor in which disturbance from machinery, the building of infrastructure, the presence of vehicles, and use by visitors may occur. **Recreation dispersal footprints** are areas within the Fossil Creek WSR corridor where effects from visitor use may occur, but no major machinery or infrastructure will be used or built in these areas. Minor allowed infrastructure or actions could include signage, hardened trails and armored creek access, and restoration activities. These areas differ by alternative, and are mapped in Appendix A.

See figure 1-2 in Chapter 1 for a map of locations in the Fossil Creek WSR corridor described in this chapter.

Alternative A (No Action): As the "no action" alternative, Alternative A serves as the basis of comparison for analyzing the environmental impacts of implementing the action alternatives. Alternative A represents a continuation of current management of the Fossil Creek and the surrounding area. Interim management such as capacity control and restoration activities would continue as needed, but would not be guided by plan direction specific to the Fossil Creek Wild and Scenic River.

Alternative B (Enhanced Protections): Alternative B would provide a more primitive visitor experience in Fossil Creek and emphasize protection of natural and heritage resources with minimal development of new facilities and infrastructure and a lower user capacity. Existing recreation sites, roads, and trails would be retained but not expanded, and a minimal amount of facility and infrastructure improvements would support the sustainability of the recreation sites and transportation infrastructure.

Alternative C (Non-Motorized Experience): Alternative C would emphasize non-motorized recreation in Middle Fossil[9] by limiting motor vehicle use in portions of the river corridor during the busiest times and developing additional trails for hiking, bicycling, and equestrian use. A lower user capacity would support a quieter recreation experience. Trail access to the historic dam and Fossil Springs would be eliminated to minimize the effects of human presence in this area. Additional parking and visitor facilities would be developed at Cactus Flat and Homestead to serve as the primary entry point into the river corridor; from there visitors would access the corridor by foot, bicycle, or horseback during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park at a reduced number of parking spaces in existing parking lots. A moderate amount facility and infrastructure improvement would support the sustainability of recreation sites and transportation infrastructure in the corridor.

Alternative D (Motorized Use and Refugia): Alternative D would expand motorized access to Middle Fossil by increasing road connectivity and providing for scenic driving. Once hazard mitigations and repairs are completed to standards, the currently closed portion of Forest Road (FR) 708 would be reopened to all motor vehicles. Recreational use would be focused at fewer sites in the river corridor. Some recreation sites would be closed and trail access to Fossil Springs and the Waterfall would be eliminated in order to maximize relatively undisturbed habitat (refugia) areas. New facility and infrastructure development would be focused on facilitating motorized access and supporting increased use at and sustainability of recreation sites. Increases in user capacity could be phased in over time.

Alternative E, Proposed Action (Enhanced Recreation Opportunities with Phased Implementation): Alternative E would emphasize providing a variety of recreation opportunities throughout the Fossil Creek corridor. Phased development of additional parking and visitor facilities could occur at Cactus Flat, Heinrich, and Irving to support increased user capacity, and improvements at other recreation sites would be focused on supporting increased use at and sustainability of those sites. New trails for hiking, bicycling, and equestrian use would be constructed. Once hazard mitigations and repairs are completed, the currently closed portion of FR 708 would be reopened to motor vehicles less than 62 inches wide.

Alternative F (Demand-based Access): Alternative F would meet anticipated demand for recreational use in Fossil Creek through 2030 in order to prevent the need for a reservation system. This would be accomplished by establishing a large parking area at Cactus Flat, with additional parking at Homestead and several other recreation sites. New trails for hiking, bicycling, and equestrian use would be constructed. New facility and infrastructure development would support increased use at and sustainability of recreation sites. Cactus Flat and Homestead would serve as the primary entry point into the river corridor; private motor vehicle access to the remaining upstream recreation sites in Middle Fossil would be restricted during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots.

[9] "Middle Fossil" includes the segment of Fossil Creek between the Mazatzal recreation site upstream to ¼ mile above the waterfall at the end of the Lewis Trail.

Alternative Implementation

An implementation plan would be developed for the selected alternative along with the final decision. If **alternatives B or C** are selected, the number of parking spaces at recreation sites would be reduced in the year following finalization of the CRMP to bring visitor use at recreation sites to levels consistent with capacities specified in table 2-4.

If **alternatives D, E, or F** are selected, increasing visitor capacity would occur incrementally and be contingent on funding availability and establishing facilities and infrastructure that are able to support higher amounts of use. Development of new facilities and infrastructure and corresponding increases in visitor capacity would require determination that river values would continue to be protected with additional visitor use. This determination would be based on assessment of monitoring data and management observations. **Alternative F** would strive to meet recreation demand relatively quickly while holding to these conditions in order to achieve the goal of eliminating the need for a reservation system efficiently.

Components of Alternatives Considered in Detail

General Management of Fossil Creek

Comprehensive River Management Plan

Alternatives B-F would adopt a CRMP for the Fossil Creek WSR corridor, as required by the Wild and Scenic Rivers Act. The CRMP would describe Fossil Creek's existing resource conditions, including its free flow, water quality, and outstandingly remarkable values (ORVs); provide management direction (desired conditions, standards, guidelines, objectives, and management approaches) to guide management of Fossil Creek and protect and enhance river values; address development of lands and facilities; address user capacities; address water quality and in-stream flow requirements; identify regulatory authorities of other governmental agencies that assist in protecting river values; and include a monitoring and adaptive management strategy to ensure protection or enhancement of river values. The CRMP would reflect collaborative development with partners and stakeholders.

The CRMP would establish a final boundary for the Fossil Creek Wild and Scenic River corridor. The interim boundary described in Fossil Creek's designation (P.L. 111-11) would be retained, except a short portion of the southeast side of the boundary in the recreational segment (T12N, R7E, SW 1/4 Section 22) would be adjusted outward approximately 0.1 miles (encompassing approximately 16.5 acres) to incorporate a spring that contributes to the river values into the corridor. The boundary on the opposite side of the corridor directly across from the spring (T12N, R7E, E 1/2 Section 21) would be reduced by approximately 16.5 acres.

In **Alternative A**, interim management measures, such as the reservation system implemented in 2016 and some restoration actions, would continue as needed. No specific management direction for Fossil Creek would be developed, so existing forest plan direction for resources and uses in the area would apply to activities in the river corridor.

Implementation

The CRMP would go into effect 30 days after publication of notice of its approval.

Adaptive Management

In **alternatives B-F**, if future changes to CRMP management direction are needed, the proposed changes would be evaluated for consistency with the Coconino and Tonto forest plans and other components of the CRMP. Proposed changes that are found to be consistent with the forest plans and other components of the CRMP would be made administratively and documented in the project file. If proposed changes are found to be inconsistent with the forest plans or other components of the CRMP, the changes would either need to be modified to ensure consistency or the forest plans amended using the current forest plan amendment process.

Forest Plan Amendment

The Land and Resource Management Plan (LRMP) for the Coconino National Forest (USDA FS 2018) would be amended to:

- Decrease the area of the Fossil Creek Designated Wild and Scenic River Special Area by four acres at T21N, R7E, E 1/2 Section 21 in order to comply with the requirements of Section 3(b) of the Wild and Scenic Rivers Act, which states, "boundaries shall include an average of not more than 320 acres of land per mile.…"
- Include the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the 2,892 acres within the Fossil Creek Designated Wild and Scenic River Special Area on the Coconino National Forest.
- Recommend an 11.6-acre addition to the Designated Fossil Springs Botanical Area in order to better incorporate the diverse vegetation community in the vicinity of Fossil Springs.

The LRMP for the Tonto National Forest (USDA FS 1985) would be amended to:

- Establish Management Area 4G, Payson Ranger District Fossil Creek Wild and Scenic River Management Area. This area would encompass approximately 2,170 acres and consist of the Wild and Scenic River Corridor established by Congress and modified by the CRMP to include a spring in the vicinity of Forest Road 708. Establishing this new Management Area would reduce the area of Management Area 4A (Mazatzal Wilderness) by approximately 1,509 acres, Management Area 4E (Proposed Fossil Springs Natural Area) by approximately 132 acres, and Management Area 4F (Payson Ranger District General Management Area) by approximately 529 acres.
- Incorporate (by reference) the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the Fossil Creek Wild and Scenic River Management Area mentioned above.
- Recommend designation of 9.4 acres of the Fossil Springs Botanical Area adjacent to and part of the Fossil Springs Botanical Area on the Coconino National Forest within the Fossil Creek Wild and Scenic River corridor. This recommended botanical area and associated plan direction would be incorporated into Management Area 4E and the new Management Area 4G (Fossil Creek Wild and Scenic River Management Area).

The forest plan amendments would be completed pursuant to the 2012 Planning Rule at 36 CFR 219.13.

In **Alternative A**, the land and resource management plans for the Coconino and Tonto national forests would not be amended.

Adaptive Management

In **alternatives B-F**, if future changes to CRMP management direction are needed, the proposed changes would be evaluated for consistency with the Coconino and Tonto forest plans and other components of the CRMP. Proposed changes that are found to be consistent with the forest plans and other components of the CRMP would be made administratively and documented in the project file. If proposed changes are found to be inconsistent with the forest plans or other components of the CRMP, the changes would either need to be modified to ensure consistency or the forest plans amended using the current forest plan amendment process.

Monitoring and Adaptive Management

In **alternatives B-F**, the CRMP would include a monitoring and adaptive management plan. The goal of the monitoring and adaptive management plan would be to detect adverse effects to river values and provide the basis for adapting management practices to ensure protection and support enhancement of Fossil Creek's river values. The monitoring and adaptive management plan would provide specific indicators and associated metrics, measurement and assessment frequencies, thresholds for initiating adaptive management action, specific adaptive

management actions, and expected outcomes. The proposed monitoring and adaptive management plan can be found in Chapter 6 of the CRMP. Anticipated adaptive management actions are summarized throughout this section. If needed to facilitate monitoring activities, on-site monitoring equipment may be established within recreation sites.

In **Alternative A**, no formal monitoring and adaptive management plan would be developed. Resource and visitor use monitoring would be conducted as needed, and future management changes would be analyzed and implemented as needed to manage use and protect resources.

Implementation

Monitoring and adaptive management actions would be implemented as described in the monitoring and adaptive management plan in Chapter 6 of the CRMP. Any adaptive management actions would be held to the same river value protection standard as anticipated actions described in this chapter.

Adaptive Management

In **alternatives B-F**, elements of the monitoring plan may be modified through an administrative change to improve assessment and protection of river values or incorporate new methodologies and the best available science.

Education, Interpretation, and Research

In **alternatives B-F**, the management direction in the CRMP would provide guidance and focus for education, interpretation, and research activities in the Fossil Creek WSR corridor (see Chapter 3 of the CRMP for details). Education and interpretation activities would be focused on supporting management activities, wild and scenic rivers, the unique Fossil Creek environment, and promoting visitor stewardship. The Forest Service would continue to support research activities that contribute to enhancing wild and scenic rivers and their values. Infrastructure to support education and interpretation, such as kiosks, displays at welcome centers, and possibly future administrative/group facilities would be provided at varying levels within recreation sites (see recreation sites section of table 2-3). An interpretive plan would be developed after the CRMP is finalized.

In **Alternative A**, existing educational and interpretive infrastructure materials (signs, kiosks, brochures, online information) would remain to support management. Research and educational activities would be approved on a case-by-case basis without the guidance of specific management direction in the CRMP.

Implementation

Upon completion of the CRMP, existing signage and other media that provide education and interpretation would be utilized, with materials updated as needed to support CRMP implementation. Over time, additional infrastructure such as kiosks, displays, welcome centers, and group facilities described in table 2-3 would be developed.

Adaptive Management

In **alternatives B-F**, education would play an important role in supporting river value protection through adaptive management. Educational messaging would be used to help promote visitors' understanding of responsible recreation practices if recreational use is found to be adversely impacting resources, and would be a tool for communicating the purpose of actions taken through adaptive management.

Mineral and Water Rights

Management direction in **Alternatives B-F** provide objectives for pursuing withdrawal of the recreational segment of the Fossil Creek corridor from locatable mineral entry and for obtaining federally reserved water rights for streamflows necessary to protect Fossil Creek's river values. The wild segments are automatically withdrawn from mineral entry by designation under the Wild and Scenic Rivers Act.

In **Alternative A**, locatable mineral entry is possible in the recreational segment of the Fossil Creek Wild and Scenic River Corridor. No federally reserved water right is held to protect stream flows.

Refugia

In **alternative A**, no specific management direction for refugia areas is provided. In **alternatives B-F**, upland and riparian areas outside of recreation sites, construction footprints, and designated roads and trails would serve as relatively undisturbed habitat (refugia) for wildlife, fish, and plants. In refugia areas, the effects from visitor use are anticipated to be so minor as to be negligible, and there would be no use of heavy machinery or development of infrastructure except for designated trails in upland areas.

Adaptive Management

In **alternatives B-F**, if human disturbance that may adversely impact the structure or function of refugia areas is detected outside of recreation sites, construction footprints, and designated roads and trails, educational messaging could be focused on the importance of refugia, or restoration activities or temporary closures may be used to allow recovery of these areas. Physical barriers such as rocks, vegetation material, or temporary fencing may be used to prevent access to these areas.

Sustainability

Environmental, economic, and social sustainability would be incorporated to the extent possible into **alternatives B-F**. Protecting and enhancing the river values would contribute to environmental sustainability, as would restoration activities. Interpretive and educational programs would provide information to visitors about Fossil Creek and its river values, with the goal of supporting protection or enhancement of the river values. Where possible, sustainable materials would be used in constructed facilities, sustainable energy sources would be harnessed for electricity needs, and low water-gray water systems would be installed. Continued access to the WSR corridor would support economic sustainability and potentially provide economic opportunities to nearby communities supporting visitors to Fossil Creek. Visitors gaining an understanding of the area and becoming stewards, partners and advocates would help assure continued interest and support of public lands.

In **alternatives B-F**, partnerships with other agencies, local communities, and other organizations would be pursued to support management of Fossil Creek, including development and maintenance of facilities and infrastructure, day-to-day management operations, and monitoring. Opportunities for on-site revenue generation would be pursued through a separate process (see next section).

In **Alternative A**, sustainability principles would be incorporated as possible into interim management of Fossil Creek.

Managed Entry, Fees, and Site Administration

In **alternatives B-E**, the interim reservation system implemented in 2016 would be formally adopted. This system would provide visitors with assurance that space is available for them in Fossil Creek ahead of time or to help plan another day to visit. The system would also help managers maintain visitor numbers within established capacities. Reservations for day use would be required to park at recreation sites in the Fossil Creek area or for scenic driving approximately April 1 – October 1. The number of available reservations would correspond with the number of available parking spaces. Separate reservations for overnight use would be required. No reservation or permit would be required to access Stehr Lake, Childs, Deadman Mesa Road, or other designated roads for public motor vehicle access outside of the wild and scenic river corridor. In **alternatives D and E**, separate scenic driving permits would be required.

In **Alternative F**, no reservation would be required to access Fossil Creek.

Permit fees are outside the scope of this analysis and would be determined through a separate process. On-site revenue generation is desirable to support management activities. Currently, visitors are charged a $10 service fee

by recreation.gov for a Fossil Creek reservation. A similar service fee is anticipated for reservations under **alternatives B-E**. No service fee would be required in **Alternative F**.

In **alternatives B-F**, the Forest Service would initially continue to oversee operations and maintenance of Fossil Creek. In the future, opportunities for partnerships, concessionaires, or other options to share operations and maintenance activities would be pursued.

In **Alternative A**, the reservation system would remain in place as an interim management measure. A reservation with a service fee would be required to park within the WSR corridor and Fossil Springs Trailhead area, April 1 – October 1. The Forest Service would continue to oversee operations and maintenance of Fossil Creek.

Implementation

If **alternatives B or C** are selected, the reservation system would be adjusted to reflect the lower number of parking spaces in the year following finalization of the CRMP. If **alternatives D or E** are selected, the reservation system would be adjusted to reflect incremental increases in parking spaces as those increases are implemented. If **Alternative F** is selected, the reservation system would be eliminated as soon as parking availability is increased to meet anticipated demand.

In **alternatives B-F**, a fee to support management of Fossil Creek may be charged following an administrative fee determination process.

Adaptive Management

In **alternatives B-E**, the timing and extent of the reservation system would be adjustable if needed to accommodate changes in use, administrative considerations, or river value protection. If visitor use exceeds capacity outside of the April 1 – October 1 timeframe, reservations could be required for additional dates. The area for which reservations are required for parking or camping may be expanded to include additional locations (such as Stehr Lake, Childs, or backcountry areas) or otherwise modified to accommodate administrative needs. The number or locations of reservations available on a daily, weekly, or seasonal basis could be adjusted if needed to provide spatial or temporal refugia for fish or wildlife species. The reservation system could also be adjusted to redistribute the timing, location, and/or type of use as needed to protect other river values. Conversely, if visitor use patterns change such that access to the corridor does not need to be limited in certain locations or on certain days or during the year as a whole, the reservation system could be modified to cover certain locations or days only or phased out altogether.

In **Alternative F**, a reservation system may be implemented at certain locations or corridor-wide if needed to protect river values or facilitate management activities. Additional detail is provided in the adaptive management portion of the user capacity section below.

User Capacity

User capacity is defined as “the maximum amounts and kinds of public use that a WSR collectively or by analysis area can accommodate without degrading river values” (IWSRCC 2018). Corridor-wide user capacities (persons at one time or PAOT) for **alternatives B-F** are provided in table 2-4. These capacities reflect the amounts of use that the Fossil Creek WSR corridor is anticipated to accommodate without degrading river values, assuming infrastructure, facilities, and management oversight are in place to support those levels of use. Factors considered in capacity determinations include parking and facilities available at recreation sites, road and trail access, and seasonal use patterns. The process used to determine user capacities for **alternatives B-F** is fully described in Chapter 4 of the CRMP, Visitor Use and User Capacity.

Actual visitor use currently differs on a seasonal basis, and this pattern is anticipated to continue. Use is highest from April through September, and popular activities include swimming, picnicking, and hiking. In **alternatives B-E**, visitor access would be managed through a reservation system during this high use season to ensure use levels are within each alternative’s capacity. In **Alternative F**, parking capacity would be expanded to

accommodate demand for access to Fossil Creek, so a reservation system would not be required. From October through March, popular activities include hiking, fishing, and hunting. During this period, visitor use is much lower than capacity and access would not be subject to a reservation system unless use increases to the point that it approaches exceeding maximum capacity or patterns of use risk degrading river values.

Most visitor use occurs in the recreational segment of the Fossil Creek WSR corridor. During the high-use season, visitors often park at one recreation site and walk to another. Thus, capacity should be viewed in the context of actual use occurring at recreation sites throughout the recreation segment, rather than at the site-by-site scale.

The portion of the capacity calculation based on parking available at recreation sites assumes one vehicle per parking space and five people per vehicle. The vehicle occupancy assumption is based on observations of actual vehicle occupancy in Fossil Creek and the number of seats present in most vehicles. The number of parking spaces available at each recreation site can be found in the "Recreation Site Names, Availability, and Amenities" section of table 2-3.

The capacity numbers in table 2-4 include both day use and overnight camping. Camping availability by alternative is described in the "Recreation Opportunities" section of table 2-3. Two vehicles would be allowed per campsite, so the total number of parking spaces at recreation sites that provide camping would include the number of parking spaces needed to accommodate two cars per campsite.

Alternative D includes the possibility of scenic driving and **Alternative E** the possibility of motorized trail vehicle use, both of which would be separate permitted uses allowing only short stops in the Fossil Creek corridor. Scenic driving permits would be available for all vehicles in **Alternative D**, so the capacity calculation in this alternative assumes five people per vehicle. Only motorized trail vehicle permits would be available in **Alternative E**. For motorized trail vehicles, the capacity calculation assumes two people per vehicle due to the lower seating capacity typical of most motorized trail vehicles.

Locations of particular management concern in the river corridor are the waterfall and Fossil Springs area. Historically, visitor use in Fossil Creek has been focused more heavily at the waterfall and on the Waterfall Trail than at other recreation sites in the river corridor. Availability of actual use data is currently limited; however, manual counts in July 2017 estimated about 65% of visitors in Middle Fossil entered the Waterfall Trail. This aligns with observations of visitor use in the past. It is anticipated that a disproportionate number of visitors will continue to desire to visit the waterfall compared to other recreation sites in the river corridor; however, because of physical limitations of the site, the waterfall location is not suitable for development of recreation infrastructure, including toilet facilities. In the Fossil Springs area, sensitive resources around and the remoteness of the area present access and management challenges.

In order to protect river values at the waterfall and Fossil Springs, **alternatives B-F** would include messaging (signage, visitor contacts, media) promoting recreation at other sites in the river corridor, Leave No Trace and low-impact recreation practices, and proper waste disposal. Further, infrastructure at other recreation sites that provide river access points would be improved to increase their visitor capacity and attractiveness.

In **Alternative A**, corridor-wide capacity is not formally designated; however, for sake of comparison with corridor-wide capacities in the action alternatives, a number similar to corridor-wide capacity is shown in table 2-4. Capacities for recreation sites in **Alternative A** are based on the number of parking spaces available under the reservation system in 2018.

Implementation

If **alternatives B or C** are selected, the number of parking spaces at recreation sites would be reduced in the year following finalization of the CRMP to bring visitor use to levels consistent with capacities specified in table 2-4.

If **alternatives D, E, or F** are selected, increasing visitor capacity would occur incrementally and be contingent on funding availability and establishing facilities and infrastructure that are necessary to support higher amounts of use. Development of new facilities and infrastructure and corresponding increases in visitor capacity would

require determination that river values would continue to be protected with additional visitor use. This determination would be based on management observations and assessment of monitoring data. **Alternative F** would strive to meet recreation demand relatively quickly while holding to these conditions in order to achieve the goal of eliminating the need for a reservation system efficiently.

Adaptive Management

In **alternatives B-F**, if monitoring indicates levels or patterns of visitor use are adversely impacting river values, a variety of actions may be taken to reduce these impacts. These actions may include increasing management presence, education efforts targeted at addressing observed impacts, temporary site closures, recreation site infrastructure improvements, restoration actions, or changes in in the locations, kinds, or amounts of visitor use in the river corridor.

Specifically, if visitor use at the waterfall or Fossil Springs area is found to be adversely impacting river values, the following adaptive management actions could be implemented during times of high recreation demand:

- Additional management presence to direct visitors to other locations in the river corridor
- Requiring a separate reservation or permit for access to the waterfall and/or Fossil Springs locations
- Limiting access to the waterfall and/or Fossil Springs to guided groups
- Requiring use of portable toilet kits (such as “WAG bags”) at the waterfall and/or Fossil Springs
- Short-term closures if determined necessary to protect public health

Recreation Site Names, Availability, and Amenities

In **alternatives B-F**, the names of the Waterfall and Fossil Springs trailheads would be changed to Lewis and Bear trailheads, respectively. Available recreation sites and parking and facilities at these sites would vary by alternative (details are in table 2-3) to support the goals of each alternative. In **alternative A**, no recreation site name changes would be made. Existing recreation sites would remain and any infrastructure or facility changes would be subject to separate analysis.

In general, the Mazatzal, Purple Mountain, Sally May, Junction, Tonto Bench, and Lewis (Waterfall) Trailhead sites would not be expanded. The presence of overhead powerlines at Sally May and Purple Mountain limits construction of permanent structures these sites. In **alternatives C, E, and F**, a new parking area and welcome center would be constructed at Cactus Flat, which is approximately 500 feet north of FR 708 on FR 9D. The welcome center would provide an opportunity for visitors to learn about Fossil Creek and any current safety or stewardship messages as they enter the corridor. In **alternatives C and F**, most parking in the corridor would be located at Cactus Flat and Homestead, and private motor vehicle access to the remaining upstream recreation sites in Middle Fossil would be restricted during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots.

In 2016, the Forest Service acquired the only private land parcel (Heinrich) in the Fossil Creek WSR corridor. The welcome center would be located at this site in **alternatives B and D**. Heinrich would also contain administrative facilities (such as amenities for a site host) in **alternatives B-F**. River access would not be provided at Heinrich in order to protect its intact riparian environment; however, a short interpretive trail or canopy walk may be constructed in **alternatives B, D, and E** to support education about the riparian environment.

In **alternatives B-F**, permanent or temporary amenities to support research, interpretive, and educational programs may be established along with welcome centers or, in **alternatives D and E**, at Irving, within the boundaries of the recreation sites. These amenities could consist of a central meeting location with dining, meeting, administrate, and display space; restrooms; and overnight facilities with showers and lodging such as trailer hookups, platform tents, yurts, or small cabins.

The Irving site may be expanded with various amenities in **alternatives D-F**, and a new bridge and additional parking in **alternatives D and E**. In these alternatives, Irving would serve as a focus for recreation activities in the corridor, taking advantage of a large, previously-disturbed area on the west side of the creek.

In **all alternatives**, portions of the Homestead site would be prioritized for tribal use when requested.

In **alternatives C and D**, no trail access to the Fossil Springs and historic dam area would be available in order to maximize refugia for wildlife, fish, and vegetation in this area. In **alternative F**, the Bear Trail would be closed and recreational access to the Fossil Springs and historic dam area would be via the Flume Trail.

In addition to the proposed recreation site amenities listed in table 2-3, in **alternatives B-F**, parking areas and any creek access paths within recreation sites may be armored using existing natural bedrock, permeable pavement, or other materials to reduce erosion potential and increase site sustainability. Runoff retention basins and other drainage features may also be constructed. Barriers such as wood fencing or rocks may be strategically placed at recreation site boundaries where needed to minimize resource impacts outside of site boundaries.

The precise location and arrangement of amenities described here and in table 2-3 within recreation sites would be determined after approval of the CRMP through a separate site design process. For purposes of this analysis, developed recreation/construction footprints and recreation dispersal footprints have been delineated (Appendix A). The areas associated with each of the developed recreation footprints will be analyzed as if the entire area could be disturbed by machinery, the building of infrastructure, the presence of vehicles, and use by visitors. In the areas associated with the recreation dispersal footprints, the effects of visitors (ground disturbance, noise disturbance, trash, etc.) will be analyzed but the assumption is that no major machinery or infrastructure will be used or built in these areas. Within recreation dispersal footprints, minor infrastructure or actions including signage, hardened trails and armored creek access, and restoration activities may occur.

Implementation

If **alternatives B or C** are selected, the number of parking spaces at recreation sites would be reduced in the year following finalization of the CRMP. If **alternatives C, D, E, or F** are selected, development of new facilities and infrastructure would occur incrementally as funding is available and doing so would support protection of river values. **Alternative F** would strive to meet recreation demand relatively quickly while holding to these conditions in order to achieve the goal of eliminating the need for a reservation system efficiently.

Priority infrastructure for recreation sites would be toilets, armored creek access routes, designated parking areas with sediment retention features, kiosks, and other signage where these features do not currently exist.

Adaptive Management

In **alternatives B-F**, a variety of actions may be taken to improve the ability of recreation sites to protect river values. These actions may include implementing BMPs or mitigation measures, modifying the type or arrangement of facilities provided within recreation sites (such as adding toilets), targeted restoration activities, or temporary or long-term site closures. Establishment of new recreation sites not considered in this document would require separate analysis.

Other Infrastructure Construction

In **alternatives B-F**, a new bridge would be constructed adjacent to the existing Fossil Creek Bridge. The existing bridge, which was constructed in 1924-25, is load restricted for certain vehicle passage across Fossil Creek, particularly for heavier vehicles needed to maintain the road and infrastructure at recreation sites beyond the bridge. The existing bridge is a closed spandrel concrete arch and structurally deficient. The structure is narrow, and the approaches involve steep grades and tight horizontal curves. The new bridge is needed to provide safer and sustainable access across Fossil Creek. The existing bridge would be retained, as it is listed on the National Register of Historic Places, and remain available for pedestrian use.

In **alternatives D and E**, a new bridge would be constructed at Irving to provide vehicle access to the expanded recreation site on the west side of Fossil Creek.

In **alternatives B-F**, the existing gabion between Fossil Creek and Forest Road 502 would be repaired and extended. These actions are needed to prevent erosion of FR 502 and potential water quality impacts.

In **alternative F**, a new bridge would be installed on the Flume Trail across a side canyon to provide for limited administrative OHV access to the historic dam via the Flume Trail.

In **alternative A**, separate NEPA analysis would be conducted for construction of a new Fossil Creek bridge and for the repair and extension of the gabion.

Implementation

Construction of new bridges across Fossil Creek and the gabion repair/extension would require analysis under Section 7 of the Wild and Scenic Rivers Act because these activities would take place within the ordinary high water mark of Fossil Creek. The Section 7 analysis for the Fossil Creek Bridge and gabion will be included in the final CRMP analysis. The Section 7 analysis for the Irving bridge (**alternatives D and E**) would be completed once bridge designs that provide adequate information to support the analysis are available. Construction of these features would only occur if the Section 7 analysis determines that no direct and adverse effect on Fossil Creek's river values would result. If the Section 7 analysis makes this determination, construction of the new Fossil Creek Bridge and repair/extension of the gabion would occur if funding allows. Construction of the new bridge at Irving in **alternatives D and E** would only occur if expansion of the Irving recreation site is determined to be compatible with river value protection and funding allows.

Recreation Opportunities

Day Use Opportunities

Alternatives A-F would allow for a full range of day use recreation opportunities in the Fossil Creek corridor year-round; however, **Alternative C** emphasizes non-motorized use and **Alternative D** emphasizes motorized access. In general, river-related activities such as swimming, hiking, non-motorized boating, wilderness exploration, learning about history and contemporary uses associated with the river corridor, and viewing scenery, wildlife, fish, and plants/wildflowers would be emphasized. Hunting and fishing would be allowed and coordinated with Arizona Game and Fish Department. Equestrian and bicycle use would be available on certain trails (see "Non-Motorized Trails" section of table 2-3). Bicycle use would be available on National Forest System roads in vicinity of corridor. The closed portion of Forest Road 708 (varies by alternative; see "Motor Vehicle Access" section of table 2-3) would be available for non-motorized travel.

Adaptive Management

In **alternatives B-F**, if monitoring indicates specific recreation activities may be adversely impacting river values, a variety of actions may be taken to reduce these impacts. These actions may include increased management presence, education efforts targeted at addressing observed impacts, or changes in the locations, kinds, or amounts of visitor use in the Fossil Creek corridor.

Camping

In **alternatives B, C, E, and F**, camping would be available at specific locations in and around the WSR corridor, as described in the "Recreation Opportunities" section of table 2-3. In **Alternative D**, no camping would be available in Middle Fossil, at trailheads, or in the Historic Dam/Fossil Springs area. In **alternatives B-F**, camping for administrative activities and special events may occur throughout the WSR corridor and would be approved on a case-by-case basis.

In Middle Fossil, up to 10 campsites would be available at recreation sites as specified in table 2-3 in **alternatives B and E**. Campsites may be distributed among multiple sites, or provided at a single site (such as Homestead or Irving) once adequate facilities are developed. In **Alternative C**, up to three campsites would be available at Cactus Flat. In **Alternative F**, up to 10 campsites would be available at Homestead.

In the Historic Dam/Fossil Springs area, dispersed camping would be available for up to three groups in **Alternative B** year-round and up to three designated campsites would be available in **Alternative E** year-round. In **Alternative F**, camping would not be available in the Historic Dam/Fossil Springs area during the high-use

season, and dispersed camping upstream of the dam would be available during the low use season. Up to four designated campsites would be available at the Rim Trailhead in **alternatives C and E**.

In **alternatives B-F**, dispersed backcountry camping would be allowed in wild segments beginning 1/4-mile upstream of the Bear Trail in the Fossil Springs wild segment and 1/4-mile downstream of the Mazatzal recreation site in the Mazatzal wild segment.

In **Alternative A**, dispersed camping would be allowed downstream of the Fossil Creek Bridge and upstream of the Historic Dam outside of the permit season, with no specific limitation on the number of available campsites. Camping for administrative activities and special events may occur throughout the WSR corridor and would be approved on a case-by-case basis.

Dispersed camping would continue to be allowed year-round in the Stehr Lake area in **alternatives A-F**.

Implementation

In **alternatives B, C, E, and F**, dispersed camping in Middle Fossil would continue to be allowed in the low-use season downstream of the Fossil Creek Bridge until campsites are designated at locations described in table 2-3 and resources are adequate to manage designated camping. Specific designated campsite locations would be determined through the future recreation site design process.

No camping would be provided at the Rim Trailhead in **alternatives C and E** until campsites are designated, management capacity is adequate to oversee designated camping, and the reservation system is updated to include camping.

In **alternatives B and E**, dispersed camping would continue to be available in the Fossil Springs area outside of the permit season until campsites are designated (**Alternative E only**), resources are adequate to manage year-round designated camping, and the reservation system is updated to include camping permits.

Camping would no longer be allowed in Middle Fossil in **Alternative D** or the Fossil Springs/Historic Dam area in **alternatives C and D** in the year following finalization of the CRMP.

Adaptive Management

In **alternatives B-F**, if monitoring indicates camping may be adversely impacting river values, a variety of actions may be taken to reduce these impacts. These actions may include increased management presence, education efforts targeted at addressing observed impacts, reducing the number of campsites, or modifying campsite locations or the season of use. To limit observed impacts, a camping permit may be required for backcountry areas in the wild segments if camping use in these areas increases substantially or is found to be adversely impacting river values.

Scenic Driving and Motorized Trail Use

Scenic driving and motorized trail use are considered separate activities from current day use (whereby visitors reserve parking at a specific recreation site). Scenic driving and motorized trail use would consist of a separate permit that allows visitors to drive or ride into the Fossil Creek corridor without parking in one of the day use parking spaces; instead, limited short-term parking would be provided within recreation sites to facilitate short stops at restroom facilities or interpretive signage. **Alternatives A, B, C and F** contain no specific provision for scenic driving or motorized trail use. **Alternative D** provides access for scenic driving for all motor vehicles. **Alternative E** provides access for motorized trail vehicles less than 62 inches wide.

Implementation

Scenic driving or motorized trail use would be provided in **alternatives D and E**, respectively, as a separate permitted use if the currently-closed portion of FR 708 is repaired and reopened to motorized travel, recreation site design is able to accommodate short stops, and the reservation system is updated to include this additional

use. The initial number of scenic driving permits provided may be lower than the full number described in tables 2-3 and 2-4 and then gradually increased to the full number if no adverse impacts to river values are observed.

Adaptive Management

In **alternatives D and E**, if monitoring indicates that scenic driving may be adversely impacting river values or is incompatible with management objectives, education efforts may be targeted at addressing observed impacts, the number of scenic driving permits may be reduced on a temporary or permanent basis, or the season of use adjusted.

Outfitter/Guide Use

Outfitters and guides can provide services for some visitors that the Forest Service typically does not provide or does not have capacity to provide. Outfitters and guides may also help to reduce impacts to resources by providing additional oversight and amenities (such as portable restrooms) for visitors. In **alternatives B-F**, A separate analysis to evaluate potential outfitter/guide opportunities and a prospectus would be prepared within approximately two to five years of CRMP approval. This process would evaluate the types, locations, and number of permitted uses that would be appropriate. Any permitted uses would be held to visitor capacity levels determined in this analysis.

Adaptive Management

In **alternatives B-F**, outfitter/guide services could be used to mitigate impacts from specific recreational activities or use at specific recreation sites. Conversely, if outfitter/guide activities are found to be incompatible with management objectives or contributing to adverse impacts to river values, these activities may be reduced or discontinued.

Non-Motorized Trails

In **alternatives B-F**, the Waterfall and Fossil Springs trails would be re-named Lewis and Bear trails, respectively. The “Non-Motorized Trails” section of table 2-3 describes trail system modifications by alternative. In **Alternative B**, changes to the existing trail system would be minimal, so as to retain existing opportunities. In **Alternative C**, two new trails (Creek View in Middle Fossil and Rim in the vicinity of the Bear Trailhead) would be constructed to provide hiking opportunities away from the riparian area. Trail access to the Historic Dam and Fossil Springs area would be eliminated in this alternative in order to protect sensitive resources in the area. A minimal trail system would be maintained in **Alternative D** to maximize refugia areas in the WSR corridor. The Lewis Trail and Bear Trail would be closed and decommissioned, and the Flume Trail would be shortened, eliminating access to the Historic Dam and Fossil Springs area. The Rim Trail would be constructed to provide hiking opportunities away from the riparian area. **Alternative E** would increase the trail network in and around the WSR corridor. Existing trails would remain, and the new Creek View and Rim trails would be constructed. In **Alternative F**, the new Creek View and Rim trails and a connector trail between Cactus Flat and Homestead would be constructed. The Bear Trail would be closed and decommissioned and recreational access to the Fossil Springs and historic dam area would be via the Flume Trail. In **alternatives B, C, E, and F**, the Lewis Trail would be formally adopted as a Forest Service system trail. The Lewis Trail is not currently a system trail. Formally adopting this trail would facilitate maintenance activities needed to ensure trail sustainability and resource protection.

In **alternatives B-F**, creek access paths would be established to provide access recreation sites to Fossil Creek. These paths would be located in areas resistant to impacts or be armored (e.g. stone steps) to increase their sustainability.

In **Alternative A**, existing trails would remain. No new trails would be constructed, and the Lewis Trail would not be adopted as a Forest Service system trail.

Implementation

Additions to the non-motorized trail system in **alternatives C, E, and F** would be implemented only if funding is available for construction and maintenance and monitoring indicates that resources are protected. Trail removed from the system in **alternatives C, D, and F** would be closed administratively (via forest order) in the season following finalization of the CRMP and trail routes would be naturalized when funding is available.

Adaptive Management

In **alternatives B-F**, if monitoring indicates non-motorized trail use or the presence of trails may be adversely impacting river values, a variety of actions may be taken to reduce these impacts. These actions may include increased management presence, education efforts, implementation of BMPs, additional maintenance, trail re-routes or hardening, or temporary or long-term trail closures.

Motor Vehicle Access and Roads

The primary access to the Fossil Creek WSR corridor is provided by FR 708. Prior to 2011, access to Fossil Creek was available on FR 708 from State Route 260 (near Camp Verde) and from State Route 87 (in Strawberry). In 2011, a 4.1-mile section of FR 708 between the canyon rim near Strawberry and the Lewis Trailhead in the canyon bottom was closed to protect public safety due to repeated rockfall and road instability; this section of road has been closed since then and continues to deteriorate.

Table 2-3 describes motor vehicle access in **alternatives A-F**. Across **all alternatives**, access to Fossil Creek via FR 708 from State Route 260 and to Stehr Lake and Childs via FR 502 would continue to be available. In **alternatives D and E**, the currently closed section of FR 708 would be re-opened to highway-legal vehicles or motorized trail vehicles less than 62 inches wide, respectively, following repairs. In **alternatives B, C, and F**, the currently closed section of FR 708 would remain closed to motor vehicles (but available for non-motorized travel). Additionally, in **alternatives C and F**, FR 708 between Homestead and the Lewis Trailhead would be closed to private motor vehicles during the high-use season. This section of road would be open to private motor vehicles during the low-use season in these alternatives.

In **all alternatives**, on designated roads, ground-disturbing activities and use of equipment may occur. Maintenance (including grading, new drainage improvements, vegetation maintenance, and utility maintenance) and hazard mitigation activities (including rock scaling) may be necessary within or immediately outside of the road prism and would be conducted on an as-needed basis. A particular focus of maintenance on FR 708 would be to improve segments of the road that are problematic in wet weather, in order to reduce the impacts of vehicle travel, improve public safety, and reduce the need for closure during wet conditions. Additionally, FR 708 would continue to receive maintenance necessary to support continued operation of the fiber optic cable that follows the alignment of the road. Finally, exempted uses under the Travel Management Rule[10] may occur on any road in the Fossil Creek area.

The currently closed section of FR 708 is in need of substantial road bed stabilization, upslope rock scaling, and drainage improvements. In **Alternative A**, no road bed stabilization or drainage improvements would occur. In **alternatives B, C, and F**, road bed stabilization and drainage improvements would be implemented at a level required to mitigate runoff and sedimentation impacts and support long-term road sustainability for emergency access, continued operation of the fiber optic cable, and public non-motorized use. In **alternatives D and E**, road bed stabilization and drainage improvements would be implemented at a level required to mitigate runoff and sedimentation impacts and support long-term road sustainability for public motorized use, and major repairs would be completed as described below.

[10] Exempted uses consist of: (a) Aircraft; (b) Watercraft; (c) Over-snow vehicles; (d) Limited administrative use by the Forest Service; (e) Use of any fire, military, emergency, or law enforcement vehicle for emergency purposes; (f) Authorized use of any combat or combat support vehicle for national defense purposes; (g) Law enforcement response to violations of law, including pursuit; (h) Motor vehicle use that is specifically authorized under a written authorization issued under Federal law or regulations (36 CFR 212.51(a)).

Implementation

In **alternatives D and E**, re-opening the currently closed section of FR 708 would require a number of hazard mitigations and road prism improvements. A list of potential mitigations and improvements are described in the 2014 Forest Service report, *FN708 Conceptual Remediation Strategies*; however, this report notes an expanded field exploration and better hazard mapping would be required prior to implementation of the remediation strategies. The currently closed portion of FR 708 would not be reopened until the required additional studies, hazard mitigations, and road prism improvements are completed (pending available funding) and adequate funding for future maintenance is anticipated to be available.

In **Alternative C**, the section of FR 708 between Homestead and the Lewis Trailhead would be closed to private motor vehicles in the high-use season following finalization of the CRMP. In **Alternative F**, this section of road would be closed to private motor vehicles in the high use season once construction of additional parking at Cactus Flat and Homestead is completed.

Adaptive Management

In **alternatives B-F**, motor vehicle access into the Fossil Creek corridor may be temporarily restricted to protect public safety (such as during times of high fire danger or when construction activities are occurring) or to protect resources (such as in the event of wet weather). Any future permanent changes to road designations would follow the requirements of the Travel Management Rule (36 CFR 212).

Restoration Activities

In **alternatives B-F**, unauthorized trails, decommissioned Forest Service system trails, and bare areas outside of open recreation sites would be restored using a variety of methods such as soft closures (using vegetation or other materials to discourage use) to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Additionally, certain system roads would be decommissioned and restored and unauthorized roads would be restored; a table of these roads is available in Appendix C. The acreage of bare area restoration and mileage of unauthorized trail and road restoration can be found in table 2-3.

In **Alternative A**, restoration of bare areas, and unauthorized roads and trails would be completed as needed and be subject to separate analysis. Any future permanent changes to road designations would follow the requirements of the Travel Management Rule (36 CFR 212).

Implementation

Restoration activities would be prioritized in areas where there is direct connectivity with Fossil Creek or where sensitive cultural or natural resources occur.

Adaptive Management

In **alternatives B-F**, bare areas and unauthorized roads and trails that are discovered within the project area outside of the areas described in table 2-3 and Appendix C would be restored following required site-specific clearances for wildlife and cultural resources. Any future permanent changes to road designations would follow the requirements of the Travel Management Rule (36 CFR 212).

Fossil Springs Botanical Area

On the Coconino National Forest, a 12-acre botanical area is currently designated in the vicinity of Fossil Springs. On the Tonto National Forest, a 20-acre Recommended Natural Area is described in the Forest Plan in the vicinity of Fossil Springs. The intent of these areas is to encompass the large and complex series of springs that is the headwaters for Fossil Creek's unusual travertine system. In order to ensure consistent management of the Fossil Springs area and better reflect the area's vegetation community, **Alternatives B-F** would recommend modifications to the Fossil Springs Botanical Area. These modifications would consist of expanding the Botanical Area to a total of 33 acres, 23.6 of which would be on the Coconino and 9.4 of which would be on the Tonto.

In **Alternative A**, no changes to the Fossil Springs Botanical Area would be recommended.

Visitor access to the Fossil Springs Botanical Area would be maintained in **alternatives A, B, E, and F**, and would be unavailable in **alternatives C and D**. Across all alternatives, special use permits for research activities in the Botanical Area would be evaluated on a case-by-case basis.

Implementation

The Coconino and Tonto forest plans would be amended with the revised Fossil Springs Botanical Area boundary, which would replace the potential natural area on the Tonto National Forest, upon finalization of the CRMP. Existing management direction for the Fossil Springs Botanical Area would be applied to the delineated 33 acres.

Adaptive Management

In **alternatives B, E, and F**, if human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented. In **alternatives C and D**, if adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Cost

Estimated costs for construction and restoration actions, annual maintenance, annual cost to government, and annual monitoring for each alternative are presented in table 2-2. All costs reflect full implementation of the alternatives, which consists of full build-out of facilities and completion of all restoration actions that would be possible under each alternative plus the annual cost of facility and infrastructure maintenance, full staffing that would be required to manage the facilities and visitor use prescribed by each alternative, and annual monitoring.

Table 2-2. Estimated costs of implementing the alternatives

Item	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Implementation Costs						
Construction[1]	$0	$3,121,440	$3,675,300	$9,292,590	$10,884,750	$5,622,075
Restoration[2]	$0	$520,400	$561,000	$625,000	$508,400	$560,400
TOTAL (Implementation)	**$0**	**$3,641,840**	**$4,236,300**	**$9,917,590**	**$11,393,150**	**$6,182,475**
Annual Costs						
Maintenance[3]	$110,757	$145,483	$140,136	$308,501	$343,394	$181,147
Cost to Government[4]	$234,000	$265,000	$325,500	$287,500	$365,500	$403,500
Monitoring[5]	$14,500	$42,800	$42,800	$42,800	$42,800	$42,800
TOTAL (Annual costs)	**$359,257**	**$453,283**	**$508,436**	**$638,801**	**$751,694**	**$627,447**

Table Notes

All costs are based on 2018 estimates.

[1]Construction costs include all road and trail repairs or construction and infrastructure development prescribed by alternative, along with associated design, survey, and mobilization. Costs to repair the currently closed section of FR 708 are derived from the 2014 report, *FN708 Conceptual Remediation Strategies* (Romero 2014).

[2]Restoration costs include restoration of unplanned bare areas and any roads and trials decommissioned through the alternatives.

[3]Annual maintenance includes road, trail, and facility maintenance, including toilet cleaning and trash removal.

[4]Annual cost to government includes personnel and vehicle costs based on FY18 rates.

[5]Annual monitoring includes only monitoring described in the CRMP.

Comparison of Components of the Alternatives

Table 2-3 summarizes components of the Fossil Creek CRMP alternatives. The descriptions in this table represent conditions at full implementation of the alternatives.

Table 2-3. Comparison of the components of the alternatives for the Fossil Creek Wild & Scenic River CRMP at full implementation

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
General Management of Fossil Creek						
Management direction for the Wild and Scenic River corridor	No specific management direction developed for the Fossil Creek Wild and Scenic River Corridor.	CRMP provides management direction (desired conditions, standards, guidelines, and objectives) specific to Fossil Creek to ensure protection or enhancement of river values.				
Forest plan amendment	The land and resource management plans for the Coconino and Tonto national forests would not be amended.	The Land and Resource Management Plan (LRMP) for the Coconino National Forest (USDA FS 2018) would be amended to: • Decrease the area of the Fossil Creek Designated Wild and Scenic River Special Area by four acres at T21N, R7E, E 1/2 Section 21 in order to comply with the requirements of Section 3(b) of the Wild and Scenic Rivers Act, which states, "boundaries shall include an average of not more than 320 acres of land per mile…." • Include the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the 2,892 acres within the Fossil Creek Designated Wild and Scenic River Special Area on the Coconino National Forest. • Recommend an 11.6-acre addition to the Designated Fossil Springs Botanical Area in order to better incorporate the diverse vegetation community in the vicinity of Fossil Springs. The LRMP for the Tonto National Forest (USDA FS 1985) would be amended to: • Establish Management Area 4G, Payson Ranger District Fossil Creek Wild and Scenic River Management Area. This area would encompass approximately 2,170 acres and consist of the Wild and Scenic River Corridor established by Congress and modified by the CRMP to include a spring in the vicinity of Forest Road 708. Establishing this new Management Area would reduce the area of Management Area 4A (Mazatzal Wilderness) by approximately 1,509 acres, Management Area 4E (Proposed Fossil Springs Natural Area) by approximately 132 acres, and Management Area 4F (Payson Ranger District General Management Area) by approximately 529 acres. • Incorporate (by reference) the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the Fossil Creek Wild and Scenic River Management Area mentioned above. • Recommend designation of 9.4 acres of the Fossil Springs Botanical Area adjacent to and part of the Fossil Springs Botanical Area on the Coconino National Forest within the Fossil Creek Wild and Scenic River corridor. This recommended botanical area and associated plan direction would be incorporated into Management Area 4E and the new Management Area 4G (Fossil Creek Wild and Scenic River Management Area). The forest plan amendments would be completed pursuant to the 2012 Planning Rule at 36 CFR 219.13.				
Monitoring	No formal monitoring plan exists for Fossil Creek WSR. Resource and visitor use monitoring conducted as needed.	CRMP establishes monitoring plan to ensure protection and enhancement of river values. Other monitoring conducted as needed and as opportunities arise. Some differences may exist by alternative in the timing and/or nature of completing monitoring in order to ensure river value protection. More information about the monitoring plan and any differences between alternatives can be found in Chapter 6 of the CRMP.				

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
Adaptive management	No formal adaptive management plan exists for Fossil Creek WSR. Interim management changes are analyzed and implemented as needed to manage use and protect resources.	CRMP establishes adaptive management plan to adjust management activities, user capacities, and infrastructure as needed (as indicated by monitoring) to ensure protection or enhancement of river values. Anticipated adaptive management activities are disclosed and analyzed in CRMP NEPA in order to facilitate timely future implementation. More information about specific adaptive management actions can be found in the narrative above and in Chapter 6 of the CRMP.				
Education, interpretation, and research	Educational and interpretive materials (signs, kiosks, brochures, online information) provided to support current management. Research and education activities approved on case-by-case basis.	CRMP management direction provides guidance and focus for education, interpretation, and research activities. Education, interpretation, and research designed to facilitate successful implementation of each alternative and protection and enhancement of river values. Additional facilities and infrastructure to support education, interpretation, and research are provided (details vary by alternative).				
Refugia	No specific management direction for refugia areas provided.	Areas in riparian and upland areas outside of recreation sites, construction footprints, and designated roads and trails serve as relatively undisturbed habitat (refugia) for wildlife, fish, and plants. In refugia areas, the effects from visitor use are so minor as to be negligible, and there would be no use of heavy machinery or development of infrastructure.				
Mineral and water rights	Locatable mineral entry possible in the recreational segment of Fossil Creek. No federally reserved water right to protect stream flows.	CRMP management direction provides objectives for pursuing withdrawal of the recreational segment of the Fossil Creek corridor from locatable mineral entry and for obtaining federally reserved water rights for streamflows necessary to protect Fossil Creek's river values. The wild segments are automatically withdrawn from mineral entry by designation under the Wild and Scenic Rivers Act.				
Managed Entry, Fees, and Site Administration						
Reservation for Middle Fossil and Fossil Springs area day use	Reservation required to park within WSR corridor and Strawberry side trailhead, April 1-October 1.	Reservation required to park within WSR corridor and Strawberry side trailhead, during high-use season (currently defined as April 1 – Oct. 1) unless determined to be unnecessary. Number of available permits corresponds to number of available parking spaces.				No reservation required to park within WSR corridor or Strawberry side trailhead.
Reservation for camping	No reservation required for camping use.	In alternatives where camping is provided (see “Recreation Opportunities” section below), separate reservation required for camping use in Middle Fossil, the Fossil Springs area, and at trailheads. No separate camping reservation required for backcountry camping in wild segments beginning 1/4-mile upstream of the Bear Trail in the Fossil Springs wild segment and 1/4-mile downstream of the Mazatzal recreation site in the Mazatzal wild segment.				No reservation required for camping. Camping first-come, first-served at 10 campsites at Homestead.
Reservation for scenic driving or motorized trail use	No separate provision for scenic driving exists.			Separate reservation required for scenic driving	Separate reservation required for motorized trail use	No separate provision for scenic driving exists.
Permit for Stehr Lake, Childs, and Deadman Mesa Road	No permit or reservation required to access Stehr Lake, Childs, or Deadman Mesa Road.					
Permit Fees	Permit fees are outside the scope of this analysis and are determined through a separate process. Currently, visitors are charged a $10 reservation service fee for a Fossil Creek permit.					Determining fees is outside the scope of this analysis. Fees would be determined through a separate process. No reservation service fee.

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
Site administration	Forest Service oversees operations and maintenance.	In the short term, Forest Service oversees operations and maintenance. If possible, opportunities for partnerships, concessionaires, or other options to share operations and maintenance activities will be pursued.				
Recreation Site Names, Availability, and Amenities						
Recreation site name changes	No recreation site name changes.	Waterfall Trailhead changed to Lewis Trailhead. Fossil Springs Trailhead changed to Bear Trailhead.		Waterfall Trailhead changed to Lewis Trailhead. Fossil Springs Trailhead changed to Rim Trailhead.	Waterfall Trailhead changed to Lewis Trailhead. Fossil Springs Trailhead changed to Rim Trailhead. Bear Trailhead moved.	Waterfall Trailhead changed to Lewis Trailhead. Fossil Springs Trailhead changed to Rim Trailhead.
Mazatzal	Approximately 4 parking spaces; vault toilet; kiosk; access to Mazatzal Wilderness.	Approximately 4 parking spaces; vault toilet; trash receptacles; access to Mazatzal Wilderness.	Approximately 4 parking spaces; vault toilet; trash receptacles; access to Mazatzal Wilderness.	Approximately 4 parking spaces; vault toilet; trash receptacles; access to Mazatzal Wilderness.	Approximately 4 parking spaces; vault toilet; trash receptacles; access to Mazatzal Wilderness.	Approximately 4 parking spaces; vault toilet; trash receptacles; access to Mazatzal Wilderness.
Purple Mountain	Approximately 6 parking spaces; portable toilet; kiosk.	Approximately 6 parking spaces; trash receptacles; portable toilet.	No parking. Site rehabilitated.	No parking. Site rehabilitated.	Approximately 6 parking spaces; trash receptacles; portable toilet.	Approximately 6 parking spaces; trash receptacles; portable toilet.
Sally May	Approximately 10 parking spaces; portable toilet; kiosk.	Approximately 10 parking spaces; trash receptacles; portable toilet.	No parking. Site rehabilitated.	No parking. Site rehabilitated.	Approximately 10 parking spaces; trash receptacles; portable toilet.	Approximately 10 parking spaces; trash receptacles; portable toilet.
Junction	Temporary parking; vault toilet; kiosk; visitor contact station with gate.	Temporary parking; vault toilet; kiosk; visitor contact station.	Approximately 5 parking spaces; temporary parking; vault toilet; kiosk; visitor contact station.	Temporary parking; vault toilet; kiosk; visitor contact station.	Temporary parking; vault toilet; kiosk; visitor contact station.	Approximately 5 parking spaces; temporary parking; vault toilet; trash receptacles; kiosk.
Cactus Flat	Site does not exist.	Site does not exist.	Welcome center with approximately 47 parking spaces, plus 3 stock trailer spaces; interpretive displays; toilet; trash receptacles; picnic tables; and bike racks. New Creek View Trailhead just north on FR 9D.	Site does not exist.	Welcome center with approximately 47 parking spaces, plus 3 stock trailer spaces; interpretive displays; toilet; trash receptacles; picnic tables; and bike racks. New Creek View Trailhead just north on FR 9D.	Welcome center with approximately 367 parking spaces & horse trailer accommodation; potential for partial closure of parking lot during the low-use season; interpretive displays; possible visitor center; toilet; trash receptacles; picnic tables; and bike racks. Potential for portion of area to be available for group use (e.g. camping for school groups). New Creek View Trailhead just north on FR 9D.
Homestead Upper Loop	Approximately 25 parking spaces; vault toilet; kiosks; picnic tables.	Approximately 20 parking spaces; vault toilet; trash receptacles; kiosks; picnic tables.	Site meant to serve as an extension of the Cactus Flat welcome center, with approximately 40 parking spaces, vault toilets, kiosks, trash receptacles, picnic tables, and bike racks.	Approximately 10 parking spaces; vault toilet; kiosks; trash receptacles; picnic tables; shelters.	Approximately 25 parking spaces; vault toilet; kiosks; trash receptacles; picnic tables; shelters.	Site meant to serve as an extension of the Cactus Flat welcome center. Approximately 75 parking spaces; vault toilet; kiosks; trash receptacles; picnic
Homestead Lower Loop	Walk-in only.	Walk-in only.		Walk-in only.		

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						tables with shade structures; and bike racks.
Homestead West Loop	Prioritized for tribal use as needed; vault toilet available for all use. Potential for portion of area to be available for group use (e.g. camping for school groups).	Prioritized for tribal use as needed; vault toilet available for all use. Potential for portion of area to be available for group use (e.g. camping for school groups).	Prioritized for tribal use as needed; vault toilet available for all use. Potential for portion of area to be available for group use (e.g. camping for school groups).	Prioritized for tribal use as needed; vault toilet available for all use. Potential for portion of area to be available for group use (e.g. camping for school groups).	Prioritized for tribal use as needed; vault toilet available for all use. Potential for portion of area to be available for group use (e.g. camping for school groups).	Walk-in for camping at designated sites; prioritized for tribal use as needed. Vault toilet, trash receptacles. Potential for portion of area to be available for group use (e.g. camping for school groups).
Heinrich	Site does not exist.	Welcome center with approximately 15 parking spaces, interpretive displays, short interpretive trail and/or canopy walk, toilet, trash receptacles, and one-way loop road. Host/ administrative site with toilet. No river access.	Host/ administrative site with toilet. No public access.	Small welcome center with approximately 10 parking spaces, kiosks, toilet, trash receptacles, short interpretive trail and/or canopy walk. Host/ administrative site with toilet. No river access.	Approximately 25 parking spaces, kiosks, possible short interpretive trail and/or canopy walk. Toilet and trash receptacles. Host/ administrative site with toilet. No river access.	Host/ administrative site with toilet and wastewater holding tank, open-air cooking/dining space; trash receptacles; administrative campsites. No public access.
Fossil Creek Bridge	Approximately 10 parking spaces; vault toilet; kiosk.	New bridge. Approximately 15 parking spaces; vault toilet; kiosk; trash receptacles; bike racks.	New bridge. Walk-in only during high use season; approximately 10 parking spaces during low-use season vault toilet; kiosk; trash receptacles; bike racks; picnic tables.	New bridge. Approximately 15 parking spaces; vault toilet; kiosk; trash receptacles; bike racks.	New bridge. Approximately 15 parking spaces; vault toilet; kiosk; trash receptacles; bike racks.	New bridge. Walk-in only during high-use season; approximately 10 parking spaces during low-use season; vault toilet, kiosk; trash receptacles; bike racks; picnic tables.
Tonto Bench	Approximately 21 parking spaces; vault toilet; kiosk.	Approximately 4 parking spaces; vault toilet; kiosk; trash receptacles; bike racks.	Walk-in only during high-use season; approximately 4 parking spaces during low-use season; vault toilet; kiosk; bike racks; trash receptacles.	No long-term parking. Site rehabilitated. Roadside vault toilet available, with temporary parking.	Approximately 15 parking spaces; vault toilet; kiosk; trash receptacles; bike racks.	Walk-in only during high-use season; approximately 15 parking spaces during low-use season; vault toilet; kiosk; bike racks; trash receptacles.
Irving	Approximately 18 parking spaces, vault toilet, and kiosks on southwest side of creek. Pedestrian access to northwest side via low water crossing. Flume Trailhead and kiosks on northeast side of creek.	Approximately 15 parking spaces, vault toilet, kiosks, and trash receptacles on southwest side of creek. Pedestrian access to northwest side via low water crossing. Flume Trailhead and kiosks on northeast side of creek.	No vehicle access during high-use season; approximately 18 parking spaces during low-use season on southwest side of creek. Vault toilet, kiosks, trash receptacles, picnic tables, and bike racks on southwest side of creek. Pedestrian access to northwest side via low water crossing. Flume Trailhead and kiosks on northeast side of creek, with Creek View Trail connector.	Approximately 60 parking spaces, toilets, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks possible on both sides of creek. New vehicle bridge across creek. Boardwalk; trail to wildlife blind. Flume trailhead.	Approximately 60 parking spaces, toilets, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks possible on both sides of creek. New vehicle bridge across creek. Boardwalk; trail to wildlife blind. Flume trailhead; Creek View Trail connector.	No vehicle access during high-use season; approximately 18 parking spaces during low-use season on southwest side of creek. Vault toilets and kiosks on south side of creek; in the long-term, possible alternative toilets, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks on both sides of creek. Pedestrian access to northwest side via low water

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
						crossing; Flume trailhead; Creek View Trail connector.
Lewis Trailhead and Trail	Approximately 21 parking spaces; vault toilet; kiosks.	Approximately 5 parking spaces; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No vehicle access during high-use season; approximately 5 parking spaces during low-use season; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No long-term parking. Trailhead and trail rehabilitated. Roadside vault toilet available, with temporary parking.	Approximately 21 parking spaces; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No vehicle access during high-use season; approximately 21 parking spaces during low-use season; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.
Bear/Rim Trailheads	**Bear Trailhead only**. No Rim Trail. Approximately 30 parking spaces, plus 3 stock trailer spaces with corrals; vault toilet; kiosks; trash receptacles.	**Bear Trailhead only**. No Rim Trail. Approximately 15 parking spaces, plus 3 stock trailer spaces with corrals; vault toilet; kiosks; trash receptacles.	**Combined parking for new Rim Trailhead and existing Bear Trailhead**. Approximately 30 parking spaces, plus 3 stock trailer spaces with corrals. Vault toilet; kiosks; trash receptacles; picnic tables; bike racks.	**Rim Trailhead only**. No Bear Trail. Approximately 30 parking spaces; vault toilet; kiosks; trash receptacles; picnic tables; bike racks.	**Bear Trailhead** moved approx. 1/4-mile east on FR 708. Approximately 6 parking spaces; toilet, kiosk. **Rim Trailhead** has approximately 30 parking spaces plus 3 stock trailer spaces with corrals; vault toilet; kiosks; trash receptacles; picnic tables; bike racks.	**Rim Trailhead only.** Approximately 30 parking spaces, plus 3 stock trailer spaces with corrals; vault toilet; kiosks; trash receptacles; picnic tables; bike racks.
Historic Dam and Fossil Springs area	Accessible via foot trails.	Accessible via foot trails. Alternative toilet if needed.	No trail access.	No trail access.	Accessible via foot trails. Alternative toilet if needed.	Accessible via foot trails. Alternative toilet if needed.
East Welcome Station	Visitor contact station with gate.	Visitor contact station, with possibility of improved entry area and signage.				No visitor contact station.
Total number of parking spaces/ possible vehicles during high-use season	Up to 148	Up to 112	Up to 132	Up to 129	Up to 270	Up to 500
Other Infrastructure Construction						
Other infrastructure	Any new infrastructure construction subject to separate analysis.	New vehicle bridge constructed adjacent to existing Fossil Creek Bridge; existing gabion between Sally May and Purple Mountain repaired and extended.		New vehicle bridge constructed adjacent to existing Fossil Creek Bridge; new bridge constructed at Irving to provide vehicle access to recreation site on west side of Fossil Creek; existing gabion between Sally May and Purple Mountain repaired and extended.		New vehicle bridge constructed adjacent to existing Fossil Creek Bridge; existing gabion between Sally May and Purple Mountain repaired and extended. New trail bridges across two side canyons along the Flume Trail. Approximately 200 feet of FR 9D between FR 708 and the Cactus Flat parking lot would be realigned to improve access.
Recreation Opportunities						

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
Day use opportunities	Full range of recreation opportunities available year-round. Emphasis is placed on river-related activities such as swimming, hiking, boating, wilderness exploration, exploring cultural attractions related to the river corridor, and viewing scenery, wildlife, fish, and plants/wildflowers. Hunting and fishing are allowed and coordinated with Arizona Game and Fish Department. Equestrian and bicycle use available on certain trails (see "Non-Motorized Trails" section below). Bicycle use available on National Forest System roads in vicinity of corridor.					
Camping in Middle Fossil and east side trailheads	Dispersed camping allowed downstream of Fossil Creek Bridge outside of permit period.	Up to 10 designated campsites divided amongst Mazatzal, Purple Mountain, Sally May, Homestead, Tonto Bench, and/or Irving outside of the high-use season.	Up to 3 designated campsites at Cactus Flat year-round. Up to 4 designated campsites provided at Bear/Rim Trailhead, year-round.	No camping provided, year-round.	Up to 10 designated campsites divided amongst Mazatzal, Purple Mountain, Sally May, Homestead, Tonto Bench, and/or Irving, year-round. Up to 3 administrative campsites at Cactus Flat. Up to 4 designated campsites provided at Rim Trailhead, year-round.	Up to 10 designated walk-in campsites at Homestead middle loop, year-round.
Camping in Fossil Springs area	Dispersed camping allowed upstream of historic dam outside of the high-use season only.	Up to 3 dispersed campsites near Fossil Springs, year-round.	No camping provided, year-round.	No camping provided, year-round.	Up to 3 designated campsites in the Fossil Springs area, year-round.	Dispersed camping allowed upstream of historic dam outside of the high-use season only.
Camping in wild segments	Dispersed backcountry camping allowed outside of permit area in wild segments.	Dispersed backcountry camping allowed in wild segments beginning 1/4 mile upstream of the Bear Trail in the Fossil Springs wild segment and 1/4 mile downstream of the Mazatzal recreation site in the Mazatzal wild segment.				
Camping for Administrative and special event camping	Camping for administrative activities and special events authorized throughout WSR corridor on a case-by-case basis.					Administrative camping at Heinrich; camping for special events authorized throughout WSR corridor on a case-by-case basis.
Scenic driving/ motorized trail use	No specific provision for scenic driving/motorized trail us.			Access for scenic driving provided for up to 40 vehicles at one time with short-term parking at recreation sites. Special permit required during permit season.	Access for up to 40 motorized trail vehicles <62 inches wide with short-term parking at recreation sites. Special permit required during permit season.	No specific provision for scenic driving/motorized trail use.
Outfitter/guide use	Outfitter/guide use in Fossil Creek WSR corridor minimal. Assessed on as-needed basis.	Needs assessment and prospectus for outfitter/guide use in Fossil Creek WSR corridor completed within two years of CRMP approval. Would not increase visitor numbers beyond maximum capacity set by alternatives.				
Non-Motorized Trails and Trailheads						
Trail name changes	No trail name changes would occur.	Waterfall Trail changed to Lewis Trail. Fossil Springs Trail changed to Bear Trail.				

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
Creek View Trail	Trail does not exist.	Trail does not exist.	New Creek View trail constructed from trailhead near Cactus Flat parking area on Forest Road (FR) 9D to Flume Trail. Trail length: 3 miles. Two connector trails from Creek View Trail—one to FR 708 between Heinrich and Bridge, and one to Irving. Connector trail length: 1.3 miles. Creek View Trail and connector open to foot, equestrian, and bicycle use.	Trail does not exist.	New Creek View trail constructed from trailhead near Cactus Flat parking area on Forest Road (FR) 9D to Flume Trail. Trail length: 3 miles. Two connector trails from Creek View Trail—one to FR 708 between Heinrich and Bridge, and one to Irving. Connector trail length: 1.3 miles. Creek View Trail and connector open to foot, equestrian, and bicycle use.	New Creek View trail constructed from trailhead near Cactus Flat parking area on Forest Road (FR) 9D to Flume Trail. Trail length: 3 miles. Two connector trails from Creek View Trail—one to FR 708 between Heinrich and Bridge, and one to Irving. Connector trail length: 1.3 miles. Creek View Trail and connector open to foot, equestrian, and bicycle use.
Flume Trail	Trail open to foot and equestrian travel from Irving to junction with Bear Trail at Historic Dam. Trail length: 4.5 miles. Trailhead at Irving.	Trail open to foot and equestrian travel from Irving to junction with Bear Trail at Historic Dam. Trail length: 4.5 miles. Trailhead at Irving.	Trail open to foot and equestrian travel from Irving to viewpoint (no access to Historic Dam). Portion of trail from viewpoint to Dam is closed and decommissioned. Trail length: 3.25 miles. Trailhead at Irving.	Trail open to foot and equestrian travel from Irving to viewpoint (no access to Historic Dam). Portion of trail from viewpoint to Dam is closed and decommissioned. Trail length: 3.25 miles. Trailhead at Irving.	Trail open to foot and equestrian travel from Irving to junction with Bear Trail at Historic Dam. Trail length: 4.5 miles. Trailhead at Irving.	Trail open to foot and equestrian travel from Irving to junction with Mail Trail. Trail length: 5.2 miles. Trailhead at Irving.
Lewis Trail	Trail open to foot travel; not a designated Forest Service system trail. Trail length: 0.9 miles. Trailhead at Lewis Trailhead parking lot.	Trail open to foot travel and formally designated as Forest Service system trail. Trail length: 0.9 miles. Trailhead at Lewis Trailhead parking lot.	Trail open to foot travel and formally designated as Forest Service system trail. Trail length: 0.9 miles. Trailhead at Lewis Trailhead parking lot.	Trail and trailhead closed and decommissioned.	Trail open to foot travel and formally designated as Forest Service system trail. Trail length: 0.9 miles. Trailhead at Lewis Trailhead parking lot.	Trail open to foot travel and formally designated as Forest Service system trail. Trail length: 0.9 miles. Trailhead at Lewis Trailhead parking lot.
Rim Trail	Trail does not exist.	Trail does not exist.	New Rim Trail loop constructed near existing Bear Trailhead. Connector trail constructed from FR 708 to west side of loop. Total trail length, including connector: 1.4 miles. Open to foot, equestrian, and bicycle use.	New Rim Trail loop constructed near existing Bear Trailhead. No connector trail constructed. Trail length: 1 mile. Open to foot, equestrian, and bicycle use.	New Rim Trail loop constructed near existing Bear Trailhead. Connector trail constructed from FR 708 to west side of loop. Total trail length, including connector: 1.4 miles. Open to foot, equestrian, and bicycle use.	New Rim Trail loop constructed near existing Bear Trailhead. Connector trail constructed from FR 708 to west side of loop. Total trail length, including connector: 1.4 miles. Open to foot, equestrian, and bicycle use.
Bear Trail	Full trail open to foot and equestrian travel from trailhead to junction with Flume Trail at Historic Dam. Trail length: 4 miles.	Full trail open to foot and equestrian travel from trailhead to junction with Flume Trail at Historic Dam. Trail length: 4 miles.	Trail open to foot and equestrian travel to junction with Mail Trail but no longer continues to Fossil Springs, the Historic Dam, or the Flume Trail. Portion of trail between Mail Trail and Flume Trail is decommissioned. Trail length: 3.3 miles	Trail closed and decommissioned.	Full trail open to foot and equestrian travel from trailhead to junction with Flume Trail at Historic Dam, but trailhead moved to new parking lot. Trail length: 3.7 miles.	Trail closed and decommissioned.
Creek access trails	Informal trails determined to provide direct, low-impact	Informal trails determined to provide direct, low-impact	Informal trails determined to provide direct, low-impact	Informal trails determined to provide direct, low-impact	Informal trails determined to provide direct, low-impact	Informal trails determined to provide direct, low-impact

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
	access from parking areas to creekside locations available. Total length about 0.97 miles.	access from parking areas to creekside locations available. Total length about 0.98 miles.	access from parking areas to creekside locations available. Total length about 0.89 miles.	access from parking areas to creekside locations available. Total length about 0.35 miles.	access from parking areas to creekside locations available. Total length about 0.98 miles.	access from parking areas to creekside locations available. Total length about 0.98 miles.
Mail Trail	Trail open. Trail length: 8.5 miles, 1.5 miles of which is within the Wild & Scenic River Corridor. Trail receives little use.					
Interpretive and other trails	Trails do not exist.	Short interpretive trail and/or canopy walk at Heinrich.	Trails do not exist.	Short boardwalk and trail to wildlife blind at Irving.	Short interpretive trail and/or canopy walk at Heinrich. Short boardwalk and trail to wildlife blind at Irving.	Shade structures with interpretive information along FR 708. New 0.3-mile trail to connect Cactus Flat and Homestead.
Total trail mileage (includes full Mail Trail)	18 miles	18 miles	21.5 miles	13 miles	23 miles	22 miles
Motor Vehicle Access						
Motor vehicle access to Middle Fossil	Only motor vehicle access into Middle Fossil is via Forest Road (FR) 708 from State Route (SR) 260 (Camp Verde side). This section open to all motor vehicles. 4.1-mile section of FR 708 between Waterfall (Lewis) Trailhead and gate at canyon rim (Strawberry side) closed to public motorized travel.	Only motor vehicle access into Middle Fossil is via FR 708 from SR 260 (Camp Verde side). This section open to all motor vehicles. 4.1-mile section of FR 708 between Waterfall (Lewis) Trailhead and gate at canyon rim (Strawberry side) closed to public motorized travel.	Only motor vehicle access into Middle Fossil is via FR 708 from SR 260 (Camp Verde side). This section open to all motor vehicles. 4.1-mile section of FR 708 between Waterfall (Lewis) Trailhead and gate at canyon rim (Strawberry side) closed to public motorized travel year-round. Section of FR 708 between Homestead and gate at Waterfall (Lewis) Trailhead closed to public motorized travel during high use season and open to all motor vehicles during low-use season.	Motor vehicle access into Middle Fossil on FR 708 available from SR 260 (Camp Verde side) and from Strawberry side, pending repair of 4.1-mile closed section. FR 708 open to all motor vehicles.	Motor vehicle access into Middle Fossil on FR 708 available from SR 260 (Camp Verde side) and from Strawberry side, pending repair of 4.1-mile closed section. FR 708 from SR 260 to Lewis Trailhead open to all motor vehicles. FR 708 from gate at canyon rim (Strawberry side) to Lewis Trailhead designated as motorized trail open to vehicles less than 62 inches wide.	Only motor vehicle access into Middle Fossil is via FR 708 from SR 260 (Camp Verde side). This section open to all motor vehicles. 4.1-mile section of FR 708 between Waterfall (Lewis) Trailhead and gate at canyon rim (Strawberry side) closed to public motorized travel year-round. Section of FR 708 between Homestead and gate at Waterfall (Lewis) Trailhead closed to public motorized travel during high use season and open to all motor vehicles during low-use season.
Motor vehicle access to Fossil Springs (Bear) and Rim trailheads	Access for all motor vehicles to Fossil Springs (Bear) Trailhead available via FR 708 from Strawberry only.		Access for all motor vehicles to Rim Trailhead available via FR 708 from Strawberry only.	Access for all motor vehicles to Rim and Bear trailheads available via FR 708 from Strawberry and Middle Fossil.	Access for all motor vehicles to Rim and Bear Trailheads available via FR 708 from Strawberry only. Access for motorized trail vehicles less than 62 inches wide available via FR 708 from Strawberry and Middle Fossil.	Access for all motor vehicles to Rim Trailhead available via FR 708 from Strawberry only.
Motor vehicle access to Stehr Lake and Childs	Access for all motor vehicles to Stehr Lake and Childs available via FR 502.					
Restoration Activities						

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based Access)
Bare area restoration	Bare areas in the vicinity of Fossil Creek restored on an as-needed basis.	Bare areas outside of open recreation sites restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration area: 36 acres.	Bare areas outside of open recreation sites restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration area: 37 acres.	Bare areas outside of open recreation sites restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration area: 38 acres.	Bare areas outside of open recreation sites restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration area: 35 acres.	Bare areas outside of open recreation sites restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration area: 35 acres.
User-created trail and decommissioned system trail restoration	User-created trails in the vicinity of Fossil Creek restored on an as-needed basis.	No system trails decommissioned. User-created trails restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration: 4 miles.	User-created and decommissioned trails restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration: 6 miles.	User-created and decommissioned trails restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration: 10 miles.	No system trails decommissioned. User-created trails restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration: 4 miles.	No system trails decommissioned. User-created trails restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Total restoration: 7 miles.
Road restoration	User-created roads in the vicinity of Fossil Creek restored on an as-needed basis. Changes to status of system roads subject to separate analysis.	0.8 miles of user-created roads restored. 0.3 miles of system roads decommissioned and restored.	0.8 miles of user-created roads restored. 0.4 miles of system roads decommissioned and restored.	0.8 miles of user-created roads restored. 0.4 miles of system roads decommissioned and restored.	0.8 miles of user-created roads restored. 0.3 miles of system roads decommissioned and restored.	0.8 miles of user-created roads restored. 0.3 miles of system roads decommissioned and restored.
Fossil Springs Botanical Area						
Fossil Springs Botanical Area	Area around Fossil Springs described inconsistently between the Coconino and Tonto forest plans.	Changes to the Fossil Springs Botanical Area boundary recommended to better reflect vegetation community and designation intent. Total recommended size approximately 33 acres in the vicinity of Fossil Springs.				
Access to Fossil Springs Botanical Area	Fossil Springs Botanical Area accessible via Fossil Springs (Bear) Trail and Flume Trail.	Fossil Springs Botanical Area accessible via Fossil Springs (Bear) Trail and Flume Trail.	No trail access.	No trail access.	Fossil Springs Botanical Area accessible via Fossil Springs (Bear) Trail and Flume Trail.	Fossil Springs Botanical Area accessible via Flume Trail.

Comparison of Alternative Capacities

Table 2-4 summarizes user capacities that would be provided in each alternative. The descriptions in this table represent conditions at full implementation of the alternatives.

Table 2-4. Corridor-wide user capacities for the Fossil Creek Wild & Scenic River CRMP alternatives at full implementation

	Alternative A (No Action)	Alternative B (Enhanced Protections)	Alternative C (Non-Motorized Experience)	Alternative D (Motorized Use and Refugia)	Alternative E (Enhanced Recreation Opportunities with Phased Implementation)	Alternative F (Demand-based access)
Recreation site capacities[1]	People at one time: 740 (148 vehicles)	People at one time: 560 (112 vehicles)	People at one time: 660 (132 vehicles)	People at one time: 645 (129 vehicles)	People at one time: 1,350 (270 vehicles)	People at one time: 2,500 (500 vehicles)
Scenic driving/ motorized trail user capacities[2]	N/A	People at one time: 0	People at one time: 0	Scenic driving, all vehicles. People at one time: 200 (40 vehicles)	Motorized trail vehicles less than 62 inches wide. People at one time: 80 (40 vehicles)	People at one time: 0
Administrative use[3]	People at one time: 50	People at one time: 50	People at one time: 50	People at one time: 50	People at one time: 50	People at one time: 50
Walk-ins[3]	People at one time: 20	People at one time: 30	People at one time: 10	People at one time: 10	People at one time: 30	People at one time: 30
Corridor-wide capacity	**810 PAOT**	**640 PAOT**	**720 PAOT**	**905 PAOT**	**1,510 PAOT**	**2,580 PAOT**

[1] Recreation site capacities are based on the number of available parking spaces during the high use season. It is not anticipated that maximum capacities will not be exceeded during the low-use season. Persons at one time (PAOT) calculations for recreation sites assume one vehicle per parking space and five people per vehicle. Alternatives B-F reflect available parking at full implementation of the alternatives.

[2] Capacity for scenic driving is based on 40 permitted vehicles and assumes five people per vehicle. Capacity for motorized trail use is based on 40 permitted vehicles less than 62 inches wide and assumes two people per vehicle.

[3] Administrative use includes Forest Service and other agency staff, partners, researchers, volunteers, law enforcement, and emergency responders. Walk-ins include walk-in visitors occasionally observed near the town of Strawberry and in the Mazatzal area, and backcountry campers in the wild segments.

Summary Comparison of Effects

Table 2-5 summarizes the effects of implementing each alternative by resource area.

Table 2-5. Summary of effects of implementing the alternatives by resource area

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Watershed and Soils							
Free Flow	Presence/absence of water resources projects that may affect free flow	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.	No impact because of section 7 analysis process preventing impacts to free flow condition from newly proposed water resources projects.
Water Quantity	Groundwater extraction within the Fossil Creek WSR corridor	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly	No impact because Forest Service Manual 2500, chapter 2540, water uses and development, explicitly

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
		indicates that proposals to pump or transport water must not impair National Forest System resources.	indicates that proposals to pump or transport water must not impair National Forest System resources.	indicates that proposals to pump or transport water must not impair National Forest System resources.	indicates that proposals to pump or transport water must not impair National Forest System resources.	indicates that proposals to pump or transport water must not impair National Forest System resources.	indicates that proposals to pump or transport water must not impair National Forest System resources.
Water Quality	Provision of toilet facilities as a function of capacity (PAOT/toilet)	45 PAOT/toilet	29 PAOT/toilet	40 PAOT/toilet	57 PAOT/toilet	63 PAOT/toilet	99 PAOT/toilet
Soil Condition	Extent of soil disturbance (acres rounded to nearest whole number)	152 acres	120 acres	107 acres	102 acres	141 acres	135 acres
Riparian Function	% of perennial stream with adjacent rec site (rounded to nearest whole number)	10%	10%	6%	4%	11%	10%
Air quality	New disturbance from construction activities that may create dust	No expansion of existing recreational infrastructure.	5.6 acre expansion of recreational infrastructure.	7.5 acre expansion of recreational infrastructure	10.7 acre expansion of recreational infrastructure	24.4 acre expansion of recreational infrastructure	20.6 acre expansion of recreational infrastructure
Geology							
Travertine disturbance	Potential for visitor use to damage existing or developing travertine features through direct contact	Unplanned recreation that may be more common without CRMP guidance has greater potential to damage travertine formations through direct contact. No formal monitoring of impacts to travertine features would occur.	Most visitor use would occur away from the reach of Fossil Creek where travertine formation is greatest. Guidance provided by CRMP management direction and comprehensive design of recreation sites would reduce the potential for visitor use to damage travertine formations. Lowest visitor capacity of all alternatives, therefore lowest potential for human contact with travertine features.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition. Second lowest visitor capacity of all alternatives, therefore second lowest potential for human contact with travertine features.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition. Third highest visitor capacity of all alternatives, therefore third highest potential for human contact with travertine features.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition. Second highest visitor capacity of all alternatives, therefore second highest potential for human contact with travertine features.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition. Highest visitor capacity of all alternatives, therefore highest potential for human contact with travertine features.
Travertine deposition	Potential for sedimentation to impact travertine deposition	Sedimentation may result from poorly designed or maintained parking lots, creek access, roads, or trails, thereby reducing travertine deposition potential.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition.	Impacts from sediment inputs on travertine deposition are comparable across all action alternatives. Recreation site design and improved creek access should reduce sediment inputs that may reduce travertine deposition.
Wildlife and Vegetation							
Biological Resources	Acres of habitat disturbance includes the sum acres of open	Upland habitat disturbed = 106	Upland habitat disturbed = 84.7	Upland habitat disturbed = 88.6	Upland habitat disturbed = 82.3	Upland habitat disturbed = 92.8	Upland habitat disturbed = 93.8

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
	roads, open trails, developed recreation areas, and dispersed recreation areas.	Riparian habitat disturbed = 20.3 Total =126.3	Riparian habitat disturbed = 9.3 Total = 94.0	Riparian habitat disturbed = 8.6 Total =97.2	Riparian habitat disturbed = 13.6 Total =95.9	Riparian habitat disturbed = 21.6 Total =114.4	Riparian habitat disturbed = 14.9 Total = 113
Biological Resources	Acres of habitat restored would be the sum of bare areas to be restored, recreation sites to be closed and restored, roads to be closed and restored, and trails to be closed and restored. Once these acres become restored, they are considered as wildlife refugia.	0	41.2 acres	43.7	46.4	40.6	41.55
Biological Resources	Acres of full riparian potential equals the sum of undisturbed riparian refugia acres (riparian acres where there are no roads, trails, or recreation sites) plus riparian acres to be restored. This is the ultimate amount of riparian habitat that would be available in a relatively undisturbed state to wildlife as refugia.	625.60 ac	663.4 ac	665.4 ac	661.0 ac	651.0 ac	657.94 ac
Biological Resources	Total refugia habitat is the sum of the full riparian potential along with the undisturbed acres of all upland habitat types. This is the ultimate amount of all habitat types within the corridor that would be available in a relatively undisturbed state to wildlife as refugia.	5073.7	5105.9	5102.8	5104.1	5085.6	5091.3
Biological Resources	Botanical Area (Acres within the Fossil Springs Botanical Area boundary)	Inconsistent size as per the two forest plans. No current measures to protect botanical resources	Size of botanical area is consistent in both forest plans at 33 acres. Accessible via foot trails but if impacts are	Size of botanical area is consistent in both forest plans at 33 acres. No trail access, so botanical area would receive no human-caused impacts.	Size of botanical area is consistent in both forest plans at 33 acres. No trail access, so botanical area would receive no human-caused impacts.	Size of botanical area is consistent in both forest plans at 33 acres. Accessible via foot trails but if impacts are	Size of botanical area is consistent in both forest plans at 33 acres. Access to the botanical area is permitted but only via Flume trail. If impacts

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
			detected, means to limit access may be implemented.			detected, means to limit access may be implemented.	are detected, means to limit access may be implemented.
Adverse Affect/Degradation to Biological Resources	Whether or not an alternative would result in a segment wide adverse effect or degradation to Biological resources from actions proposed in each alternative.	No	No	No	No	No	Yes
Aquatic Resources							
Native fish and aquatic macroinvertebrate habitat	Disturbed area (acres) and recreation density (people at one time divided by total recreation disturbed acres) estimates the potential for increased anthropogenic sedimentation and impact to riparian function from roads, trails and recreation sites. More disturbed acres and higher visitor density represents greater negative impact.	36.8 acres 22.0 people per acre	42.4 acres 15.1 people per acre	28.4 acres 25.4 people per acre	28 acres 32.3 people per acre	61.5 acres 24.6 people per acre	57.7 acres 44.7 people per acre
Native fish and aquatic macroinvertebrate habitat	This measure identifies the average distance between visitors if Recreation Dispersal sites were used at maximum capacity (People At One Time / total length of stream in recreation sites). Smaller values represent more crowded conditions, suggesting people are more likely to leave the recreation site.	10.15 feet between visitors	13.41 feet between visitors	7.03 feet between visitors	4.38 feet between visitors	6.07 feet between visitors	3.21 feet between visitors
Native fish and aquatic macroinvertebrate habitat	Habitat enhancement (acres) measures the potential for decreased anthropogenic sedimentation and impact to riparian	0 acres	20.5 acres	21.8 acres	22.3 acres	20.5 acres	20.37 acres

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
	function from roads, trails and recreation sites. More restored acres represents greater positive impact.						
Native fish and aquatic macroinvertebrate habitat	This measure ranks the potential for introduction of fecal bacteria and personal care products (5 = most potential for negative impacts to water quality)	X	1	2	3	4	5
Native fish populations	Potential for human-mediated non-native fish introduction and direct recreation impacts. More people represent a greater likelihood that a visitor will introduce an invasive fish species.	810 visitors	640 visitors	720 visitors	905 visitors	1510 visitors	2580 visitors
Heritage Resources							
Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV	Traditional cultural practitioner observation and assessment	The institution of the reservation system for the 2016 high season (continuing to present) and the installation of vault toilets has resulted in Fossil Creek being in a healthy state.	If they had to choose, the Yavapai – Apache Nation would choose Alternative B (assume that this is because Alternative B would result in the smallest amounts of impacts, as well as the smallest PAOT number). Alternative B would have a lower PAOT maximum than currently allowed.	Alternative C would have a lower PAOT maximum than currently allowed.	Alternative D allows a maximum of 95 more people than currently allowed, assume that this small increase (10.5%) would not be a serious concern to the Yavapai – Apache Nation.	The Alt. E 1,510 PAOT, constituting essentially of a doubling of the current capacity, would presumably be a non-starter for the Yavapai – Apache Nation. In reality, though, any increase above current capacity as a part of operations under Alternative E would be done under a monitoring and adaptive management regime that would include management decisions/actions that would mitigate the secondary impacts of PAOT increases.	The Yavapai – Apache Nation has told the USFS that it is categorically opposed to Alternative F. The Yavapai – Apache Nation has stated that the first come first serve policy during the peak season will hinder and/or preclude Tribal members from easy access to Fossil Creek. The Yavapai – Apache Nation has told the USFS that the Alternative F component that closes the Bear (Fossil Springs) Trail and provides access to the Fossil Springs area via the Flume Trail (modified for emergency ATV use) is acceptable to them.
Heritage Resources (National Register of Historic Places-eligible Properties)	Criteria of adverse effect	Continuation of the current management of the Fossil Creek in which the USFS would comply with the National Historic Preservation Act regarding register-eligible properties on a case-by-case	For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or	For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or	For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or	For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or	For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
		basis for individual undertakings.	prohibition of ground disturbing activities in certain areas will result in no adverse effects.	prohibition of ground disturbing activities in certain areas will result in no adverse effects.	prohibition of ground disturbing activities in certain areas will result in no adverse effects.	prohibition of ground disturbing activities in certain areas will result in no adverse effects.	prohibition of ground disturbing activities in certain areas will result in no adverse effects.
Recreation							
Preserve/enhance recreation ORV	Recreation access (number of people during permit or high-use season)	53,000 above baseline	21,000 above baseline	39,000 above baseline	36,000 above baseline (for scenic driving)	Up to 163,000 above baseline (includes up to 14,400 via OHV)	392,140 above baseline
	Recreation experience quality	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	More crowding, trash, sanitation issues
	Recreation activity participation	Limited camping	Limited camping	Limited camping Less boating More hiking Less swimming access No Springs access	No camping Less hiking Less swimming access	Limited camping More hiking	Limited camping Less boating More hiking
Socioeconomics							
Economic Impact	Economic Activity – visitation and spending on project activities and FC management	Recreation visitation would support a maximum of 6 jobs and $149,000 in labor income during the permit period. Spending on project activities would support a total of 4 jobs and $52,000 in labor income annually.	Recreation visitation would support a maximum of 4 jobs and $113,000 in labor income during the permit period. Spending on project activities would support a total of 7 jobs and $117,000 in labor income annually.	Recreation visitation would support a maximum of 5 jobs and $133,000 in labor income during the permit period. Spending on project activities would support a total of 9 jobs and $133,000 in labor income annually.	Recreation visitation would support a maximum of 6 jobs and $170,000 in labor income during the permit period. Spending on project activities would support a total of 13 jobs and $234,000 in labor income annually.	Recreation visitation would support a maximum of 12 jobs and $313,000 in labor income during the permit period. Spending on project activities would support a total of 16 jobs and $269,000 in labor income annually.	Recreation visitation would support a maximum of 19 jobs and $490,000 in labor income during the permit period. Spending on project activities would support a total of 12 jobs and $175,000 in labor income annually.
Financial Efficiency	Financial Feasibility	($3,994,360)	($7,739,205)	($8,793,048)	($14,453,610)	($16,802,522)	($11,547,691)
Environmental Justice	Disproportionate and adverse effects to low-income and/or minority populations	User fees and reservation system have the potential to disproportionately impact low income populations and minority populations. The reduction in available weekend permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.	User fees and reservation system have the potential to disproportionately impact low-income populations and minority populations. The reduction in available permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.	User fees and reservation system have the potential to disproportionately impact low-income populations and minority populations. The reduction in available weekend permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.	User fees and reservation system have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should meet demand under conditions in 2016, therefore, it is unlikely that travel costs would disproportionately impact low-income populations.	User fees and reservation system have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should meet demand under conditions in 2016, therefore, it is unlikely that travel costs would disproportionately impact low-income populations.	User fees have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should meet demand, therefore, it is unlikely that travel costs would disproportionately impact low-income populations.
Quality of Life	Recreation Access	Available permits would meet current demand for weekday visitation. It is difficult to say with certainty if future weekday demand will be met. Demand for weekend permits would not be met as the population grows. Reduction in quality of	Available permits are the lowest, which affects visitation. Alt B will likely have the greatest negative impact on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.	Available permits are the second lowest, which affects visitation. Alt C will likely have negative impacts on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.	The impact to quality of life due to permit availability/accessibility of Fossil Creek will be less than under Alternatives A, B, and C.	The impact to quality of life due to permit availability/accessibility of Fossil Creek is likely minimal since the number of permits is greater than the current visitation.	The impact to quality of life due to permit availability/accessibility of Fossil Creek is the least under Alt F since the number of permits is the greatest.

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
		life for visitors who wish to recreate at Fossil Creek on the weekend, but aren't able to obtain a permit would be expected.					
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	No changes to opportunities for recreation such as camping, fishing, hiking, swimming, kayaking, horseback riding, and OHVs. Therefore no change to the existing quality of life for recreation visitors that rely on a diversity of recreation opportunities.	People that value the area for its wild and scenic character will benefit from this alternative as visitor capacity is the lowest among the alternatives and infrastructure development is minimal. People that value swimming and boating may be negatively impacted more than under the existing condition as parking capacity and motorized access is decreased.	People that value the area for its wild and scenic character and ecosystem integrity will benefit from this alternative as access to Fossil Springs is closed. People that value motorized access to swimming, boating, and camping opportunities will be negatively impacted compared to the existing condition.	People that value the area for its wild and scenic character will benefit from this alternative as hiking, camping, swimming, and boating opportunities are limited. People that value scenic driving will benefit more than under the existing condition as the alternative includes scenic driving for up to 40 additional vehicles per day.	People that value the area for its wild and scenic character will benefit from this alternative but less than under the other alternatives as permits for the Fossil Springs area would be reduced. Since recreation opportunities will be increased for hiking, camping, boating, and swimming, people that value diverse recreation opportunities will be positively impacted more than under the other alternatives.	People that value the area for its wild and scenic character will be negatively affected by this alternative since it has the greatest capacity for visitation. Since recreation opportunities will be increased as boating and swimming are not restricted, people that value diverse recreation opportunities will be positively impacted more than under alternatives A, B, C, and D, though hikers for the Fossil Spring trail will be negatively impacted.
Scenery							
Valued landscape character	Acres of planned landscape disturbance	90 ac of planned disturbance (recreation sites, roads, and trails), plus 36.3 acres of other disturbed areas for a total of 126.3 acres of disturbance. This represents the most disturbed area of all alts and thus the most potential for negative impact to landscape character due to departure from the natural-appearing landscape.	A total of 94.1 ac of planned disturbance (recreation sites, roads, and trails). This represents the least disturbed area of all alts and thus the least negative impact to landscape character due to departure from the natural-appearing landscape.	A total of 97.2 ac of planned disturbance (recreation sites, roads, and trails). This represents less disturbed area and thus less negative impact to landscape character due to departure from the natural-appearing landscape than alts A, E, and F and more disturbance and thus more negative impact to landscape character than B and D.	A total of 95.9 ac of planned disturbance (recreation sites, roads, and trails). This represents less disturbed area and thus less negative impact to landscape character due to departure from the natural-appearing landscape than alts A, C, E, and F and more disturbance and thus more negative impact to landscape character than B.	A total of 114.4 ac of planned disturbance (recreation sites, roads, and trails). This represents the most disturbed area of all action alts and thus the most potential for negative impact to landscape character due to departure from the natural-appearing landscape, but less disturbed area than Alt A.	A total of 108.7 ac of planned disturbance (recreation sites, roads, and trails). This represents less disturbed area and thus less negative impact to landscape character due to departure from the natural-appearing landscape than alts A and E and more disturbance and thus more negative impact to landscape character than B, C, and D.
Valued landscape character	Description of built environment	Interim measures including signage, kiosks, and toilets currently present in Fossil Creek detract from the natural-appearing landscape because their development has lacked a comprehensive set of design principles. These features do, however, provide for both user comfort and resource protection.	Presents opportunities to improve accessibility and upgrade elements of the built environment. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort.	Presents opportunities to upgrade elements of the built environment. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be lessened during the high-use season, as visitors would be	Presents opportunities to upgrade elements of the built environment. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be increased year-round, as FR 708 would be repaired and	Presents opportunities to upgrade elements of the built environment. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be increased year-round, as FR 708 would be repaired and	Presents opportunities to upgrade elements of the built environment. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. However, the size of the parking lot at Cactus Flat and the overall high number of vehicles in the WSR corridor may detract from landscape

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
				unable to drive past Homestead.	reopened for public motorized use.	reopened for limited public use as a motorized trail.	character by representing a marked departure from the relatively remote and natural Fossil Creek setting. Accessibility of the WSR corridor would be decreased in the high use season, as FR 708 would be closed to public motorized travel beyond the Homestead site to reduce traffic congestion in the corridor.
Valued landscape character	Acres of dispersed recreation area; persons at one time (PAOT)	26.0 ac of dispersed recreation areas. This is slightly less than alts E and F, the same as Alt B, and more than alts C and D. Alt A would provide for a visitor capacity of 740 PAOT, which is more than alts B and C (with more potential for impacts such as vegetation and ground cover disturbance, soil compaction, and trash and human waste than these alternatives) and less than alts D, E, and F.	26.0 ac of dispersed recreation areas. This is slightly less than alts E and F, the same as Alt A, and more than alts C and D. Alt B would provide for a visitor capacity of 560 PAOT, which is the lowest of any alt. This would result in the lowest potential for impacts from dispersed recreation. A recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation.	10.1 ac of dispersed recreation areas. This is substantially less than alts A, B, E, and F and more than Alt D. Alt C would provide for a visitor capacity of 660 PAOT, which is the second lowest of any alt, including current management. This would result in a relatively low potential for impacts from dispersed recreation. A recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation.	6.6 ac of dispersed recreation areas. This is substantially less than all other alts. Alt D would provide for a total visitor capacity of 845 PAOT, approximately 200 PAOT of which would be for scenic driving (no extended stops in the WSR corridor). This total capacity is higher than alts A, B, or C and lower than alts E and F. The increased number of visitors would increase the potential for impacts from dispersed recreation; however, a substantial portion of this capacity would be from visitors who are driving through the corridor and only stopping for short periods of time, which has a lower likelihood of impacts. A recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation.	26.3 ac of dispersed recreation areas. This is the same as Alt F and more than alts A, B, C, and D. Alt E would provide for a total maximum visitor capacity of 1,430 PAOT, approximately 80 PAOT of which would be for motorized trail use (no extended stops in the WSR corridor). This total capacity is lower than Alt F and substantially higher than alts A, B, C, and D. The increased number of visitors would increase the potential for impacts from dispersed recreation; however, visitor numbers would be increased incrementally. Additionally, a portion of this capacity would be from visitors who are driving through the corridor on motorized trail vehicles and only stopping for short periods of time, which has a lower likelihood of impacts. Further, a recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation.	26.3 ac of dispersed recreation areas. This is the same as Alt E and more than alts A, B, C, and D. Alt F would provide for a total maximum visitor capacity of 2,500 PAOT. This total capacity is substantially higher than all other alternatives. The increased number of visitors would increase the potential for impacts from dispersed recreation; however, visitor numbers would be increased incrementally. The higher number of visitors that could result may result in “creep” of dispersed recreation and associated impacts outside of recreation sites. This effect may be exacerbated by the Cactus Flat parking lot, where most parking would occur, being relatively removed from creekside access points and visitors needing to seek access to the creek on foot or bike. However, adaptive management actions would be taken to address these effects if they are found to occur. Further, a recreation environment that is more managed overall would reduce the potential for impacts of dispersed recreation.
Valued landscape character	Seen area from travelways and recreation sites	All management activities and most recreational use would occur in foreground areas	All management activities and most recreational use would occur in foreground areas	Two new trails (Creek View in Middle Fossil and Rim near the Fossil Springs Trailhead)	Although the new Rim Trail would be constructed, the Bear Trail and portions of the Flume	The new Rim and Creek View trails would be constructed, increasing the overall seen	The new Rim and Creek View trails, as well as a connector trail between Cactus Flat and

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
		where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt A would contain 11 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than alts B, E, and F; the same as Alt C; and more than alt D. However, the chance of adverse impacts to foreground areas and their contribution to landscape character is greatest in Alt A because no comprehensive design guidance would be provided by the CRMP.	where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt B would contain 12 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than Alt E; the same as Alt F; and more than alts A, C, or D.	would be established. These would represent new travelways providing views into the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt C would contain 11 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than alts B and E, the same as Alt A, and more than Alt D.	Trail would be closed, reducing the overall seen area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt D would contain 10 developed sites (parking areas, visitor contact stations, and administrative sites), which is the fewest of all alts.	area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt E would contain 13 developed sites (parking areas, visitor contact stations, and administrative sites), which is the most of all alts.	Homestead, would be constructed, and the Bear Trail would be closed and decommissioned. These trail system changes would increase the overall trail mileage and therefore increase the overall seen area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Alt F would contain 12 developed sites (parking areas, visitor contact stations, and administrative sites), which is less than Alt E, the same as Alt B, and more than alts A, C, and D.
Landscape character enhancement	Acres of restoration of disturbed areas	No specific additional restoration actions are planned, and restoration of disturbed areas would be completed on an as-needed basis and be subject to separate NEPA analysis. The 36.3 acres of “other disturbed areas” identified in Fossil Creek would continue to cause deviations from the landscape character.	41.2 ac of restoration actions are planned. These actions would restore these unplanned bare areas and make progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Until restoration is completed, these areas would continue to cause deviations from the landscape character. Alt B proposes less restoration than alts C, D, and F and more restoration than alts A and E.	43.7 ac of restoration actions are planned. These actions would restore unplanned bare areas, recreation sites and associated roads that would be closed, some trails. Restoration would make progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character. Alt C proposes less restoration than Alt D and more restoration than alts A, B, E, and F.	46.4 ac of restoration actions are planned. These actions would restore unplanned bare areas, recreation sites and associated roads that would be closed, and some trails. Restoration would make progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character. Because of the number of recreation sites proposed to be closed, Alt D would provide the most restoration—and thus the most potential for landscape character enhancement through restoration—of all alternatives.	40.6 ac of restoration actions are planned. These actions would restore unplanned bare areas. Restoration would make progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character. Because Alt E contains the highest number of recreation sites of all alternatives and no recreation sites or trails would be closed, the amount of restoration is lowest of all alternatives.	42 ac of restoration actions are planned. These actions would restore unplanned bare areas and the Bear Trail. Restoration would make progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character. Alt F proposes less restoration than alts C and D and more than alts A, B, and E.

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Landscape character enhancement	Changes in management that would affect landscape character	If new permanent facilities are constructed under Alt A, they would be analyzed under a separate NEPA process. The opportunity to improve existing infrastructure and facilities exists, but would not be propelled forward by the CRMP process. Without the additional guidance identified in the CRMP, development of additional facilities in Fossil Creek may continue to be perceived as a hodge-podge with no coherent guiding design themes.	New development possible under Alt B is fairly limited in order to provide a more primitive visitor experience. This would likely enhance landscape character as perceived by those seeking a more primitive experience; however, those seeking a more developed environment may be negatively affected. New development that does occur would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.	New development possible under Alt C is intended to support a generally non-motorized visitor experience. This would likely enhance landscape character as perceived by those seeking a quieter recreation experience; however, those seeking a motorized experience may be negatively affected. New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.	New development possible under Alt D is intended to support increased motorized access and scenic driving. This would likely enhance landscape character as perceived by those seeking increased access and a motorized recreation experience; however, those seeking a quieter or non-motorized experience may be negatively affected by the sight and sounds of more motor vehicles. New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.	New development possible under Alt E is intended to support increased visitor use and motorized access. This would likely enhance landscape character as perceived by those seeking increased access and a motorized trail recreation experience; however, those seeking a quieter or non-motorized experience without relatively high numbers of visitors may be negatively affected by a relatively high number of visitors and the sight and sound of motorized trail vehicles (ATVs and UTVs). New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.	New development possible under Alt F is intended to support increased visitor use. This would likely enhance landscape character as perceived by those seeking increased access to Fossil Creek; however, those seeking a quieter or non-motorized experience without relatively high numbers of visitors may be negatively affected by a high number of visitors. New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.
Visual quality/scenic integrity	Management changes impacting visual quality/scenic integrity (trail construction, amount of dispersed recreation, amount of camping)	It is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. Dispersed camping in the past has resulted in impacts such as vegetation and soil disturbance, trash, and human waste, which negatively impact visual quality/scenic integrity. Although the locations of camping are limited in Alt A, negative impacts are expected to continue to occur.	It is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. Because Alt B emphasizes fairly limited development, associated decreases in visual quality/scenic integrity should be lessened as compared to alts that propose more development. Alt B would have relatively low visitor numbers, so the potential for impacts of dispersed recreation would be lessened compared to the other alts. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity.	It is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. Because Alt C would have fairly limited development and restore several recreation sites and a portion of the Flume Trail, impacts to visual quality/scenic integrity would be lessened as compared to alts that propose more development. Cut and fill associated with new trails may result in slight reductions in visual quality/scenic integrity, but this impact is anticipated to be fairly minor and the trails would be designed to minimize scenery impacts. Alt C would have relatively low visitor numbers, so the	It is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. Because Alt D would have fairly limited development and restore several recreation sites, the Bear Trail, and a portion of the Flume Trail, impacts to visual quality/scenic integrity would be lessened compared to alts that propose more development. Cut and fill associated with new trails may result in slight reductions in visual quality/scenic integrity, but this impact is anticipated to be fairly minor because the trail is outside of the WSR corridor and the trail would be designed to minimize scenery impacts.	Alt E would contain the most recreation site development in the WSR corridor of all alternatives. Although this represents the most potential for decreasing visual quality/scenic integrity of the alternatives, this should be mitigated by management direction for scenery provided by the CRMP and comprehensive design guidelines. As a result, Alt E is not anticipated to cause irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. While cut and fill associated with new trails may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor and the trails would	Alt F would contain less total acreage of recreation site development than Alt E, and more than alts A, B, C, and D. This represents relatively high potential for decreasing visual quality/scenic integrity compared to most alternatives, but this should be mitigated by management direction for scenery provided by the CRMP and comprehensive design guidelines. However, the size of the parking lot at Cactus Flat and the overall high number of vehicles in the WSR corridor may detract from visual quality/scenic integrity by representing a marked departure from the relatively remote and natural Fossil Creek setting. Overall, Alt F is not anticipated to cause irreversible alterations to areas of Preservation/Very High and

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
			Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past and corresponding impacts to visual quality/scenic integrity.	potential for impacts of dispersed recreation would be lessened compared to the other alts. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity. Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past and corresponding impacts to visual quality/scenic integrity.	The higher total number of visitors in Alt D increases the potential for dispersed recreation impacts; however, a portion of the total visitors would be in the WSR corridor for a short duration as they engage in scenic driving. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity. Eliminating camping should eliminate impacts that have been associated with dispersed camping in the past and corresponding impacts to visual quality/scenic integrity.	be designed to minimize scenery impacts. The higher total number of visitors in Alt E increases the potential for dispersed recreation impacts; however, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity. Additionally, visitor numbers would be increased incrementally if monitoring indicates river values are protected and adaptive management actions would be taken to prevent dispersed recreation impacts from “creeping” outside of recreation sites. Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past and corresponding impacts to visual quality/scenic integrity.	Retention/High visual quality/scenic integrity in the analysis area. While cut and fill associated with new trails may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor and the trails would be designed to minimize scenery impacts. The high total number of visitors in Alt F increases the potential for dispersed recreation impacts, and it is anticipated that the unprecedented number of visitors that could be accommodated may result in “creep” of dispersed recreation and associated impacts outside of recreation sites. However, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity, and adaptive management actions would be taken to address these impacts. Identifying specific camping locations in Middle Fossil would help reduce impacts that have been associated with dispersed camping in the past and corresponding impacts to visual quality/scenic integrity. Although dispersed camping in the Fossil Springs area may continue to impact visual quality/scenic integrity in this area, this use is anticipated to be relatively low because it would occur outside of the high-use season.
Valued sense of place	Degree to which the river values would be protected and enhanced	Alt A would do the least of the alts to protect river values because no CRMP would be in place to provide resource-specific management direction	With a CRMP in place, it is anticipated that Alt B would protect river values. However, because Alt B would provide access to Fossil Creek to the	With a CRMP in place, it is anticipated that Alt C would protect river values. However, because Alt C would provide access to Fossil Creek to	With a CRMP in place, it is anticipated that Alt D would protect river values. Additionally, because Alt D would provide access to Fossil	With a CRMP in place, it is anticipated that Alt E would protect river values. Additionally, because Alt E would provide access to Fossil	As described in other resource reports, it is possible that the implementation strategy of Alt F, and, in some case, the high number of people, may

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
		or a comprehensive strategy for management of Fossil Creek. Alt A therefore has the lowest potential to promote Fossil Creek's valued sense of place. However, because Fossil Creek is still a designated wild and scenic river, interim actions would continue to be taken to support river value protection as required by the Wild and Scenic Rivers Act. If actions requiring additional NEPA analysis become necessary to protect river values, there may be a delay in implementation and river values—and thus sense of place—may experience short-term adverse effects as a result.	fewest people of any alternative, a relatively low number of people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alt B would promote Fossil Creek's valued sense of place. Those whose sense of place of Fossil Creek is enhanced by encountering few people may be positively impacted.	relatively few people, a relatively low number of people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alt C would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by motorized access or visiting the Fossil Springs and historic dam area may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a non-motorized recreation experience or being in the presence of fewer people may be positively impacted.	Creek to more people, more people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alt D would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by non-motorized recreation or visiting the Fossil Springs and historic dam area may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a motorized recreation may be positively impacted.	Creek to more people, more people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alt E would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by a quieter recreation experience with fewer people may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a motorized recreation or proximity to other visitors may be positively impacted.	adversely impact components of the river values. However, the Wild and Scenic Rivers Act requires the Forest Service to protect Fossil Creek's river values. If adverse impacts are found to be occurring, adaptive management actions must be taken to address these impacts. As a result, though Alt F may result in adverse impacts to Fossil Creek's river values and thus its valued sense of place, it is anticipated these effects would be relatively short-term and would be reversed by the application of adaptive management. Alt F would provide access to Fossil Creek to substantially more people, so more people would be able to experience Fossil Creek as a unique place. However, those whose sense of place of Fossil Creek is enhanced by a quieter recreation experience with fewer people may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by expanded access or proximity to other visitors may be positively impacted.
Valued sense of place	Degree to which facilities maintain or enhance scenic attractiveness	Facilities put in place during interim management do not enhance the valued sense of place, but rather provide for key visitor needs at a minimal level. Additional facilities determined to be necessary would likely continue to be installed in this fashion and therefore not enhance the sense of place.	Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.	Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.	Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.	Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.	Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives not developed in detail (40 CFR 1502.14). The "range" of alternatives considered includes both those considered in detail and those eliminated from detailed study. Alternatives not considered in detail may include, but are not limited to, those that are outside the scope of the project, fail to meet the purpose and need, are technologically infeasible or illegal, or would result in unreasonable environmental harm.

An unusual number of alternatives has been considered over the course of the CRMP planning process. Many elements of these alternatives have been carried forward into the alternatives considered in detail in this EIS, so these previous alternatives are generally not considered to be eliminated from detailed study. However, certain components of alternatives are not given detailed consideration for the reasons described below.

Shuttle System Alternative

An alternative that would have required the use of a shuttle service to access the Fossil Creek area from nearby communities was considered. The shuttle service would have originated in Camp Verde or Strawberry, Arizona. After further analysis and discussion, it was determined that the distance and road conditions from these locations would preclude a viable shuttle system. The distance traveled by the shuttle on the primitive FR 708 would likely result in at least a 40-60 minute round trip, which would limit the revenue of a shuttle system and create undesirable conditions for Forest visitors who would have to wait up to an hour each way in extremely hot and possibly dangerous conditions. For these reasons, a shuttle system of this nature was eliminated from detailed study.

No-Fee Alternative

Some commenters expressed concern that charging fees for use of amenities in the Fossil Creek WSR corridor would prohibit some groups from enjoying the area because of cost, suggesting that fees should not be considered in the alternatives. Although determination of a fee is outside the scope of this analysis, all alternatives retain the possibility of charging a fee for use of Fossil Creek. Management of Fossil Creek and protection of river values would not be sustainable in the long term without the ability to provide facilities and maintain visitor numbers within the capacity of the wild and scenic river corridor. Fees may be used for maintenance and operation of recreation facilities, restoration activities, parking and road maintenance, monitoring, and development of interpretive programming in the wild and scenic river corridor.

Rapid Implementation of Alternative F

A rapid implementation of Alternative F was initially considered, whereby development of additional parking and other facilities and infrastructure in the corridor and corresponding increases in visitor capacity would occur in two main phases. Assuming funding availability, the first phase would have been completed shortly after finalization of the CRMP and established approximately 80% of the planned parking capacity in order to meet the estimated current demand for access. The higher levels of visitor use would have been maintained as long as monitoring indicated river values continued to be protected. The second phase would then have developed the remaining parking capacity in the future if demand for access were to increase as anticipated and monitoring indicated river values continued to be protected.

Initial analysis of this implementation strategy indicated likely adverse impacts to certain river values resulting from immediate increases in visitor use of this magnitude or a high level of uncertainty related to these effects. These initial findings brought into question the ability of Alternative F, implemented in this way, to protect river values. For these reasons, this implementation strategy for Alternative F was eliminated from detailed study.

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes the physical, biological, cultural, social, and economic environments of the Fossil Creek area and the potential effects of implementing each alternative on those environments. It also presents the scientific and analytical basis for the comparison of alternatives presented in this EIS. The information in this chapter is excerpted from resource-specific specialist reports. These specialist reports, including full methodology descriptions and other background information, are available for review on the Fossil Creek CRMP website at http://tinyurl.com/FossilCreekCRMP. Resource protection measures required for each resource are listed in Appendix D.

Information in this chapter is presented by resource area. The section for each resource area describes relevant components of the affected environment (distinguished, where appropriate, by baseline and existing condition, with baseline condition representing that in 2009, the year of Fossil Creek's designation as a wild and scenic river) and environmental consequences, consisting of direct, indirect, and cumulative effects. Components of the affected environment relevant to all resources are described first to reduce redundancy across the resource-specific sections. Resources addressed in this chapter consist of:

- Free flow, water quality, water quantity, riparian function, soil condition, and air quality
- Geology
- Wildlife, vegetation, and rare plants
- Fish and other aquatic species
- Heritage resources (including Western Apache and Yavapai traditional and contemporary cultural values)
- Recreation
- Socioeconomics
- Scenery

Affected Environment Common to All Resources

This section describes components of the affected environment common to all resources. These include Fossil Creek's general setting and overlapping land designations, the kinds and amounts of use Fossil Creek receives, facilities and infrastructure present in the WSR corridor, management activities undertaken in recent years, and amounts of bare soil. The area analyzed for direct and indirect effects (also referred to as the project area) encompasses approximately 6,371 acres and consists of the Fossil Creek Wild and Scenic River (WSR) corridor and several connected areas around Stehr Lake, Forest Road (FR) 708, the Bear (Fossil Springs) trailhead and trail, and locations of proposed trails in some alternatives. The area analyzed for cumulative effects, unless stated otherwise for specific resource analyses in this chapter, consists of four 6th hydrologic unit code (HUC) watersheds around Fossil Creek (Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek). This analysis area encompasses approximately 89,390 acres (table 3-1 and figure 3-1).

Table 3-1. Watersheds in the cumulative effects analysis area

HUC number	Watershed name	Acres in project area	Total watershed acreage (rounded to nearest whole number)
150602030306	Hardscrabble Creek	79.7	25,232
150602030307	Lower Fossil Creek	5,642.7	29,808
150602030305	Upper Fossil Creek	560.2	25,840
150602030304	Mud Tanks Draw	31.0	8,510
		Total cumulative effects boundary area (acres)	**89,390**

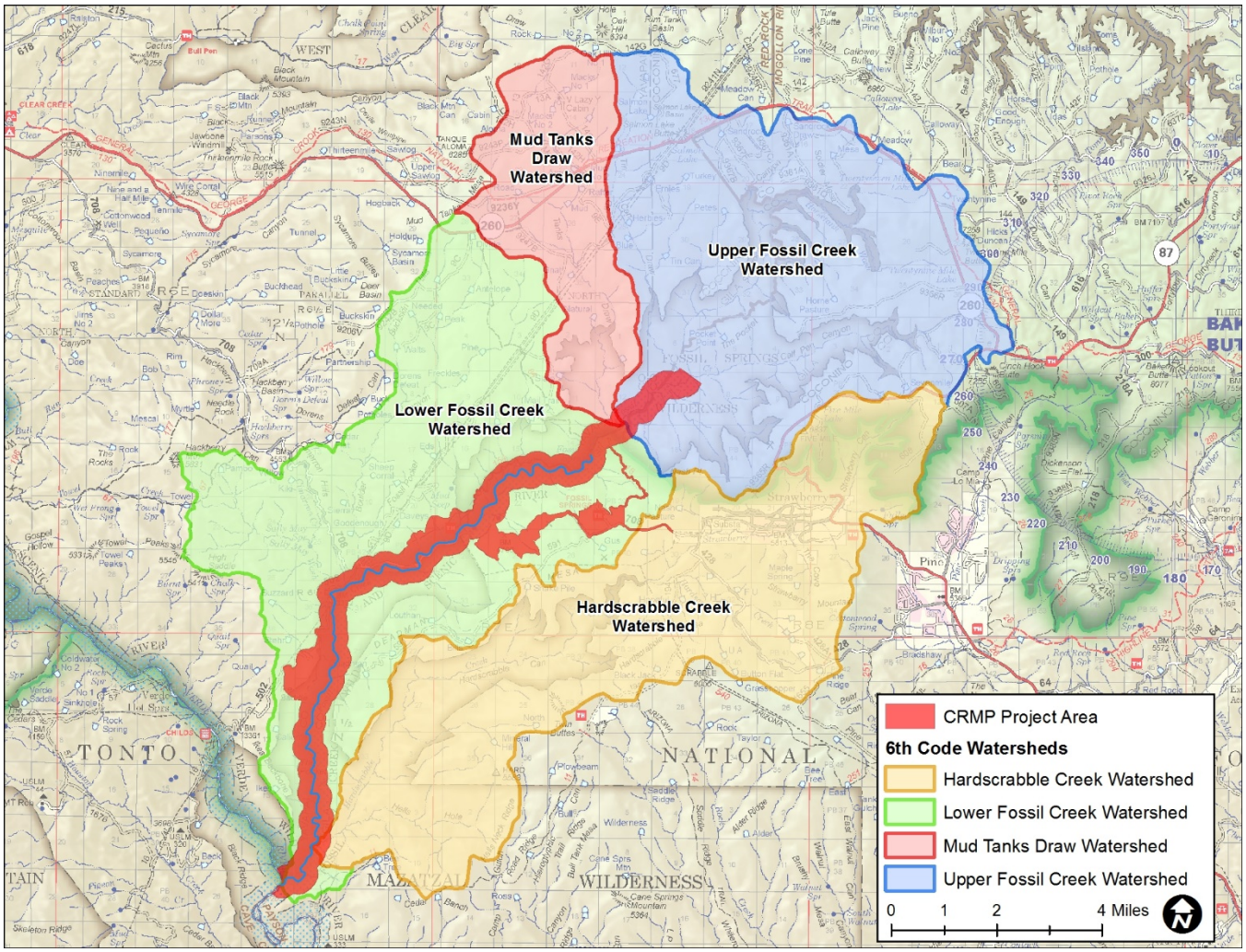


Figure 3-1. Direct, indirect, and cumulative effects analysis areas

Setting and Land Designations

The Fossil Creek WSR is located in a 1,600-foot deep canyon below the Mogollon Rim and in the Mazatzal Mountains of central Arizona within the administrative boundaries of the Coconino and Tonto national forests. Fossil Creek forms the boundary between the two forests. The area has long been the home of Western Apache and Yavapai peoples and maintains special significance to these groups today. For much of the 20th Century, Fossil Creek's waters were diverted into a flume system and used for power generation in the Childs-Irving hydropower system. This system was taken offline in the early 2000s, and through a collaborative effort full water flows were restored to the creek and most components of the Childs-Irving system were removed. This decommissioning process was completed in 2010.

Congress designated Fossil Creek as a Wild and Scenic River in 2009. The designated section of Fossil Creek extends for 16.8 miles from the confluence of Sand Rock and Calf Pen canyons to the confluence with the Verde River. The WSR corridor extends approximately 1/4-mile from either side of Fossil Creek, encompassing approximately 5,192 acres. The corridor consists of two wild segments and one recreational segment. The Fossil Springs Wild Segment begins at the confluence of Sand Rock and Calf Pen canyons and extends 2.7 miles downstream to just above Fossil Springs. The recreational segment begins at the downstream end of the Fossil Springs Wild Segment and extends 7.5 miles downstream to the Purple Mountain recreation site. The Mazatzal Wild Segment begins at the downstream end of the recreational segment and extends 6.6 miles downstream to the confluence with the Verde River (table 3-2). Approximately 14 miles of Fossil Creek flows year-round, beginning at a series of springs approximately 2.8 miles downstream of the confluence of Sand Rock and Calf Pen canyons and continuing downstream to the Verde River (see figure 1-2 in Chapter 1).

Table 3-2. Fossil Creek WSR corridor segments

WSR corridor segment	Miles	Acres	Percent of corridor area
Fossil Springs Wild Segment	2.7	840	16%
Recreational Segment	7.5	2,275	44%
Mazatzal Wild Segment	6.6	2,077	40%
TOTAL	**16.8**	**5,192**	**100%**

No private land is located within the WSR corridor and the entirety of the corridor is under the jurisdiction of the U.S. Forest Service. The WSR corridor is located in Gila and Yavapai counties, with Fossil Creek forming the boundary between the two counties. Most (92%) of the Fossil Springs Wild Segment is contained within the Fossil Springs Wilderness and most (97%) of the Mazatzal Wild Segment is contained within the Mazatzal Wilderness. Portions of both wilderness areas extend into the recreational segment, with approximately 29% of this segment overlapping with designated wilderness. A portion of the Davey's Recommended Wilderness Area (221 acres) overlaps with the recreational segment on the Coconino National Forest, and 66 acres of the Hackberry and 9 acres of the Boulder Canyon inventoried roadless areas overlap with the river corridor. The 12-acre designated Fossil Springs Botanical Area is located on the Coconino National Forest in the vicinity of Fossil Springs at the boundary of the Fossil Springs Wild Segment and recreational segment and is contained entirely within the WSR corridor. The Proposed Fossil Springs Natural Area on the Tonto National Forest is adjacent to the Fossil Springs Botanical Area; 132 acres of this area is located within the WSR corridor. Several forest plan management areas (MAs) overlap with the WSR corridor. On the Coconino NF these MAs consist of the Verde Valley and Pine Belt, and on the Tonto NF these consist of the Mazatzal Wilderness (4A), Verde Wild River (4B), Proposed Fossil Springs Natural Area (4E), and Payson Ranger District General Management Area (4F). Table 3-3 provides detail on the overlap between these land designations and the Fossil Creek WSR corridor.

Table 3-3. Overlap between various land designations and the Fossil Creek WSR corridor

Land designation	WSR corridor segment	Acres	Percent of corridor or segment
Forest Jurisdiction			
Coconino National Forest	All	2,892	56% of WSR corridor
Tonto National Forest	All	2,300	44% of WSR corridor
County Jurisdiction			
Gila County	All	2,764	53% of WSR corridor
Yavapai County	All	2,428	47% of WSR corridor
Designated Wilderness			
Fossil Springs Wilderness	Fossil Springs Wild Segment	774	92% of Fossil Springs Wild Segment
Fossil Springs Wilderness	Recreational Segment	241	11% of Recreational Segment
Mazatzal Wilderness	Recreational Segment	415	18% of Recreational Segment
Mazatzal Wilderness	Mazatzal Wild Segment	2,019	97% of Mazatzal Wild Segment
Total wilderness	**All**	**3,449**	**66% of WSR corridor**
Recommended Wilderness			
Davey's Recommended Wilderness (Coconino NF)	Recreational Segment	221	4% of WSR corridor
Inventoried Roadless Areas (IRA)			
Boulder Canyon (Coconino NF)	Recreational Segment	9	0.1% of WSR corridor
Hackberry (Coconino NF)	Recreational Segment	66	1% of WSR corridor
Total IRA	**All**	**75**	**1.1% of WSR corridor**
Botanical Area			
Fossil Springs Botanical Area (Coconino NF)	Fossil Springs Wild Segment; Recreational Segment	12	0.2% of WSR corridor
Forest Plan Management Areas			
Verde Valley Management Area (Coconino NF)	All	2,549	49% of WSR corridor
Pine Belt Management Area (Coconino NF)	Fossil Springs Wild Segment	349	7% of WSR corridor
4A – Mazatzal Wilderness (Tonto NF)	Recreational Segment; Mazatzal Wild Segment	1,509	29% of WSR corridor
4B – Verde Wild River (Tonto NF)	Mazatzal Wild Segment	62	1% of WSR corridor

Land designation	WSR corridor segment	Acres	Percent of corridor or segment
4E – Proposed Fossil Springs Natural Area (Tonto NF)	Recreational Segment	132	3% of WSR corridor
4F – Payson Ranger District General Management Area (Tonto NF)	Fossil Springs Wild Segment; Recreational Segment	592	11% of WSR corridor

Kinds and Amounts Use and Visitor Preferences

The Interagency Wild and Scenic Rivers Coordinating Council (IWSRCC) defines different types of use of a wild and scenic river, which consist of public use and other use. IWSRCC defines public use as "visitor use and WSR-specific administrative use within a WSR corridor." Visitor use is defined as "human presence within a WSR corridor for recreational purposes, including education, interpretation, inspiration, and physical and mental health." WSR-specific administrative use is defined as "use within a WSR corridor by the river manager, including ranger patrols, maintenance activities, field research, staff visits to administer contracts or facilities, search and rescue, and interpretative programs for the purpose of protection or enhancement of river values." Other use is defined as "use within a WSR corridor other than public use, such as federally authorized mining, forestry, grazing, subsistence hunting and fishing, road use and management, administrative use for other than WSR purposes, and use on non-federal lands in a WSR corridor that have a potential to affect river values. Other use also includes any use on federal or non-federal lands that border upon or are adjacent to a WSR corridor that may substantially interfere with public use and enjoyment of river values." This section describes the past and present kinds and amounts of public and other use Fossil Creek receives, highlighting baseline conditions at the time Fossil Creek was designated a wild and scenic river (2009) where relevant.

Fossil Creek has a long history of human occupation and use because of its year-round water availability in an arid region. Fossil Creek first became part of the human landscape thousands of years ago during the Archaic period. From about 7000 BCE through around 500 CE, people with a mobile hunting and foraging economy incorporated the Fossil Creek area into their lifeways. After 500 CE, people in the Fossil Creek area increasingly practiced agriculture and became less mobile. The well-watered and verdant confines of Fossil Creek were a good agricultural landscape and people settled down and built pit structures and above-ground masonry structures to live in and to store their produce. Around 1300 CE, agricultural social and economic networks shifted to places away from Fossil Creek and farming peoples moved away. However, around the same time, people with a foraging and hunting economy, similar to that of the earlier Archaic inhabitants, began to frequent the Fossil Creek area. These people were the Apache and Yavapai, and despite the severe impacts of Euromerican colonization, they have lived in and maintained a connection with Fossil Creek to the present day. Fossil Creek is a holy place for the Apache and Yavapai. *Tu'dotliz* (TOO DOE CLIZ), or "blue water" is the Apache word for Fossil Creek and the name embodies its blue waterfalls, lush vegetation, and rare riparian species.

In the early 1900s, the Childs-Irving hydroelectric power system was developed. This system was the first such system in Arizona, facilitated the development of mines in nearby areas, and, for a time, provided a substantial amount of power to the city of Phoenix. Many Apache and Yavapai worked to construct and maintain the Childs-Irving system and lived in Fossil Creek until the 1950s. In more recent years and until its decommissioning and removal in the early 2000s, the Childs-Irving system's infrastructure augmented people's attraction to Fossil Creek as a curiosity and, in the case of its flume, a recreation opportunity.

In more recent years, recreational, research, and tribal ceremonial activities became the predominant types of use in Fossil Creek, particularly after decommissioning and removal of the Childs-Irving system. These types of use continue today.

It is anticipated that the kinds of use Fossil Creek currently receives will remain popular into the future. It is also anticipated that demand for access to Fossil Creek will continue to grow as the population of Arizona increases and more people become aware of the area.

Kinds of Visitor Use

Fossil Creek provides opportunities for a variety of recreational activities and attracts visitors from local communities and around the state, country, and world. Many visitors come from desert regions of Arizona, particularly the Phoenix metropolitan area, seeking relief from the summer heat. Visitors enjoy the shade and cooler temperatures of the dense riparian canopy and the abundance of deep, clear pools in which to wade, swim, and play. The springs that feed Fossil Creek maintain constant water flow throughout the year and the high concentrations of calcium carbonate dissolved in the water give it a blue-green color, adding to the scenery and visitors' enjoyment of the area. Other recreational activities include kayaking and pack rafting; hiking; backpacking; wilderness appreciation; fishing; hunting; wildlife, fish, and nature observation; photography; bird watching; and historical site observation and interpretation, particularly related to the APS hydropower generation infrastructure. Additionally, Fossil Creek is considered by the Western Apache and Yavapai as a Traditional Cultural Property, and the area is a place of special religious importance to many traditional Apache and Yavapai.

Because the Childs-Irving hydropower system decommissioning represented a substantial change to the Fossil Creek landscape, this section addresses visitor use before, during, and after the decommissioning process.

Pre-Decommissioning

Fossil Creek has a long history of recreational use. A 1993 report notes:

> Fossil Springs is a popular destination for hikers, attractions being the sudden emergence of 43 cfs [cubic feet per second] of spring water from the ground, the riparian vegetation, and the unique travertine formations. While most of the activity takes place above the diversion [dam], some people hike down the stream course. The stream is heavily used for swimming and picnicking below the bridge at Irving Power Plant (USDA 1993, p. 261).

This report also notes that the segment of Fossil Creek downstream of the junction of FR 502/708 "receives only light use by those looking for a primitive experience" (p. 261).

A Forest Service planning effort in the early 2000s identified the most popular recreation activities in Fossil Creek as dispersed camping, swimming, day hiking, and wildlife/nature viewing. Other activities included partying, fishing, spiritual/meditation, backpacking, picnicking, and hunting (USDA 2004).

Dispersed camping was a popular activity in Fossil Creek before decommissioning. Dispersed campsites were evaluated beginning in 1988. Campsites were primarily located where forest roads 708 and 502 provided easy access to Fossil Creek. The proximity of the towns of Pine and Strawberry influenced the location and intensity of camping, with campsite locations closer to these towns receiving more use.

Decommissioning Period

A visitor study conducted before and after restoration of full flows (Hancock et al. 2007) documented changes in visitor use between 2004 and 2006. The most popular activities visitors reported are listed in table 3-4. This report acknowledges the difficulty of accurately distinguishing trends from the three years of data, but noted several observations. For example, kayaking was not reported as an activity before the dam was decommissioned, but 12 percent of returned surveys taken after decommissioning reported kayaking as an activity. On the other hand, "fluming" (water-based recreation involving the flume structure) became unavailable as a recreation activity because of decommissioning.

Table 3-4. Recreational activities in Fossil Creek before and after restoration of flows (Hancock et al. 2007)

Visitor Activities	Before Restoration of Creek Flows (%)	After Restoration of Creek Flows (%)
Sightseeing	88	90
Walking	73	71
Swimming	65	49
Hiking (day use)	62	51
Wading	56	41

Visitor Activities	Before Restoration of Creek Flows (%)	After Restoration of Creek Flows (%)
Watching wildlife	50	48
Picnicking	48	36
Photography	40	46
Camping near vehicle	34	26
Backpack camping	25	26
Hot springing	25	23
Driving for pleasure	24	44
Sunbathing	24	21
Meditation	22	29
Fluming	20	4
Partying	18	9
Fishing	18	7
Nature study	16	18
Reading for pleasure	13	16
Bird watching	13	13
Rock collecting/prospecting	12	7
Viewing Indian ruins	9	7
Target shooting	7	10
Writing for pleasure	4	4
Hunting	3	10
Mountain biking	2	8
Horseback riding	2	1
Kayaking	0	12

Post-Decommissioning

Visitor surveys that collected information on the types of use in Fossil Creek during the high-use (summer) season after decommissioning were conducted beginning the year of designation (2009) through 2012 (Rotert 2009, 2011, 2012, and 2013a). Although these surveys were conducted opportunistically (rather than using a randomized, repeatable study design), they are suggestive of the types of use occurring in Fossil Creek. The most popular activity documented in these surveys was swimming, with camping and hiking typically being the second- and third-most popular activities, respectively. Other reported activities included observing/exploring, OHV use, partying/socializing, relaxing/getting away, and kayaking/rafting. Although comparable visitor use data were not collected after 2012, subsequent observations of visitor behavior and public comments provided during the CRMP planning process indicate similar types of uses remain popular. Fossil Creek is also periodically host to a variety of education-oriented events such as environmental science school field trips, and is an important destination for members of area tribes for day use and ceremonial events.

Fossil Creek also provides opportunities for hunting and fishing. A 4.5-mile reach of the creek from the waterfall downstream to Sally May Wash is open to catch-and-release fishing for certain species, October through April. Fossil Creek and the surrounding area provides opportunities for hunting for various species, with hunting typically occurring in the fall, winter, and spring.

Amounts of Visitor Use

The amount of visitor use Fossil Creek receives varies substantially by location in the corridor and time of year. The vast majority of use occurs in approximately 30% of length the WSR corridor and within the recreational segment. Use is concentrated around recreation sites in a 5-mile reach between the Mazatzal recreation site and the waterfall at the end of the Lewis (Waterfall) Trail (referred to as Middle Fossil) and in a 0.5-mile reach in the vicinity of Fossil Springs and the historic dam. The creek in Middle Fossil is directly accessible by road and the most common access to the Fossil Springs/historic dam area is via the Bear (Fossil Springs) Trail. Use in the remaining 11 miles (70%) of the WSR corridor is very low. The wild segments are generally inaccessible because of rugged terrain and limited road and trail access, and little use occurs in the recreational segment between the waterfall at the end of the Lewis Trail upstream to just below the historic dam because access to the creek in this section is limited by terrain. Use in this latter area mostly occurs on the Flume Trail, which is located in the uplands and does not provide access to the creek. The amount of visitor use Fossil Creek receives is distinctly

seasonal, with most occurring in the spring and summer (generally May through September). Weekend use is typically much higher than weekday use (figure 3-2). Weather conditions also affect visitor use, with less use occurring on cooler, rainy days. Additionally, the corridor is occasionally closed for short periods because of wet roads or extended periods because of fire danger.

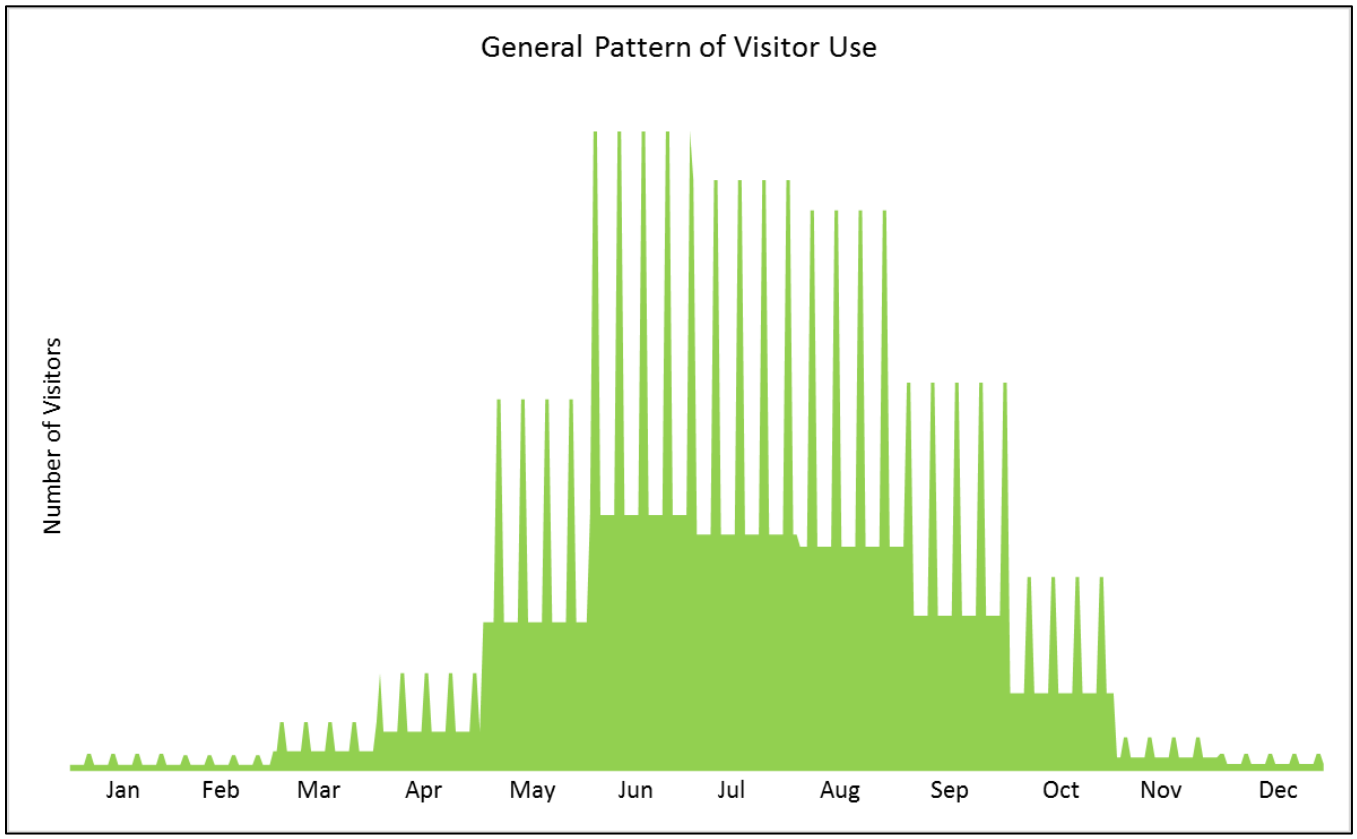


Figure 3-2. General pattern of visitor use in Fossil Creek over the year. Spikes represent weekend days[11]

Visitor use in Fossil Creek has increased in recent years, particularly after restoration of full flows. This increase has been influenced by expanded swimming opportunities, publications promoting Fossil Creek as a destination, and social media (DeSutter 2015). Trail registry data gathered between 1998 and 2002 showed between 1,604 and 3,716 visitors per year accessed the Flume Trail and between 5,922 and 28,976 visitors per year accessed the Fossil Springs Trail (Roughan 2003). In more recent years, visitor use data collection has mostly occurred during the high-use season. Figure 3-3 and table 3-5 display the estimated number of people and vehicles that visited Fossil Creek during the high use season from 2006 to 2017 (Rotert 2013b; DeSutter 2015; Smith 2016; Nichols 2017). Estimated high-use season visitation increased from approximately 20,000 people per year in 2006 to approximately 80,000 in 2009 to over 85,000 in 2011, with demand for access (discussed below) increasing substantially by 2015. In 2009, median visitation during the high-use season was 183 vehicles (551 people) per day on weekends and 52 vehicles (157 people) per day during the week. In 2011, median visitation during the high-use season increased slightly to 209 vehicles (630 people) per day on weekends and 60 vehicles (182 people) per day during the week. The highest number of vehicles observed in the river corridor in recent years occurred on September 5, 2011, when 364 vehicles (1,092 people) were present in the corridor (Rotert 2012).

[11] The general pattern of visitor use is modeled using high-use season observations of demand in 2015 and low-use season trail counter data in 2016/2017. Data were only available at the monthly scale, so daily values are highly generalized and are for purposes of illustration only.

During the low use season, trail counters installed on the Fossil Springs and Waterfall trails in 2016 indicated that average daily use on these trails dropped below 20 people per day on each trail in November and below 10 people per day on each trail in December, January, and February (Nichols 2017).

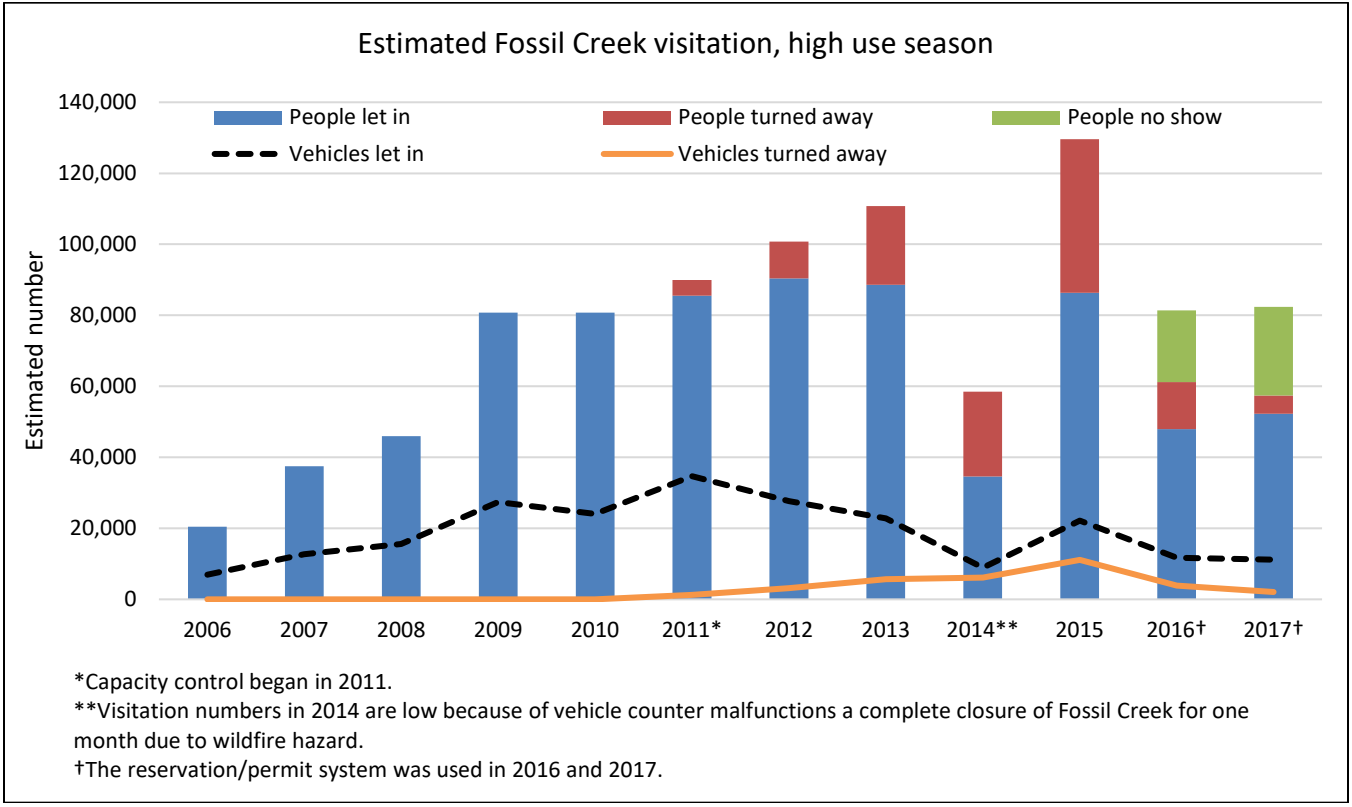


Figure 3-3. Estimated Fossil Creek visitation in the high use season (generally April – September), 2006-2017

Table 3-5. Estimated Fossil Creek visitation in the high use season (generally April – September), 2006-2017

Year	Number of people let in	Number of people turned away	Number of people no show	Number of vehicles let in	Number of vehicles turned away
2006	20,480	0	N/A	6,942	0
2007	37,461	0	N/A	12,699	0
2008	45,939	0	N/A	15,573	0
2009	80,745	0	N/A	27,371	0
2010	80,718	0	N/A	24,081	0
2011*	85,486	4,463	N/A	34,685	1,275
2012	90,396	10,407	N/A	27,644	3,128
2013	88,552	22,224	N/A	22,764	5,713
2014**	34,602	23,911	N/A	8,895	6,147
2015	86,333	43,229	N/A	22,194	11,113
2016†	47,927	13,238	20,242	11,681	3,872
2017†	52,301	5,079	24,957	11,192	2,067

*Capacity control began in 2011.

**Visitation numbers in 2014 are low because of vehicle counter malfunctions a complete closure of Fossil Creek for one month due to wildfire hazard.

†The reservation/permit system was used in 2016 and 2017.

Prior to 2016, visitation numbers were calculated by applying a person-to-car ratio to the number of vehicles counted in the corridor. In 2016 and 2017, visitation numbers and the person-to-car ratio can be determined via

data from the reservation/permit system. The person-to-car ratio has been steadily increasing—from 2.95 in 2009 (Rotert 2009) to 3.89 in 2013 (Rotert 2013b) to 4.1 in 2016 and 4.7 in 2017 (Nichols 2017).

Understanding demand for visitor use in Fossil Creek is useful for determining trends and planning for future use. Total demand for access to Fossil Creek prior to implementing the reservation/permit system can be estimated by adding the number of people let in to Fossil Creek to the number of people turned away (table 3-6). Prior to 2011, all visitors were let in, so total visitation was presumably equivalent to demand. The number of vehicles turned away increased from 2011 to 2015, indicating increasing demand. Total demand for access to Fossil Creek cannot be estimated for 2016-2017 because of a number of factors, including the no show rate and the newness of the reservation/permit system.

Table 3-6. Estimated recreational demand in the high use season (generally April – September), 2006-2017

Year	Demand (number of people)
2006	20,480
2007	37,461
2008	45,939
2009	80,745
2010	80,718
2011	89,949
2012	100,803
2013	110,776
2014*	58,513
2015	129,562
2016**	-
2017**	-

*Visitation numbers in 2014 are low because of vehicle counter malfunctions a complete closure of Fossil Creek for one month due to wildfire hazard.

**Demand cannot be accurately calculated under the reservation system.

Administrative Use

The IWSRCC considers WSR-specific administrative use to be a component of public use. WSR-specific administrative use in Fossil Creek includes use by Forest Service and other agency staff, partners, researchers, volunteers, law enforcement, and emergency responders.

The Forest Service workforce at time of designation of Fossil Creek as a Wild and Scenic River included resource specialists and recreation personnel who patrolled and picked up trash. With increasing visitation, the Forest Service increased recreation staffing at Fossil Creek year-round, with approximately 9 employees during the high use months in recent years and fewer employees during the low use months. Facility maintenance (toilet cleaning and pumping) also occurs. In addition to operations at Fossil Creek, Forest Service volunteers collect water samples and employees may be present to support habitat monitoring, conduct visitor use surveys and complete projects and other activities. The total number of Forest Service employees and volunteers present in the WSR corridor varies and may be approximately 20 people on any given day.

WSR-related monitoring and research activities also occur in Fossil Creek. These activities were occurring at time of designation and continue today. Arizona Game and Fish Department monitors the native fish annually. The Bureau of Reclamation inspects the fish barrier. There have been numerous academic research projects in the wild and scenic river corridor focusing on natural and water resources (e.g. riparian vegetation, wildlife, macro-invertebrates, and water quality) as well as recreation-related topics such as human waste and visitor preferences. Personnel associated with monitoring and research usually number fewer than 10 persons at one time within the river corridor. Emergency situations, such as when the permanent fish barrier was damaged and allowed non-

native fish into the upper reaches of Fossil Creek, required a larger number of individuals to repair the barrier and remove the non-native fish. These instances are unusual and are thus not counted in overall numbers.

Fossil Creek's visitors often require emergency assistance from ambulances, search and rescue, or tow trucks. This need existed at time of designation and incidents increased with increasing use; however, recent years have seen a decrease in emergency responses under the reservation/permit system (Nichols 2017). The need for emergency assistance is greatest during the high use season. Rescues may be accomplished using non-motorized means, motor vehicles, or helicopters depending on the location and nature of the incident. There is also frequent need for vehicle assistance due to break downs, flat tires, and accidents. The number of individuals providing emergency assistance may be approximately 20 people on any given day

Other Use

At time of designation, a privately owned land parcel totaling approximately 19 acres was present within the WSR corridor. The Forest Service acquired this parcel in 2016, so all lands within and bordering on the Fossil Creek WSR corridor are now under federal (Forest Service) jurisdiction. The closest non-federal lands are private parcels in the vicinity of the town of Strawberry approximately two miles from the WSR corridor. Of possible future concern is groundwater withdrawal on private lands, which has the potential to impact aquifers that provide the spring discharge that feeds Fossil Creek.

Other uses occurring on federal lands in and/or around the WSR corridor include motor vehicle use and routine maintenance on Forest Service system roads, utility corridor maintenance, livestock grazing, personal use fuelwood collection, vegetation and fire management, and mineral quarrying. These uses were all occurring at time of designation.

Motor vehicle use and routine maintenance on Forest Service system roads are ongoing uses within and in the vicinity of the Fossil Creek WSR corridor. Maintenance includes grading and drainage work, facilitates continued public access to Fossil Creek, and protects water quality by supporting proper road drainage. Most motor vehicle use is directly related to accessing and administering the WSR corridor; however, some motor vehicle use is for public access to the Verde River/Childs (via FR 502) and Deadman Mesa (via FR 591) or utility maintenance.

Several permitted **utility corridors** exist within and in the vicinity of the Fossil Creek WSR corridor. These consist of an overhead 345-kV Western Area Power Administration (WAPA) transmission line, an overhead 69-kV APS line, and a buried Century Link fiber optic cable. The WAPA lines cross the WSR corridor in the vicinity of the Purple Mountain and Sally May recreation sites, and the APS line roughly parallels a portion of Middle Fossil. The fiber optic cable follows the alignment of FR 708 and provides internet and cell phone service to residents along the Mogollon Rim, including in Payson, Pine, and Strawberry. Maintenance of the power lines includes vegetation clearing and pole replacement, when necessary. Maintenance of the fiber optic cable includes excavation to reach the cable, as needed.

Livestock Grazing is authorized on the Coconino and Tonto national forests as an existing use within the Fossil Creek area. Although grazing allotments overlap with the Fossil Creek WSR corridor, grazing within the WSR corridor itself is limited.

- **Coconino National Forest:** The Ike's Backbone and Fossil Creek allotments overlap with portions of the WSR corridor. In June 2017, the Ike's Backbone Allotment was closed to grazing; this allotment had not been grazed for more than 15 years prior to its closure. Portions of the Fossil Creek Allotment are grazed. Within the Fossil Creek Allotment, the Boulder Pasture, which overlaps a portion of the recreational segment, is grazed; the Upper Wilderness and Lower Wilderness pastures have not been grazed for approximately eight years due to removal of water sources associated with the power plants; and the Stehr Lake Pasture only functions as a trail-through pasture in the late winter or early spring. Three additional allotments are present within the larger Fossil Creek watershed but are distant from the WSR corridor: 13 Mile Rock, Hackberry/Pivot Rock, Baker Lake/Calf Pen.

- **Tonto National Forest:** The Deadman Mesa and Cedar Bench allotments overlap with portions of the WSR corridor. The Deadman Mesa Allotment, which overlaps with the majority of the WSR corridor, has not been grazed since the early 1990s. The Cedar Bench Allotment, a small portion of which overlaps with the downstream end of the Mazatzal Wild Segment, is grazed on an annual rotation. Three additional allotments are present within the larger Fossil Creek watershed but are distant from the WSR corridor: Cedar Bench, Hardscrabble, and Pine.

Livestock access to Fossil Creek is limited by fencing. Within the WSR corridor, a water lane exists in the Boulder pasture, allowing livestock potential access to the water; however, livestock have only used this water lane twice in approximately 15 years and are only in the pasture for a minimal amount of time (approximately 15 to 21 days) in the winter or early spring months.

Personal use fuelwood collection may occur within and adjacent to the Fossil Creek WSR corridor. Outside of the WSR corridor and designated wilderness, cross-country motorized travel may be used to facilitate fuelwood collection. Within the corridor, no cross-country motorized travel is permitted.

Planned vegetation and fire management are routine activities completed by the Forest Service. Although these activities may take place in the vicinity of the Fossil Creek WSR corridor, they are typically distant from the corridor.

A limited amount of **mineral quarrying** occurs in the vicinity of the Fossil Creek WSR corridor. The purpose of this quarrying is to provide materials for road surfacing. No **mining claims** exist within and in the vicinity of the WSR corridor. The wild segments of the WSR corridor were withdrawn from locatable mineral entry with designation.

These other uses are expected to continue into the future, and no additional uses are currently reasonably foreseeable.

Visitor Preferences

Some data are available regarding visitor preferences. Lee (2011) completed a study that included interviews with Fossil Creek users at a number of locations in the Middle Fossil Creek area. Among questions to visitors were feelings about current rules and regulations, how visitors view the current environmental and social conditions at Fossil Creek, level and type of facilities desired, preferred future and tolerance/acceptability of visitor use restrictions to have the preferred future. The following items summarize survey results:

- Almost 60% of users felt that current rules and regulations were good. Some people expressed a need for more management presence and a desire for more responsible users who would respect and obey rules.
- When asked about environmental/social conditions, visitors were split as to whether or not too much trash or too many people are present in the corridor. About 38% indicated trash was not bad where about 26% indicated lots of or too much trash. Similarly about 31% felt it was not too crowded, where as 23% felt there were too many people. About 8% of people said overall conditions were okay.
- Queries about the level and type of facilities resulted in about one-third of visitors saying to “keep it the way it is”, about 21% wanted permanent restrooms and trash facilities, and about 13% wanted fewer facilities and less development. When asked preferences for day use or overnight camping, about 80% of visitors preferred to have some overnight, 14% preferred day use only, and about 6% wanted both.
- The preferred future for Fossil Creek visitors included: keeping the area clean with less or no trash (29%), keeping it natural (17%), protecting clear and clean water (14%), protecting and preserving the environment (12%) and allowing fewer people or set a capacity (9%). Additional facilities such as restrooms received feedback of -more, cleaner, permanent, better, by about 9%, trash services were noted (8%), road improvements (6%), more and better parking (2%) and fires/fire pits (2%).

Existing Facilities and Infrastructure

At time of designation, few facilities were present in the Fossil Creek corridor. As a result, visitors parked, camped, and accessed the creek at numerous convenient locations. As described in the *Management Activities* section below, some facilities and infrastructure have been improved since designation to facilitate sustainable visitor use. The current developed recreation footprint within the Fossil Creek project area consists of limited infrastructure to primarily support parking lots—gravel surfaced with parking spaces delineated by fire hose and boulders and posts. Existing recreation sites total approximately 11 acres. Table 3-7 lists existing recreation sites with associated infrastructure and facilities.

Table 3-7. Existing Fossil Creek facilities

Recreation Site	Existing Facilities
Mazatzal	4 parking spaces; vault toilet; kiosk.
Purple Mountain	6 parking spaces; portable toilet; kiosk.
Sally May	10 parking spaces; portable toilet; kiosk.
FR 708/502 Junction	Temporary parking; vault toilet; kiosk; visitor contact station with gate.
Homestead	25 parking spaces; 2 vault toilets; kiosks; picnic tables.
Fossil Creek Bridge	10 parking spaces; vault toilet; kiosk.
Tonto Bench	21 parking spaces; vault toilet; kiosk.
Irving	18 parking spaces, vault toilet, and kiosks on southwest side of creek. Pedestrian access to northwest side via low water crossing. Flume Trailhead and kiosks on northeast side of creek.
Lewis (Waterfall) Trailhead	21 parking spaces; vault toilet; kiosks.
Bear (Fossil Springs) Trailhead	30 parking spaces, plus 3 stock trailer spaces with corrals; vault toilet; kiosks; trash receptacles.
Historic Dam and Fossil Springs area	Accessible via foot trails. No facilities.
East Welcome Station on FR 708	Visitor contact station with gate.

Other infrastructure and facilities in the Fossil Creek corridor include:

Fossil Springs Dam: As part of the decommissioning of the Childs-Irving hydropower system, APS removed the top 14 feet of the Fossil Springs dam by April 2009. The remainder of the dam is present in the stream channel approximately 0.4 miles downstream of the start of perennial flow in Fossil Creek, with water flowing over the top.

Roads: Forest roads 708 and 502 are the main routes into the WSR corridor. FR 9D also accesses the corridor; however, it is extremely rough and receives little use. A total of approximately 6.3 miles of these roads exists in the corridor. All roads are natural surface. FR 708 and FR 502 are maintained at Maintenance Level (ML) 3 for safe travel by a prudent driver in a passenger vehicle. FR 9D is a ML 2 road. FR 502 runs southwesterly from the junction with FR 708 to the Verde River at Childs. FR 708 travels east, crosses the creek at the Fossil Creek Bridge and, after paralleling the creek for approximately 2.5 miles, winds its way back out the canyon to the town of Strawberry and Highway 87.

- **Partial FR 708 Closure:** In November 2011, an administrative closure of approximately four miles of FR 708 west of the Strawberry entrance was implemented to protect public health and safety due to road issues. More than half of the closed section is prone to rock fall and landslides due to very steep and

unstable slopes.[12] A series of two-year closures have maintained the closure to today. From 2011 through 2016, the Forest Service performed minimal maintenance on the closed section of FR 708.[13] Rock fall in February 2016 swept away the outer 3-5 feet of a portion of the road and a small retaining wall. The rock was removed, revealing a remnant road of approximately 8 feet in width, with an outer edge of unknown stability. Additional rock fall in early 2017 at the same location further deteriorated the road. The Forest Service has told emergency response agencies that they are not prohibited from driving on the road, but that the Forest Service does not currently perform road maintenance like rock clearing due to safety concerns for its employees.

Entrance Gates: Two gates and associated traffic spikes are installed on FR 708 at the junction of FR 502 and FR 708 and in the vicinity of the Bear (Fossil Springs) Trailhead to prevent after-hours entry during the high-use season. A third gate at the Homestead site exists to prevent vehicle access east of the area, if needed, while allowing pedestrian access. Outside of the high-use season, traffic spikes are removed.

Parking: Approximately 148 designated parking spaces are provided within the permit area. Recreation sites that include parking are Bear (Fossil Springs) Trailhead, Lewis (Waterfall) Trailhead, Irving, Tonto Bench, Fossil Creek Bridge, Homestead, Sally May, Purple Mountain, and Mazatzal.

Corrals: Corrals for horse trailer parking are located at the Bear (Fossil Springs) Trailhead.

Toilets: Eight pre-cast concrete vault toilets, installed in May 2017, exist within the river corridor. Locations include Mazatzal, Junction of 502/708, Homestead upper and lower loops, Fossil Creek Bridge, Tonto Bench, Irving, and Lewis (Waterfall) Trailhead. One vault toilet has been in place at the Fossil Springs Trailhead since before 2017. During the high-use season, a minimal number of portable toilets are added at sites where a vault toilet cannot be installed because of overhead powerlines, such as Sally May and Purple Mountain.

Trails: A number of trails exist around Fossil Creek. This trail network totals approximately 23 miles, approximately 10 miles of which are within the WSR corridor.

- Lewis (Waterfall) Trail is an informal 0.9-mile trail within the river corridor open to hikers only that is easily accessed and the most hiked trail in the Fossil Creek WSR corridor because it leads to the Waterfall.
- Bear (Fossil Springs) Trail is a 4-mile trail from the trailhead west of Strawberry into the Fossil Springs Wilderness and Fossil Springs area that provides a challenging hiking experience, especially due to its exposed terrain in hot conditions. Many hikers come unprepared, lacking proper footing and sufficient water, to complete this popular hike. Approximately one mile of this trail is within the WSR corridor.
- Flume Trail is a 4.5-mile trail open to hikers and equestrians from Irving to the historic dam and Fossil Springs area. The non-motorized trail historically was a road used by APS to maintain elements of the Childs-Irving hydropower system. The Flume Trail is essentially entirely within the WSR corridor.
- Historic Mail Trail is 8.5-mile trail, with approximately 1.5 miles within the WSR corridor. This little-used trail routes from Highway 260 across the Fossil Springs Wilderness to join the Fossil Springs Trail in the Fossil Springs Wild Segment.
- Deadman Mesa Trail is a 5.1-mile trail, with approximately 1.8 miles within the river corridor. The trail begins at the end of the Deadman Mesa Road (FR 591) on the Tonto National Forest. This little-used trail,

[12] Maintenance and safety issues related to this section of FR 708 are not new. As documented in the 1988 *Fossil Creek Landslide Investigation* report (Sergent, Hauskins, & Beckwith 1988), the Forest Service closed this section of road in 1988 following a landslide that blocked a section of the road because of the landslide and "numerous hazards" along this section of road. Between 1978 and 1988, approximately five rock slides were known to have occurred.

[13] The Forest Service has been involved in maintenance of FR 708 since at least the 1980s. Leading up to 1988, road maintenance was shared by the Forest Service and Gila County. However, at that time Gila County ceased further maintenance of the road "due to the risk of liability and to limited resources" (Sergent, Hauskins, & Beckwith 1988, p. 4).

which is difficult to find, enters the Mazatzal Wilderness and the Mazatzal Wild Segment approximately two miles upstream of the confluence with the Verde River.

Interpretive Signage: A number of signage kiosks exist at trailheads and in parking lots to help visitors navigate throughout the river corridor and to provide environmental education, especially regarding the significance of the wild and scenic river designation and the Childs-Irving hydropower system history.

Gabion: A gabion is present between FR 502 and Fossil Creek between the Purple Mountain and Sally May recreation sites to prevent erosion of FR 502 by high flows in Fossil Creek. The gabion currently requires repair and extension to improve water drainage and protection of the road.

Bridge: A vehicle bridge exists where FR 708 crosses Fossil Creek, which is also the dividing line between the Coconino and Tonto national forests. The bridge is listed on the National Register of Historic Places as a unique engineering example of an earth-filled arch bridge.

Utilities: Several utility lines exist within the Fossil Creek WSR corridor. These are described in greater detail in the *Other Uses* section above and include a 69-kV APS power line, a section of the 345-kV WAPA Flagstaff-Pinnacle Peak transmission line, and a buried Century Link fiber optic line along FR 708.

USGS Stream Gage: A United States Geological Survey (USGS) stream gage (No. 09507480), has been present on the Fossil Creek Bridge since September 2010. This gage collects continuous flow data for Fossil Creek.

Fish Barrier: A permanent fish barrier was constructed in the Mazatzal Wild Segment in 2004 to protect native fisheries in Fossil Creek above the barrier. This barrier is key to protecting the fisheries component of the biological ORV.

Childs-Irving Remnants: Remnants of the Childs-Irving hydropower system include elements of the flume, penstocks, and siphons; a low water road crossing and remnants of the Irving power plant at the Irving recreation site; and a portion of the diversion dam downstream of Fossil Springs.

Recent Management Activities

Increasing visitor use of Fossil Creek following decommissioning of the Childs-Irving hydropower system necessitated a progression of changes in how the Forest Service has managed the Fossil Creek area. Before 2011, access to Fossil Creek was essentially unrestricted and few facilities such as delineated parking areas and restrooms were available. Beginning in 2010, the Forest Service delineated specific parking areas and creek access points, rehabilitated areas impacted by unauthorized roads and trails and vegetation and soil disturbance, improved restroom facilities, and initiated a capacity management system to control the number of vehicles in Fossil Creek at one time. More detail about the progression of management changes can be found in Appendix F.

From 2011 to 2015 the number of people turned away steadily increased, would-be visitors became increasingly frustrated when they were unable to access the creek, vehicle congestion persisted, and safety concerns for visitors and Forest Service employees worsened. This led to the implementation of a reservation/permit system during the high use season in 2016, whereby visitors are required to reserve parking at a specific parking lot online or through a call center during the high-use season (currently defined as April 1-October 1). This system established a Fossil Creek permit area (figure 3-4), within which a set number of parking spaces are available per day during the high-use season. Nine parking lots with a total of 148 parking spaces are currently available, 115 of which are in Middle Fossil and 33 are at the Fossil Springs Trailhead. The reservation system has been used since 2016.

Camping along Fossil Creek continued to be a popular activity after decommissioning; however, the location and timing of camping has been restricted in recent years to reduce resource impacts and management challenges resulting from unmanaged camping. In 2010, the reach of Fossil Creek from the historic dam downstream to the Fossil Creek Bridge was closed to camping and a seasonal restriction was placed on camping in the remainder of the Fossil Creek area from April 1 to October 1. Camping is allowed in the Fossil Springs area and downstream of

the Fossil Creek Bridge the remainder of the year and is available in areas around the corridor, including Stehr Lake and Childs, year-round.

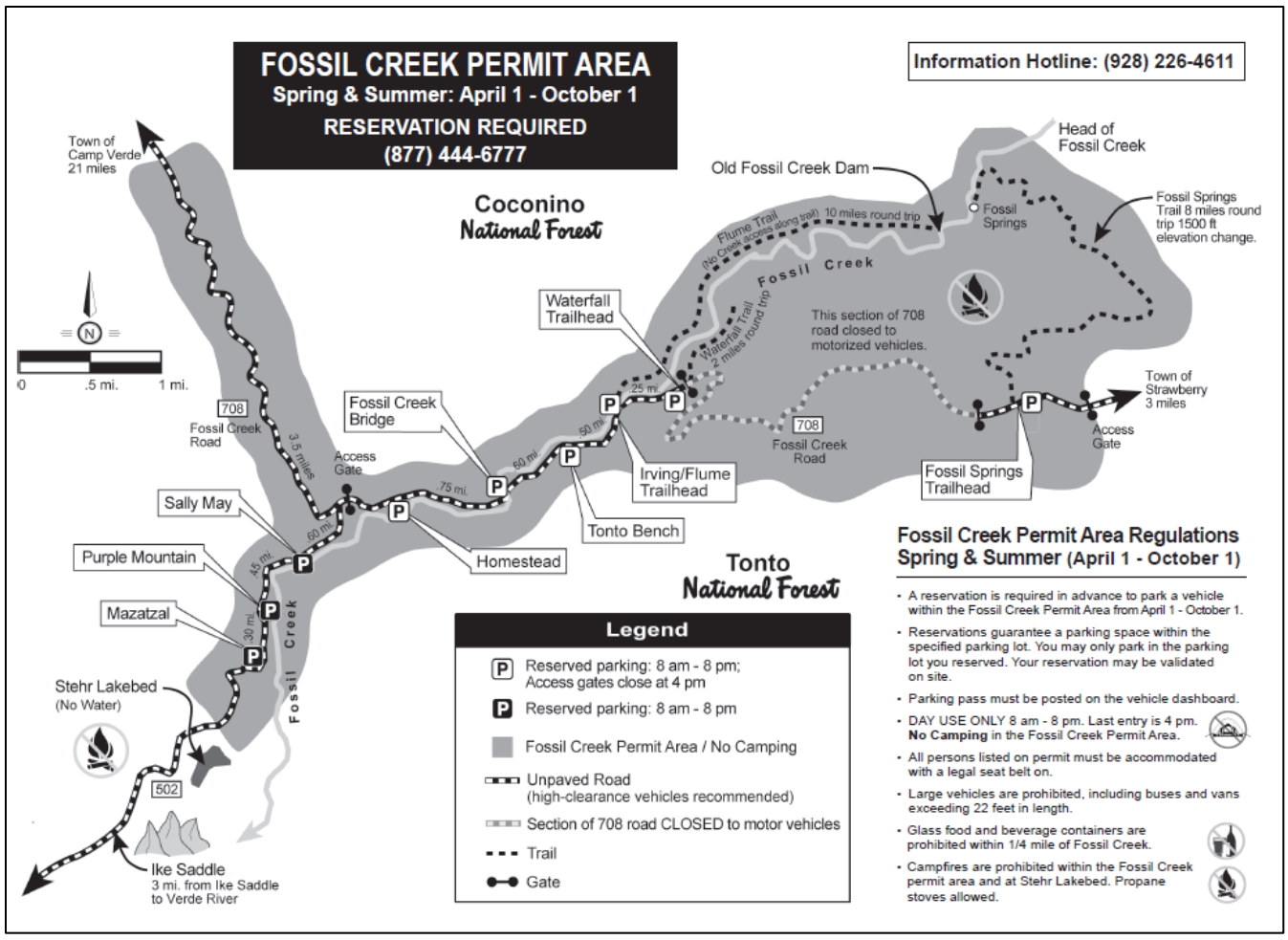


Figure 3-4. Fossil Creek permit area under the reservation system

Since 2010, the Forest Service has inventoried and treated areas within Fossil Creek for a variety of invasive plants. Mechanical and herbicide treatments have been conducted on the tree of heaven; salt cedar; giant reed; and Russian olive in 2010, 2012, 2013, and 2014 from Irving to two miles south of the permanent fish barrier, the Stehr Lake area, and the last three-quarter miles of Fossil Creek down to the Verde River confluence.

A permanent fish barrier was installed in 2004 in Fossil Creek within the Mazatzal Wilderness to protect native fisheries in the waters above the barrier. After non-native fish were discovered above the permanent barrier, a temporary fish barrier was installed in 2011 upstream of the permanent barrier in a non-Wilderness barrier site. Repairs were later done in two stages in 2012 on the permanent fish barrier. In addition to the fish barrier, piscicide treatments occurred in Fossil Creek in 2004 and 2012 to remove non-native fish. Stocking of native fish species has occurred since 2007.

Bare Soil

The amount of bare soil associated with areas in Fossil Creek receiving visitor use was tracked as an indicator of human-caused disturbance and potential for impacts to wildlife, water quality, and cultural resources from 2002 to 2013. The amount of disturbance increased as visitor numbers increased through 2011 and began to decrease once measures were taken to better manage visitor use (Rotert 2014).

Initial bare soil monitoring efforts were focused on camping impacts, so the most extensive data available are related to bare soil areas associated with camping use. In 2002, monitoring of campsites indicated that unrestricted camping had impacted many areas adjacent to Fossil Springs and Fossil Creek. The "engineering" of campsites and searching for firewood had resulted in damage to soils, trees and shrubs. Continued camping at the same locations eliminated the natural vegetation, leaving areas either devoid of ground cover or infested with noxious weeds. Social trails and human waste were also observed. A dispersed campsite inventory in 2002 identified 211 campsites in the Fossil Creek area, most of which were located along Fossil Creek between Irving and Stehr Lake. Twenty-nine of these campsites were located in the Fossil Springs Botanical Area (USDA FS 2004).

Figure 3-5 displays the total denuded area resulting from camping from 2002-2013. Though campsite monitoring in the early 2000s indicated a number of impacts, total denuded area resulting from camping more than doubled between 2005 and 2010. Impacts peaked in 2011 and began to decrease in 2012. Certain areas within the Fossil Creek corridor displayed disproportionate impacts resulting from camping. The Waterfall Trail showed the largest increase in both the number of campsites and total campsite area in the river corridor from 2005 to 2009. The number of campsites in this area increased 350% from 6 sites in 2005 to 27 sites in 2009. The cumulative campsite area along the Waterfall Trail increased 380% from 2005 to in 2009 (Rotert 2009b). Additionally, in 2009 the Fossil Springs area contained the highest number of riparian area campsites, with 72% of campsites (18 sites) located within the riparian zone. The Fossil Springs area also contained the greatest riparian zone campsite area. This comprised 68% of the total campsite area at Fossil Springs and 29% of all riparian zone campsite area along Fossil Creek (Rotert 2009b).

Condition ratings based on factors such as distance from water, amount of bare soil, and human waste presence were assigned to campsites beginning in 2005. Most campsites from 2009-2013 were rated as having moderate impact, with impact ratings remaining relatively steady throughout the period of data collection (table 3-8).

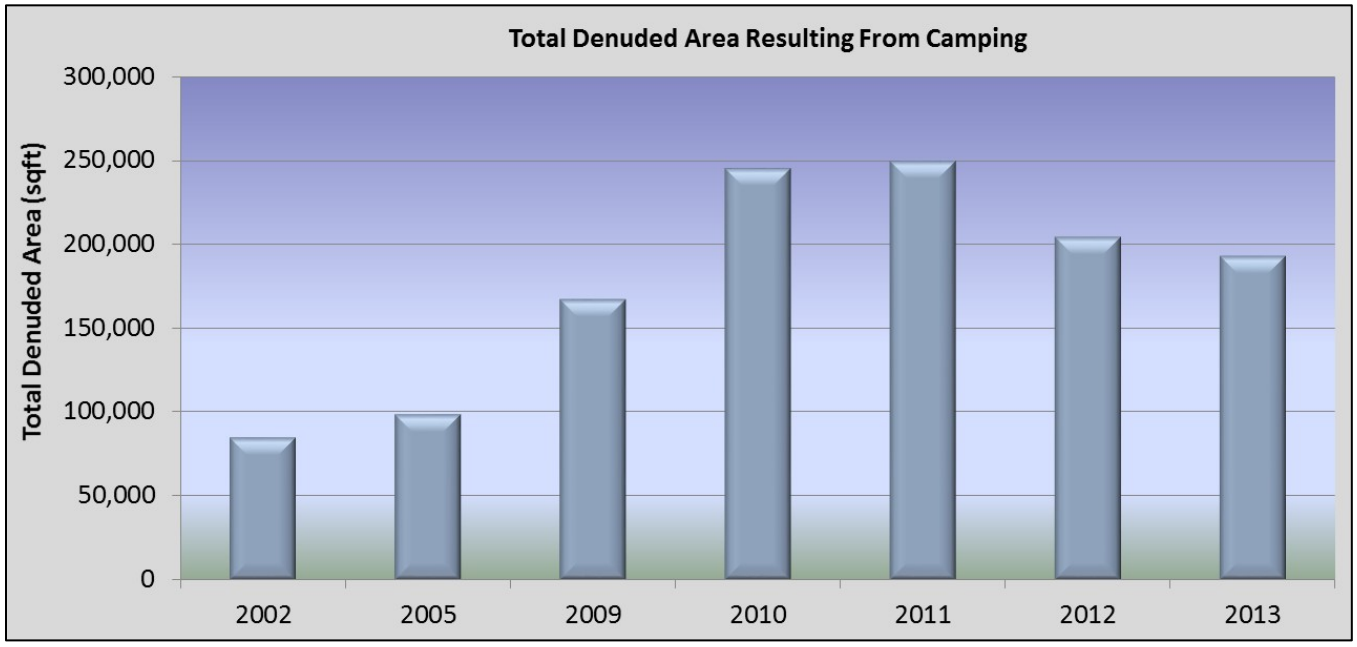


Figure 3-5. Total denuded area associated with campsites, 2002-2013 (Rotert 2014)

With vegetation loss noticeably increasing, the scope of bare soil monitoring was expanded in 2010 to include all vegetation loss resulting from visitor use. In addition to camping, the expanded monitoring included assessment of unauthorized trails, spur roads, vehicle pullouts, parking lots, and day use areas. The total denuded area detected in Fossil Creek was 15.0 acres in 2010 (Rotert 2010), 19.6 acres in 2011 (Rotert 2012b), 15.9 acres in

2012 (Rotert 2013a), and 15.0 acres in 2013 (Rotert 2014). Table 3-8 provides detail on all available bare soil and campsite rating data from 2002-2013. [14]

Table 3-8. Summary of denuded area by type in Fossil Creek, 2002-2013 (Rotert 2012b, 2013a, and 2014)

	2002	2005	2009	2010	2011	2012	2013
CAMPSITES							
Total number of open (unrestricted) campsites	87	97	163	109	106	104	99
Total denuded area of open sites	96,600 ft^2 2.22 acres	101,250 ft^2 2.32 acres	175,375 ft^2 4.03 acres	168,050 ft^2 3.86 acres	174,975 ft^2 4.01 acres	160,125 ft^2 3.68 acres	150,375 ft^2 3.45 acres
Mean campsite size	1,015 ft^2	1,045 ft^2	1,075 ft^2	1,570 ft^2	1,725 ft^2	1,615 ft^2	1,575 ft^2
Maximum campsite size	6,000 ft^2	6,000 ft^2	6,000 ft^2	7,500 ft^2	8,000 ft^2	8,125 ft^2	8,000 ft^2
Cumulative number of closed (restricted) campsites	0	0	0	56	52	44	39
Total denuded area of closed sites *(closed but not rehabilitated)*	0 ft^2	0 ft^2	0 ft^2	88,575 ft^2 2.03 acres	82,025 ft^2 1.88 acres	49,090ft^2 1.13 acres	42,380 ft^2 0.97 acres
Number of low impact campsites	No Data	47 (48%)	12 (7%)	19 (17%)	14 (13%)	15 (14%)	14 (14%)
Number of moderate impact campsites	No Data	46 (47%)	137 (84%)	85 (78%)	88 (83%)	85 (82%)	81 (82%)
Number of high impact campsites	No Data	4 (5%)	14 (9%)	4 (5%)	4 (4%)	4 (4%)	4 (4%)
TRAILS							
Number of social trails	No Data	No Data	No Data	87	92	114	95
Total denuded area of social trails	No Data	No Data	No Data	198,787 ft^2 4.56 acres	251,554 ft^2 5.77 acres	130,592ft^2 2.99 acres	105,141 ft^2 2.41 acres
Number of designated creek access trails	0	0	0	0	0	13	13
Total denuded area of designated access trails	0	0	0	0	0	48,549 ft^2 1.11 acres	46,571 ft^2 1.07 acres
Mean social trail denuded area	No Data	No Data	No Data	2,260 ft^2	2,705 ft^2	1,571ft^2	1,219 ft^2
Mean social trail width	No Data	No Data	No Data	4.85 ft	5.66 ft	4.84 ft	4.13 ft
Mean social trail depth	No Data	No Data	No Data	3 in	3 in	3 in	3.4 in
Mean social trail slope	No Data	No Data	No Data	20%	20%	20%	20%
VEHICLE PULLOUTS							
Number of vehicle pullouts	No Data	No Data	No Data	28	31	27	27
Total denuded area of vehicle pullouts	No Data	No Data	No Data	36,670 ft^2 0.84 acres	41,830 ft^2 0.96 acres	38,825 ft^2 0.88 acres	35,825 ft^2 0.82 acres
Mean denuded area of vehicle pullouts	No Data	No Data	No Data	1,360 ft^2	1,495 ft^2	1,049 ft^2	1,293 ft^2
OTHER CATEGORIES							
Day use areas	No Data	No Data	No Data	No Data	24,370 ft^2 0.56 acres	23,650 ft^2 0.54 acres	23,650 ft^2 0.54 acres
Parking lots	No Data	No Data	No Data	No Data	24,800 ft^2 0.57 acres	25,725 ft^2 0.58 acres	25,275 ft^2 0.58 acres
Spur roads	No Data	No Data	No Data	No Data	105,135 ft^2 2.41 acres	89,040 ft^2 2.04 acres	94,029 ft^2 2.16 acres
Other bare soil areas*	No Data	No Data	No Data	No Data	172,036 ft^2 3.95 acres	131,740 ft^2 3.02 acres	129,875 ft^2 2.98 acres

*Other bare soil areas are not attributable to a specific, categorical type of impact (road, social trail, campsite, etc.) but are associated with the transition zone between these elements.

[14] Differences in total denuded area between the aggregate areas in this paragraph and table 3-8 are likely due to rounding and data aggregation..

Assumptions and Definitions Common to all Resources

In general, the analysis of effects will cover the programmatic management direction (incorporated by amendment in to the Coconino and Tonto national forest plans), management actions, the monitoring plan, and adaptive management. The analysis assumes all necessary resource protection measures, design features, and monitoring will be implemented along with management actions. Connected to the management actions, there are five categories of area where analysis of management activities differs:

1) The areas associated with each of the **developed recreation footprints** and the **construction footprints** (gabion, new FR 708 bridge, and entrance stations) will be analyzed as if the entire area could be disturbed from either machinery, the building of infrastructure, the presences of vehicles, and use by visitors.
2) In the areas associated with the **recreation dispersal footprints**, the effects of visitors (ground disturbance, noise disturbance, trash, etc.) will be analyzed but the assumption is that no major machinery or infrastructure will be used or built in these areas. Minor allowed infrastructure or actions could include signage, hardened trails and armored creek access, and restoration activities.
3) In areas slated for **restoration** and roads slated for closure, a variety of methods can be used spanning from soft closures with natural revegetation occurring to hard closures involving ripping and seeding and temporary barriers.
4) On **designated roads and trails**, ground-disturbing activities and use of equipment may occur. In designated wilderness areas, no motorized equipment or mechanized transport will occur.
5) In **refugia areas**, which are upland and riparian areas outside of the above categories, the assumption is that effects from visitors will be so minor as to be negligible and that there will be no use of heavy machinery or development of infrastructure except for designated trails in upland areas.

The term “recreation site” is used to describe the combined area of developed recreation footprints and recreation dispersal footprints.

Watershed and Soils

This section is an analysis of free flow, water quantity, water quality, riparian/wetland function, soil condition, and air quality resources used to inform the Fossil Creek CRMP. The analysis discloses the direct, indirect, and cumulative environmental consequences of the no action alternative and action alternatives on the aforementioned resources. The analysis considers both site-specific actions and programmatic plan components directing management of these resources including desired conditions, standards, and guidelines.

Methodology

This report was prepared considering the best available science from peer-reviewed and published literature in addition to locally gathered data. This section describes indicators and measures and details how free-flowing condition, water quantity, water quality, riparian function, soil condition, and air quality are described. It then lists general assumptions underlying the analysis in this report and defines spatial and temporal boundaries for the analysis.

Analysis Indicators and Measures

The following indicators and measures are used to analyze the potential effects of implementing the CRMP alternatives:

Table 3-9. Indicators and measures used in the analysis

Resource Element	Resource Indicator	Measure
Free flow	Presence/absence of water resources projects that may affect free flow	Narrative description of potential impacts to free flow via the WSRA Section 7 analysis process
Water quantity	Groundwater extraction within the Fossil Creek WSR corridor	Number of wells within Fossil Creek WSR corridor.
Water quality	Presence of human waste and pet waste; exposure of bare mineral soil; state water quality standards; change in land cover that leads to more barren areas.	Exceedances of state water quality standards; extent of barren areas.
Soil condition	Soil disturbance within the Fossil Creek WSR corridor.	Extent of soil disturbance; extent of restoration of unplanned disturbance.
Riparian function	Presence/absence of water resources projects that may affect free flow; alteration of the drainage area's rainfall/runoff response and sediment yield; planned disturbance in the riparian zone.	Narrative description of potential impacts to free flow via the WSRA Section 7 analysis process; predicted change in annual water and sediment yield; extent of planned disturbance and restoration of existing unplanned disturbance in the riparian zone.
Air quality	Construction activities that may create dust; vehicle emissions	Narrative description of management direction and actions that may affect air quality

Spatial and Temporal Context for Effects Analysis

The analysis is conducted at two scales, one looking at direct and indirect effects at the project scale and then cumulative effects at a larger watershed scale. Direct, indirect, and cumulative effects to soils are only assessed at the project scale as effects to soils do not generally propagate beyond the area of disturbance. For example, disturbance to soils such compaction and loss of organic matter tend to impact soil condition only in the direct area of disturbance. It is recognized, however; that an intimate link exists between such things as soil condition and water quality as disturbance to soils that causes accelerated erosion can impact water quality distant from the area of disturbance. Soils are the medium through which hydrologic processes such as infiltration, percolation, and soil moisture storage occur and what happens to soils often is an indicator as to what happens to water quality.

The project area and area used for analyzing the cumulative effects to riparian function and water quality are described in the *Affected Environment Common to All Resources* section above and displayed in figure 3-1. The temporal boundaries for analyzing the direct and indirect effects are short-term (5 years or less) and long-term (greater than 5 years). Short-term effects are those which result in a temporary disturbance in which recovery from that disturbance would likely take up to 5 years. An example of a short-term disturbance is prescribed fire. Long-term effects are those where recovery from disturbance takes longer than 5 years or disturbance is ongoing and in some cases, is more or less permanent such as residential and commercial developments where land cover is permanently altered. The temporal scale for future activities is 5 years as there is little certainty beyond this timeframe about what may occur that would alter land cover.

For air quality resources, the Mazatzal Wilderness Class I area airshed as well as the Class II Fossil Creek Wilderness airshed were analyzed for affects.

Information Sources and Incomplete and Unavailable Information

Information on existing areas disturbed by roads, parking and camping areas, and trails, and areas proposed for rehabilitation was provided by the team lead. Where additional information was desired a GIS analysis was performed using aerial photography, FS corporate spatial data, and other sources. Water quality data is not available outside of the high use season.

Affected Environment – Baseline and Existing Condition

Regional Hydrologic / Watershed Setting

Fossil Creek is in the Central Highlands physiographic province of Arizona, which represents a transition area from the Colorado Plateau to the northeast and the basin and range provinces to the southwest. Fossil Creek provides a unique and valuable ecosystem in the southwest that originates in the incised canyons of the Mogollon Rim north of Strawberry. Fossil Creek flows in a southwesterly direction through a deep canyon for approximately 17 miles before entering the Verde River, three miles below Childs. The headwaters of Fossil Creek lie within a ponderosa pine forest at an elevation of approximately 7,260 feet. The creek flows through communities of chaparral, pinyon-juniper woodland, semi desert grassland, and Sonoran desert as it descends to its confluence with the Verde River at an elevation of around 2,550 feet.

The Fossil Creek drainage extends from the Fossil Creek/Verde River confluence to roughly State Route 260, marking the approximate upper drainage divide. Encompassing roughly 89,390 acres and over 4,000 feet of relief, the drainage area includes over 23,000 acres of designated wilderness, 1,739 acres of recommended wilderness, and approximately 8,300 acres of inventoried roadless area. Combined, these areas that are relatively free of disturbance encompass about 33,000 acres or 37% of the drainage area. Residential/commercial development on private property within the drainage area is confined to the unincorporated community of Strawberry with roughly 1,800 acres that are privately owned. The remainder of the drainage area is under the management of the U.S. Forest Service, Coconino and Tonto National Forests. The main stem of Fossil Creek begins at the confluence of two canyons, Sand Rock and Calf Pen, which drain from the Mogollon Rim. Fossil Creek is intermittent for the first three miles below the confluence of these canyons. Perennial flows begin at Fossil Springs, where a series of springs emerge from the base of the Naco Formation over a 1,000-foot reach of channel (Springer 2005). Discharge is relatively constant both in terms of discharge (nearly 46 cubic feet per second (cfs) and temperature (72 degrees F) (Springer 2005).

The weather in the Mogollon Rim region is strongly influenced by jet stream activity coming from the southwest and can be extremely variable from year to year, and season to season. The watersheds are located in a land of extremes. Within the cumulative effects area, the large elevational gradient produces a wide range of temperatures and amounts of precipitation.

Climate within the Fossil Creek river corridor is characterized by a bimodal precipitation pattern with about 60 percent occurring as frontal systems in the winter from December to March and about 40 percent occurring as monsoons in the summer from July to September. Summer storms are generally more intense than winter storms but are of shorter duration and smaller spatial extent. Cold Pacific winter frontal storms can deliver large quantities of precipitation in the form of rain or snow depending on elevation. During summer months, monsoonal storms can produce locally large amounts of rain. Annually, in general, 15 to 20 inches of precipitation is received in semi-desert grasslands, 18 to 22 in pinyon-juniper woodlands, and 20 to 24 in ponderosa pine. Summers are usually hot with average high temperatures and winters are typically mild at lower elevations.

The Western Regional Climate Center station, known as monitoring station #021614 at the historical Childs site, was monitored from 1915 to 2005. The station, located at 2,720 feet above sea level in the Fossil Creek watershed in Yavapai County, is upstream of the confluence of Fossil Creek and the Verde River. Mean annual precipitation is 18.11 inches, and snow fall total is 0.8 inches (See table 3-10). Data available from the Childs station are representative of past precipitation patterns occurring within the project area. Irving NOAA weather station (located at a higher elevation eight miles upstream from the confluence of Fossil Creek and the Verde River) shows average precipitation from 1971-2000 of 21.8 inches.

Table 3-10. Climate information for Western Regional Climate Center station, Childs AZ

In Inches	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Total Precipitation	1.95	1.89	1.74	0.97	0.39	0.35	1.97	2.65	1.72	1.20	1.28	2.01
Average Total Snow	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1

In Inches	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Annual Total Precipitation	**18.11**											

Water Chemistry

Water chemistry data collected by the US Geological Survey (Parker et al. 2005) found that recharge is dominated by precipitation that occurs during the coldest part of the year, and that spring chemistry is indicative of recharge through the Coconino Sandstone and flow through limestone. Water chemistry data identify that water discharging from the springs is calcium magnesium bicarbonate water that has the highest solute concentration of 23 springs sampled in the Mogollon Rim country. Water temperature of the discharge from the springs is relatively warm and ranges from 70 to 72 degrees F. The range of values of specific constituents from samples collected at Fossil Springs and reported in the USGS study (Parker et al. 2005) are displayed in table 3-11. For much of the year chemical characteristics of water in Fossil Creek would be dominated by discharge from Fossil Springs.

Table 1-11. Fossil Springs water chemistry

Constituent	Range of Values	Constituent	Range of Values
Specific Conductance (µS/cm)	700-753	Magnesium, dissolved (mg/l)	35 - 40
pH	6.7 – 7.3	Sodium, dissolved (mg/l)	11-12
Temperature (C)	21 – 22	Potassium, dissolved (mg/l)	1.8
Dissolved Oxygen (mg/l)	5.1	Sulfate, dissolved (mg/l)	23 – 27
Carbon Dioxide, dissolved (mg/L)	38 - 153	Chloride, dissolved (mg/l)	7.1 – 9.0
Hardness, total (mg/l as $CaCO_3$)	390 - 420	Flouride, dissolved (mg/l)	0.1 - 0.3
Total Dissolved Solids (mg/l)	418 - 440	Silica, dissolved (mg/l)	12 - 17
Calcium, dissolved (mg/l)	96 – 110		

Free-Flowing Condition

During the eligibility determination process, potential wild and scenic rivers are evaluated for free flow. Section 16(b) of the Act defines free-flowing as “existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence, however, of low dams, diversion works and other minor structures at the time any river is proposed for inclusion in the national wild and scenic rivers system shall not automatically bar its consideration for such inclusion “Provided that this shall not be construed to authorize, intend, or encourage future construction of such structures in components of the national wild and scenic rivers.”

The presence of impoundments above and/or below the segment (including those which may regulate flow within the segment), and existing minor dams or diversion structures within the study area, do not necessarily render a river segment ineligible. Section 7(a) of the Wild and Scenic Rivers Act is a key provision, directing federal agencies to protect designated rivers from negative impacts of water resource projects.

Free flow descriptions for Fossil Creek came from the free flow assessment completed by USFS hydrologist Grant Loomis in 2010 and are used to represent baseline (2009) conditions. It documents constructed features that had potential to affect free-flow. Below is a summary of the findings from this free-flow assessment.

Historic Fossil Springs Dam: Located approximately 0.4 miles downstream of the start of perennial flow in Fossil Creek. The dam formerly diverted stream flow from the creek into the flume system. The dam was partially removed during decommissioning of the Childs-Irving system, leaving a structure that is approximately 65 feet wide and 13 feet high. The effects on free flow include a reduction in the stream gradient above the dam, which reduces sediment transport capacity and creates of a vertical drop where the flow passes over the top of the dam and creates a barrier to upstream fish movement. The dam continues to represent a modification of the waterway.

Irving Diversion Structure: A concrete and rock structure located at the former Irving power plant site. When the Irving plant was constructed, the diversion structure was used when the Irving system was taken off line. There are remnants of one- to two foot-high rock and mortar walls and parts of the excavated channel still visible.

The diversion structure represents a modification of the waterway that is so minor as to have negligible impact on free flow and river processes.

Irving Low Water Crossing: Also located at the former Irving power plant site, the low-water crossing is a concrete apron that crosses Fossil Creek and previously provided vehicle access across the creek. The structure is about 45 feet long and 15 feet wide. It rises about 18 inches above the natural creekbed. Free flow is affected by a small decrease in creek gradient above the structure and a small increase in gradient below the structure.

Fossil Creek Bridge: Located at the boundary between the Coconino and Tonto national forests is a single span concrete arch bridge. The length of the arch is about 70.5 feet between the abutments, and width is 23 feet. The abutments are located within the bed and banks of Fossil Creek. The structure modifies the waterway and affects free flow by constricting flows.

Road Gabions: Located on FR 502 south of the Sally May recreation site. The gabions were installed to protect the road from flood flows in Fossil Creek. The gabions are rock-filled wire baskets that are approximately 70 feet long and 12 feet high and extend downstream to the point where the road curves away from the stream. The structure is a form of riprap and due to its location within the ordinary high water channel affects free flow by causing a small constriction of bankfull flows. The overall effect on the river values throughout the designated reach of Fossil Creek is small. Water quality is not affected by this structure.

Permanent Fish Barrier: Located in the Mazatzal wild segment, a fish barrier was constructed in 2004 to prevent non-native fish from moving above the barrier. The fish barrier was constructed in three bedrock notches in the channel. The combined length is 28 feet and it is about five feet high; however, modification to the waterway is minor. A free-flow analysis was completed prior to construction and it was determined there would be a minor effect on free flow because the barrier resulted in a slight modification of the channel and reduction in channel gradient. Floods in 2010-2011 caused partial failure of the fish barrier. The barrier was repaired in 2012-2013.

Temporary Fish Barrier: After the discovery of non-native smallmouth bass above the permanent fish barrier, a temporary fish barrier was installed as a joint effort with the Bureau of Reclamation, the U.S. Fish and Wildlife Service, and Arizona Game and Fish Department in August 2011 just below the Sally May recreation site to limit further upstream migration of non-native fish. In August 2013, the temporary barrier was removed after the permanent barrier was repaired.

All features (except the temporary fish barrier) existed at the time Fossil Creek was designated as a Wild and Scenic River, and all but one of the features are within the reach designated as a Recreational Segment. River segments defined as “recreational” are those sections of rivers that are readily accessible by road or railroad, may have some development along the shoreline, and may have had some impoundment or diversion in the past. The remaining structure (the permanent fish barrier) was constructed within the lower “wild” segment of the river in the Mazatzal Wilderness.

Overall, the free-flow analysis determined that the historic Fossil Springs Dam, Irving low water crossing, Fossil Creek Bridge, road gabions, and the permanent fish barrier affect free flow by modifying the waterway. The historic dam, Irving low-water crossing, and permanent fish barrier cause changes in channel gradient. The Fossil Creek Bridge and the FR 502 gabion cause small constrictions in bank full flows. The Irving diversion structure’s modification of the waterway is so minor as to have negligible impact on free flow and river processes. Cumulatively, all structures have negligible adverse or direct effects to any of the river values. Both the fish barrier and the historic dam have beneficial effects on the biological ORV by preventing upstream migration of non-native fish.

The number of structures present currently has not changed since baseline conditions were established in the free flow assessment in 2010. The free-flowing condition of Fossil Creek was improved by the lowering of the Fossil Springs Dam to its current height.

Protection of Free Flow

Free flow would be protected by adhering to the Section 7 analysis process for newly proposed water resources projects that may affect Fossil Creek.

Adverse Impact to Free Flow

Free flow would be adversely impacted by water resources projects that impound, divert, and/or impact the ability of Fossil Creek to interact with its floodplain.

Water Quantity and Channel Morphology

Perennial flow in Fossil Springs occurs because of groundwater discharge from a series of springs located over a roughly a 1,000-foot (305 meter) reach of channel. This series of springs is collectively referred to as "Fossil Springs" and includes at least 60 individual spring orifices that discharge from just a few liters per minute to more than 10 cubic feet per second (cfs) (NAU 2005). Continuous spring discharge data have not been collected, but median monthly flow data collected by the Forest Service proximate to Fossil Springs in support of an instream flow water right application recorded flows ranging from about 40 to 52 cfs (Nelson 2003). Discharge from the springs forming Fossil Creek is more than twice that of any other spring or spring complex in the Central Highlands Planning Area. In the State of Arizona, the only springs with discharge greater than that of Fossil Springs are Blue Springs, which discharge into the Little Colorado River above the Grand Canyon at a rate of about 225 cfs and Havasu Spring that forms the beginning of perennial flow in Havasu Creek and flows at a rate of about 65 cfs (Springer 2005).

The U.S. Geological Survey (USGS) installed a continuously recording flow gage in 2010 in Fossil Creek at the bridge along FR 708; data collected by the gage are important to developing an understanding of Fossil Creek's flows. Note that discharge measurements at the USGS stream gage record flow from groundwater and stormwater discharge. Figure 3-6 is a graphical summary of daily mean discharge data for the USGS stream gage highlighting the consistent discharge attributable to groundwater at about 46 cfs and annual peak flows related to snowmelt or rain events that range from several hundred cfs to several thousand cfs. Floods that overflow channel banks and transport large quantities of sediment occur about every other year (W.L. Bouchard and Associates, 1998). Although these flood flows can cause short-term damage to riparian vegetation and travertine deposits, they constitute the natural hydrology of the Fossil Creek drainage and are important in maintaining a healthy riparian community consisting of diverse plants species and age classes. Flood flows are hydrologically important factors in shaping the channel characteristics of most streams.

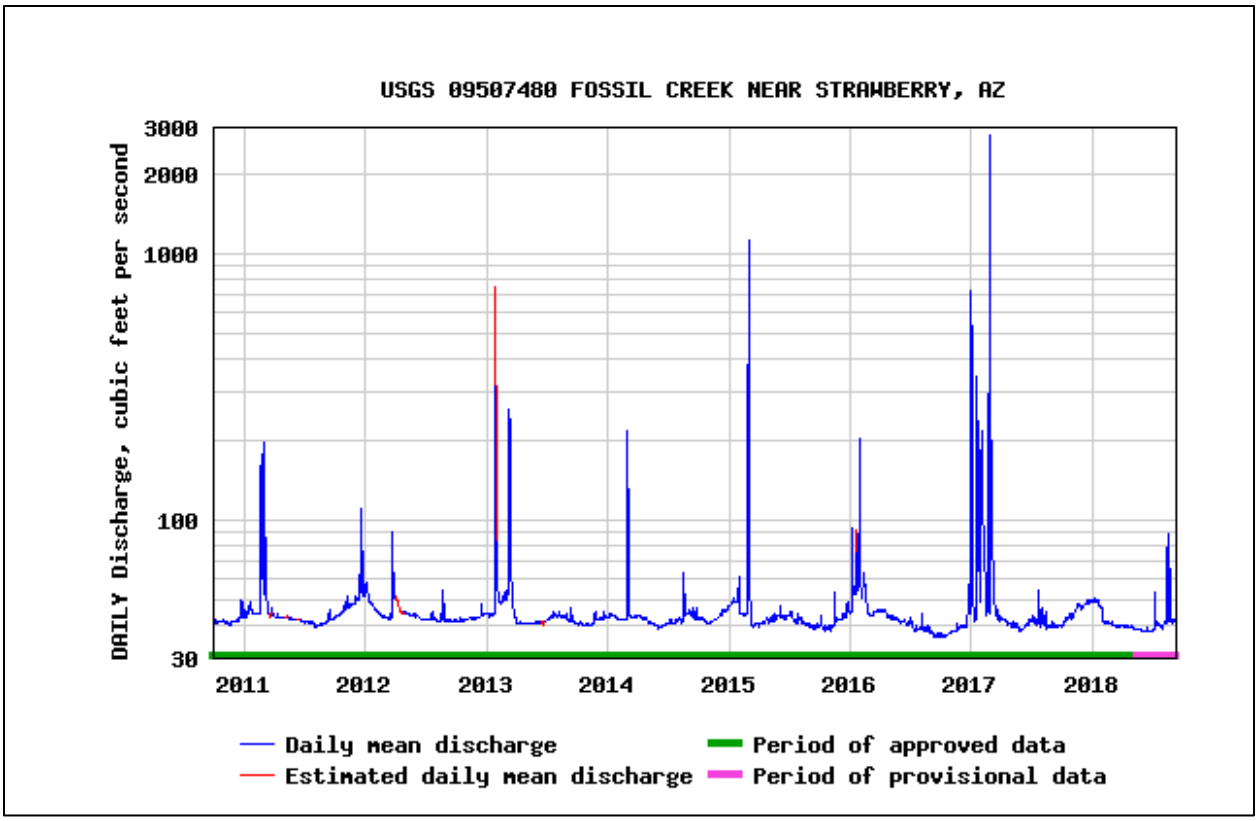


Figure 3-6. Daily mean discharge in cubic feet per second (cfs) for Fossil Creek at USGS gage 09507480

One of the most unique aspects of Fossil Creek is the presence of travertine dams that in some cases are channel spanning and at least several feet tall. Historic accounts indicate that the largest dams were up to 10 feet in height (NAU 2005). Groundwater discharging from Fossil Springs contains high concentrations of calcium carbonate and carbon dioxide. Travertine deposition typically occurs in areas of high turbulence when carbon dioxide is released from solution causing supersaturation of the water with respect to calcium carbonate (NAU 2005). The formation of these travertine deposits creates a complex, ever-changing system of pools and thalweg location and is particularly evident in the inundation and subsequent die-off of woody riparian vegetation from the shifting location of pools. Water is backed up in deep pools behind the travertine dams, and a series of pools or terraces often forms in a stair-step pattern in the stream channel (Matthews, 1996). A study of the chemistry of travertine deposition in Fossil Creek indicates that the majority of travertine deposition occurs within the first 6.7 km (4.2 miles) downstream of Fossil Springs (Malusa et.al. 2003). The influence of bankfull and greater flood flows on shaping the channel of Fossil Creek is uniquely affected by travertine deposition. Periodic flooding of this system adds to the complexity and dynamic nature of the riparian and aquatic zone through breaching of travertine dams, unrooting of woody riparian plants, and movement of sediment.

The morphology of the travertine reach of Fossil Creek reflects the interaction between flood flows, which degrade travertine structures, and travertine deposition during baseflows. Floods in January 2008, January 2010, January 2013 and February 2017 degraded many of the travertine features in the upper reaches of the Creek. Fuller et al. (2011) observed substantial erosion of travertine structures in the January 2008 flood, which they estimated had a 4 year return interval. They observed much smaller erosive effects from floods approximating the annual flood.

The channel from the diversion dam down to about the FR 708 Bridge is dominated by travertine deposition processes. Travertine deposition continues to occur to the confluence with the Verde River but at much lower rates and with much less effect on channel morphology than the upper reach. Below the FR 708 Bridge, channel formation is dominated by normal channel forming processes. Cobbles, boulders, and bedrock armor much of the

channel in this reach resulting in fairly stable streambank conditions. Riparian vegetation also adds stability to the banks.

Channel morphology in reaches above and below the zone influenced by travertine deposition is dominated by more typical channel formation processes. Stream channel morphology from the confluence of Calf Pen and Sandrock Canyons to the remnants of the Fossil Creek Diversion Dam is characterized by bedrock shelves and cobble and boulder dominated substrates. This reach is intermittent above the springs but does support a few perennial pools. Scattered riparian vegetation is present along the margins of the channel.

Stream channel cross sections surveyed by the Forest Service between the Fossil Springs Diversion Dam and Irving prior to decommissioning of the Childs-Irving project suggested the channel was primarily a "B" type channel in the Rosgen (1996) Classification System. B type stream channels are moderately entrenched, have a moderate gradient, are riffle dominated, and have cross section width/depth ratios greater than 12 (Rosgen 1996). B type channels generally have very low to moderate sensitivity to disturbance. Since decommissioning of the Childs/Irving project, deposition of travertine has created numerous dams and pools that result in a unique step/pool channel system that does not easily fit into the Rosgen Classification system (travertine dams increase the width/depth ratio of the bankfull channel and channels with 2-4% gradients are typically riffle/run channels rather than step/pool systems).

Observations of bank conditions at popular recreation sites along Middle Fossil Creek indicate most of the channel is well armored with bedrock, boulders, cobbles, and riparian vegetation. Areas disturbed by recreational use are primarily located along low floodplain surfaces adjacent to the wetted channel. The highest areas of recreational use have typically been at the Waterfall, and other areas in Middle Fossil Creek accessible from adjacent parking lots. The historic dam site is another popular destination for the more adventurous visitors requiring a roughly 10 mile round trip hike from the nearest parking area. Visitor use is minimal from just upstream of the Waterfall to the historic dam site largely because of limited access to the creek. For much of the length of this reach, the Flume Trail traverses Fossil Creek upwards of 400 vertical feet above the creek with slopes exceeding 60% between the trail and creek bottom. Additionally, visitor use is minimal in the approximately 6-mile reach of Fossil Creek downstream of the Mazatzal recreation site because of limited access. This reach is entirely contained within the Mazatzal Wilderness area. A total of 15 acres of recreational disturbance leading to exposure of bare mineral soil surrounding Fossil Creek was recorded in 2013 (see description in the *Affected Environment Common to All Resources* section above). This is a relatively small footprint of disturbance when compared to the watershed as a whole, constituting less than 0.03% of the watershed area above Sally May Wash. Although recreational disturbance has caused localized impacts to the riparian zone, stream banks, and travertine deposits, it is not likely to have altered stream channel morphology nor influenced the timing and size of flood events.

Water Rights

Arizona Public Service (APS) held a Fossil Creek water right with a Feb. 26, 1900, priority date for 31,123 acre feet per year to generate hydroelectric power at its Irving and Childs power plants. The point of diversion was the Fossil Springs Diversion Dam, and the diverted water was eventually discharged to the Verde River at Childs, 3.5 miles above its confluence with Fossil Creek. The settlement agreement signed by APS (APS et al. 2000) to surrender its license and decommission its facilities[15] in Fossil Creek included a stipulation that transferred APS's water right to the Forest Service. This transfer was completed in August of 2011.

The Coconino and Tonto national forests also applied for and received from the State of Arizona an instream flow water right for Fossil Creek (Certificate No. 33-96622) that is separate from the APS right. The instream flow water right is to protect flows for wildlife, including fish, and recreation and is based on median monthly flows ranging from a low of 42.5 cfs in September to 51 cfs in February. The total volume of the right is 33,280 acre feet per year. The priority date for this right is 12/1999, which is junior to the APS right. The reach protected by

[15] Decommissioning actions of Fossil Creek's hydropower system, operated by APS, began in 2004 and was completed in 2010.

the state-based water right certificate for instream flow use begins approximately one half mile above the remnants of the Fossil Springs Diversion Dam, and extends to the confluence with the Verde River.

Several other water rights and claims exist within the Fossil Creek watershed. These include water right claims for stock ponds, water right certificates for domestic use from springs in the watershed for use at APS's employee housing (also transferred to the Forest Service in 2011), and water rights claims for instream livestock use by grazing permittees.

The Wild and Scenic Rivers Act (WSRA) expressly reserves waters for the U.S. federal government. This reservation requires the U.S. federal government to the quantity of water sufficient to achieve the purposes of the WSRA, and the right is to waters not otherwise obligated under state law. The purposes of the WSRA are identified in Section 1(b): free-flowing condition, water quality, and the outstandingly remarkable values (ORVs). Therefore the Wild & Scenic designation provides a federally reserved water right that enables the U.S. federal government to manage for identified river values, which extend beyond the beneficial uses identified in the state-based claim. The priority date for the federally reserved right is the date of Wild and Scenic designation, March 30, 2009. Quantification of this right will follow designation of river values.

The Forest Service is currently quantifying stream flows required to protect Fossil Creek's river values in order to claim the federally reserved water right that comes with Wild and Scenic River designation. This right may result in protection of greater flows than the state-based right. To be able to determine the quantity of water necessary to defend the Federal Reserve water right, a gage was needed that could record all flows events including peak flows. The Forest Service, in collaboration with USGS, installed a gage at the Fossil Creek Bridge in 2010 that has been continuously collecting stream flow data. This gage data helps determine required flows so that Fossil Creek would have sufficient water to support river values. The federally reserved water right appropriation sought by the Forest Service for Fossil Creek would not have a detrimental effect on valid, existing, senior surface water rights since the application is for an in-situ, non-consumptive use that would not reduce water available to downstream water right holders.

Adverse Impact to and Degradation of Water Quantity

Adverse impact/degradation would occur if public use, development, or administrative use results in a persistent decrease in Fossil Creek's baseflow discharge.

Protection and Enhancement of Water Quantity

Water quantity is protected if Fossil Creek's baseflow discharge is maintained within its natural range of variability. Opportunities for enhancement include strengthening administrative protections of Fossil Creek's baseflow discharge.

Water Quality

The Arizona Department of Environmental Quality (ADEQ) is responsible for establishing state water quality standards and monitoring the quality of the state's surface water. As required under the Clean Water Act (CWA), ADEQ assesses the water quality of Arizona every two years and publishes its findings in a report submitted to the U.S. Environmental Protection Agency (EPA) titled "Water Quality in Arizona 305(b) Assessment Report" (305b report). The purpose of the report is to provide a comprehensive analysis of water quality data associated with Arizona's surface waters to determine whether state water quality standards are being met and designated uses of these waters are being supported. Designated uses of a surface water include full-body contact, partial-body contact, domestic water source, fish consumption, aquatic and wildlife (cold water), aquatic and wildlife (warm water), aquatic and wildlife (ephemeral), aquatic and wildlife (effluent-dependent water), agricultural irrigation, and agricultural livestock watering. Based on the results of this assessment, surface waters are classified into one of five categories as shown in table 3-12.

Table 3-12. Surface water quality categories

Category number	Category	Description
1	Attaining All Uses	All uses were assessed as "attaining uses," all core parameters monitored
2	Attaining Some Uses	At least one designated use was assessed as "attaining," and not designated uses were not attaining or impaired
3	Inconclusive or Not Assessed	Insufficient samples or core parameters to assess *any* designated uses
4	Not Attaining	One or more designated uses is not attaining, but at TMDL is *not* needed
5	Impaired	One or more designated uses is not attaining, and a TMDL is needed

Fossil Creek is also an Outstanding Arizona Water (OAW), which triggers implementation of Clean Water Act Tier 3 anti-degradation protection. Under this standard existing water quality must be maintained and new or expanded point source discharges directly to an OAW are permitted.

The most recent 305b report indicates that Fossil Creek is in full attainment of water quality standards and supports all designated uses (ADEQ 2016), however; additional monitoring conducted by NAU (Adams et al. 2014) suggests that there may be localized water quality issues in areas where high concentrations of humans tend to congregate.

Beginning in 2010, monitoring for enterococci, an indicator of fecal coliform contamination, was conducted by NAU as part of the "Middle Fossil Creek Riparian Habitat Protection and Restoration Project", hereafter referred to as the NAU study (Adams et al. 2014). Although a state water quality standard for enterococci has not been promulgated, the U.S. EPA has published recreational water quality criteria for enterococci based on an estimated illness rate with a geometric mean of 35 colony forming units (cfus) per 100 mL for an estimated illness rate of 36 per 1,000 primary contact recreators and a geometric mean of 30 cfus/100mL for an estimated illness rate of 32 per 1000 primary contact recreators. Samples were typically collected by NAU in late May/early June, August, and October during the years 2010 through 2013 at three sites in Middle Fossil Creek including a site 0.3 miles below the popular Waterfall area (referred to as "Mid-Falls" in the NAU study), the Fossil Creek Bridge, and Purple Mountain. When compared against EPA's water quality criteria value for the lower illness rate (i.e., 30 cfus/100mL), out of a total of 30 samples, 9 exceeded the EPA's water quality criteria value. It is difficult to draw conclusions from this study regarding causation. Exceedances most often occurred in August (7 exceedances, however; no samples were collected in August of 2012) with the other two exceedances occurring in late May/early June. Visitor use is typically high in August but so is the incidence of storm events associated with the North American Monsoon. In the fall of 2009 and into 2010, 10 temporary toilets were placed at popular recreation nodes in the Fossil Creek area. During that time, evidence of human waste deposited outside toilet facilities was recorded by NAU graduate student Emily Anderson (Anderson 2011). Despite the presence of the portable toilets, Anderson detected evidence of more than 2,200 incidents of improper human waste disposal. The numbers of incidences were highest at Homestead with 831 and lowest at the Irving site with 27. This is waste that was disposed of improperly and could have led to bacterial contamination of Fossil Creek.

As discussed more fully in the section on water quality in *Direct and Indirect Effects Common to All Action Alternatives*, exceedances of water quality standards for fecal indicator bacteria have been noted to occur during high use periods at Slide Rock State Park in Oak Creek Canyon. The resuspension of bottom sediments through recreation activities and with an increase in river discharge during storm events has been identified as a primary means by which state water quality standards for *E. coli* have been exceeded at this popular recreation site (OCWC, 2012). Additionally, there are many sources of fecal indicator bacteria including natural, non-fecal sources including plants, sand, soil and sediments (https://www.epa.gov/national-aquatic-resource-surveys/indicators-enterococci). All of the various sources of fecal indicator bacteria produce a background level in surface waters that varies according to local environmental and meteorological conditions. *E. coli* monitoring conducted by the Coconino National Forest at four sites in Fossil Creek including Irving, Sally May, FR708 bridge, and Purple Mountain did not detect any exceedances of state water quality standards for this species of fecal indicator bacteria.

Under baseline conditions, trash has been picked up annually by volunteers, including kayakers, and seasonal employees regularly at high-use recreation sites along the creek during peak season. Fossil Creek is a Pack it in Pack it out site, and recreational users are expected to pack out all of their own garbage, except at the Fossil Springs Trailhead site, where a dumpster was present. NAU (Adams et al. 2012) detected increasing amounts of garbage at transects in riparian areas established to detect disturbance to riparian areas between 2010 and 2011. As a later example of the existing condition, Forest Service removed 11,511 pounds of trash in 2015 (reduce to 4,463 pounds in 2016 and 2,490 pounds in 2017 after the start of the seasonal reservation system).

The other water quality constituent of concern at Fossil Creek is suspended sediment. Arizona's numeric water quality standard for suspended sediment is based on a median sediment value of 80 mg/l with a minimum of four samples collected at least seven days apart and an exclusion of data within 48 hours of a local storm event (see ACC R18-11-109(d). Arizona also has a narrative standard for bottom sediments that applies to "wadeable, perennial streams with an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use" (ACC R18-11-108.02). With Fossil Creek's designated aquatic and wildlife (warm water) (A&Ww) use, the following narrative standard would normally apply, however; ADEQ does not apply this standard to Fossil Creek because of the naturally high deposition of travertine on bottom sediments (Jones, personal communication, 2018).

"A surface water shall not contain pollutants in amounts or combinations that settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life." (AAC R18-11-108(A)(1))

Baseline conditions show that ADEQ has not detected exceedances for suspended sediment.

In April 2009, when the Historic Fossil Springs Dam was lowered by 14 vertical feet as part of the APS decommissioning project, a portion of the estimated 25,000 cubic yards of sediment that had accumulated behind the dam was exposed. The lowering of the dam resulted in erosion and sloughing of the stream banks from the dam location and continuing upstream. Erosion of sediments formerly stored behind the dam has created an incised zone that extends upstream from the remnants of the dam approximately 800 feet. Steep eroding banks up to 15 feet high bordered the channel in this reach, but this has decreased over time with active revegetation and recovery. Channel width between the eroding banks is approximately 100 feet. Sufficient channel width exists between the banks to provide an opportunity for a stable channel to begin to develop. Seedling woody riparian vegetation exists in the channel bottom and channel geomorphology has stabilized since this time.

Continued erosion of the steep banks is likely but the majority of the sediments stored behind the original diversion dam have eroded from the site and are migrating downstream. Many of these sediments may already have been transported well downstream or deposited on floodplains as a result of the 2008, 2010, 2013 and 2015 floods. ADEQ monitoring has not detected violations of the suspended sediment standard since these sediments began moving downstream.

In 2011, road deterioration came to the forefront in Fossil Creek, for safety reasons with related water quality concerns. The Forest Service had to close an approximate four-mile section of FR708 road between the Waterfall and Fossil Springs Trailhead due to the deteriorating condition of the road. In particular, a road segment of at least ½ mile extending from the Waterfall parking area to the first switchback is hydrologically connected to Fossil Creek meaning that much of the runoff and associated sediment from the roadbed drains directly to Fossil Creek. In the context of natural erosion from an intense rain event such as occurs during the North America monsoon, the contribution of sediment from the road may be a small portion but nonetheless, it is something that could at least be partly addressed through improved road maintenance.

In 2011 the waterfall trail was realigned in several areas to move the trail out of wetted soil. In addition, footbridges were installed over several spring drainages along the waterfall trail, mitigating effects to riparian habitat and special status species (native fish and Fossil springsnails). By elevating the footbridges off of the exposed wetted soils, sediment input was reduced to Fossil Creek at this location. Interim measures have also included efforts that have resulted in the re-vegetation of many bare soil areas that may have previously added sediment to Fossil Creek.

Adverse Impact to Water Quality

Water quality would be adversely impacted if exceedances of state water quality standards that are attributed to public use, development, or administrative use are detected, such as through the presence of human or pet waste in areas that may result in water contamination. Specific indicator(s) and sampling locations may be selected to indicate adverse impact.

Degradation of Water Quality

Water quality would be degraded if any segment of Fossil Creek is included on the federal Section 303d (Clean Water Act) listing of waters not attaining minimum water quality objectives.

Protection and Enhancement of Water Quality

Water quality is protected if public use, development, or administrative use do not result in exceedances of state water quality standards. Opportunities for enhancement include actions such as improving sanitation facilities, preventing expansion of areas of unplanned disturbance, focusing recreational use in areas less susceptible to causing water quality impacts, restoring areas impacted by unplanned disturbance, and expanding educational programming related to responsible visitor behavior.

Riparian, Wetland, and Spring Resources

Riparian areas and wetlands share similar attributes and frequently overlap, in riverine settings. In the case of Fossil Creek, areas mapped as wetlands in the National Wetlands Inventory (NWI) overlap with riparian areas so the two habitat types are treated together in this report. NWI is maintained by the U.S. Fish and Wildlife Service (USFWS) and is the format through which USFWS makes available information on the extent and status of the Nation's wetlands. Springs in the project area are either associated with the complex of springs collectively referred to as "Fossil Springs" or occur mainly on the northwest-facing hillslopes above Fossil Creek. These springs that emerge on the hillslope tend to have dense riparian vegetation and are largely inaccessible, occurring on slopes greater than 60%.

Riparian areas within the Fossil Creek drainage were identified using a combination of GIS and remote sensing technologies as part of the Regional Riparian Mapping Effort (RMAP) conducted by the Southwestern Region of the USFS (Triepke et.al 2013). Under this effort, riparian areas were identified according to the following definition:

"*Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies. Riparian areas have distinctively different vegetative species than adjacent areas; specifically, riparian mapping is conducted where riparian/wetland plant species are common. Where indicator plants may not be present, riparian areas are identified by signs of fluvial processes and/or fluvial features created under the current flow and climatic regimes*." (Triepke et.al 2013).

RMAP defined "common" as areas where wetland/riparian indicator taxa, as determined by USFWS, comprised at least 1% canopy cover (aerial extent) at the minimum map feature size of 1 hectare (roughly 2.5 acres). RMAP includes 24 map units designated by the dominant riparian plants present (i.e., Arizona Alder-Willow). A summary of riparian plant communities identified by RMAP in the Fossil Creek drainage is provided as table 3-13.

Table 3-13. Regional RMAP data of riparian type and acres in Fossil Creek drainage

RMAP Riparian Type	Total Acres
Fremont Cottonwood / Shrub	14.5
Narrowleaf Cottonwood / Shrub	7.4
Sycamore Freemont Cottonwood	1391.1
Grand Total	**1413.0**

Throughout the Fossil Creek WSR corridor, patchiness of the riparian forest occurs owing to the presence of bedrock and restricted channel width (i.e., channel and flooplain are restricted by valley type). Dominant tree species include sycamore (*Platanus wrightii*), ash (*Fraxinus velutina*), alder (*Alnus oblongifolia*), Fremont cottonwood (*Populus fremontii*), walnut (*Juglans major*), and willows (*Salix* spp.). The presence of travertine dams leads to complex patterns of pools which can flood riparian areas and locally alter the composition and structure of woody riparian species incapable of surviving inundation by water for extended periods.

Since restoration of full flows, riparian function along Fossil Creek has not been assessed using the proper functioning condition (PFC) protocol as originally described by Prichard et al. (1998). This is partly because of the dynamic nature of the riparian system as influenced by the presence of travertine dams and partly because of the inaccessibility of the riparian area for much of its length. Since restoration of full flows, the riparian area along Fossil Creek is largely free of anthropogenic disturbance.

Long-term trend vegetation monitoring was implemented in 2004 and monitored through 2010. Four stream channel cross-sections were established at locations that would display changes most readily in Fossil Creek, from dewatering through restoration of full flows. At each cross-section, vegetation transects were established on either side of the creek to capture tree density, age and size class distribution, ground cover attributes, and overall vegetation composition.

- **Cross-Section 1**, located just above the dam and below Fossil Springs, displayed the most dramatic changes as the dam was lowered. The stream bed dropped by fifteen to twenty feet, exposing dead trees buried under decades of sediment building behind the dam and leaving mature riparian trees suspended on a bench far above base flows. Most vegetation recorded in 2004 was removed by 2010 floods and a large headcut was observed moving upstream of the Dam.
- **Cross-Section 2,** located just below the dam, had already begun to show dramatic changes in 2007. Water levels had risen and sapling and pole sized trees were submerged in base flows. By 2010, new vegetation was establishing along a new greenline, located on the former floodplain along the north side of the creek. Many seedling trees dominated the north bank in 2010.
- **Cross-Section 3**, located above the large waterfall, has remained comparatively stable from dewatering to restoration of full flows. An abundance of seedling trees was noted along the greenline in 2010. An unauthorized trail along the south bank has widened slightly but remains in the uplands. Riparian vegetation was not being trampled but there could be erosion from the trail in this area as it is located in fine soils.
- **Cross-Section 4,** located above the Flume Trail crossing, remains stable due to dense giant fescue and alder cover. Unauthorized trails on the north bank in the uplands are affecting a mesquite bosque.

Soils

The description of existing conditions of soil resources in the analysis area is based on the Terrestrial Ecosystem Survey (TES) for the Coconino National Forest (Miller et al. 1995), and Tonto National Forest (USDA 1985), as well as bare soil monitoring conducted within the Fossil Creek WSR corridor.

The TES of Coconino National Forest (1995) and TES of the North Tonto National Forest (1985) lists the soil classification of each map unit on the forest. Most soils in the Fossil Creek WSR corridor are derived from basalt residuum or colluvium with lesser amounts derived in sandstone. Map units occur on slopes ranging from 15-120% and on elevated plains with slopes ranging from 0-15%. Soils with basalt parent material are well developed and are shallow (<20 inches to bedrock) to moderately deep (20-40 inches to bedrock), and deep (>40 inches to bedrock) on flatter slopes. These soils are fine textured or have high amounts of clay with loam or clay loam surface textures and well developed soils with clay accumulations in the subsoil and thin, organic surfaces. The dominant soil classifications at the family level are Typic and Lithic Haplustalfs, clayey-skeletal or fine, montomorillonitic, mesic soils and are shallow, moderately deep and deep.

TES rated soils as satisfactory, unsatisfactory, or unsuited (currently referred to as satisfactory but inherently unstable) based on long-term annual soil loss predictions using the Universal Soil Loss Equation (USLE). These ratings were then applied to all the soils within a particular terrestrial ecological unit (TEU) as a means of assessing soil stability. Since the publication of the TES for both forests, a soil condition assessment protocol titled "Technical Guidance for Soil Quality Monitoring in the Southwestern Region, USDA Forest Service" was developed by Region 3 of the USFS (USDA FS 2013). This soil condition assessment protocol is used to assess the three primary soil function of hydrologic function, soil stability, and nutrient cycling. Since release of the soil condition assessment protocol, refined soil condition assessments have been made in the field and/or using the professional judgement by soil scientists on both forests. According to Rory Steinke, former soil scientist on the Coconino National Forest, adjectival ratings of "impaired" were mainly assigned to soils formerly classified as "satisfactory" based on reduced nutrient cycling from loss of vegetative ground cover diversity and density (Steinke, personal communication, 2015). A summary of soil condition ratings for TEUs within the Fossil Creek WSR is provided in table 3-14.

Table 3-14. TES Soil Condition acres by condition class in the project area

TES Soil Condition Rating	Sum of Acres	Percent Total of Project Area
Impaired	1678	26.3%
Impaired & Unsatisfactory	50	0.8%
Unrated (Old Stehr Lake)	28	0.4%
Satisfactory	421	6.6%
Satisfactory - Inherently Unstable	3799	59.6%
Unsatisfactory	394	6.2%
Grand Total	**6371**	**100%**

For satisfactory soils, the ability of the soil to maintain resource values and sustain outputs is high. Soils rated as "satisfactory but inherently unstable" are located primarily on steep to very steep slopes. Based on soil erosion estimates using the Universal Soil Loss Equation (USLE), these soils are eroding faster than they are being renewed but are functioning within normal ecosystem limits since they are by definition, inherently unstable. There are areas of unsatisfactory soils mixed with impaired soils. These occur mostly in pinyon/juniper woodlands and juniper savannas. Impaired soils tend to occur where there is overstory cover and needle cast covering the soil while unsatisfactory soils occur in interspaces between shrubs where there is little cover and erosion is high.

One of the factors that most influences a soil's sensitivity to disturbance is its degree of protection by surface cover. Robichaud et al. (1993) noted that erosion in forested areas is more a function of the vegetative community than properties of the soil. In particular, erosion rates have been found to be positively correlated with the percentage of bare soil supporting the use of percentage bare soil as a proxy for erosion (Robichaud et al. 2005). The exposure of bare mineral soil may influence its susceptibility to erosion in several ways. Raindrop impact can displace fine soil particles at the surface leaving behind a poorly permeable surface crust that inhibits water infiltration and promotes runoff increasing the shear stress exerted on the soil surface. This increased shear stress can, in turn, cause accelerated erosion along preferential flow paths that develop on the surface. Vegetation dissipates the energy of flowing water so the in its absence we can expect higher flow velocities and higher rates of erosion.

Forest Service recreation employees and others have collected bare ground data in Fossil Creek since 2002. Areas of bare ground are typically associated with past and current recreation activities including dispersed camping, parking, spur roads, pullouts, day use, and creation of unauthorized trails. These areas are located in upland areas and floodplains adjacent to Fossil Creek. The *Affected Environment Section Common to All Resources* section above describes the findings of this bare soil monitoring.

Air Quality

The FS has a responsibility to protect air quality under both the 1916 Organic Act and the Clean Air Act. Accordingly, the FS seeks to perpetuate the best possible air quality to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas.

Vehicular use can potentially result in changes to air quality. Particulate matter 10 microns in size and smaller can penetrate the lungs of human beings and animals and is subject to a National Ambient Air Quality Standard (NAAQS) to protect public health and welfare. Particulate matter 2.5 microns in size and smaller is difficult for lungs to expel and has been linked to increases in death rates; heart attacks by disturbing heart rhythms and increasing plaque and clotting.

The primary factors that influence air quality are the locations of air pollutant sources, the types and amounts of pollutants emitted, meteorological conditions, and topographic features. Atmospheric conditions, such as wind speed, wind direction, and air temperature gradients, interact with the physical features of the landscape to determine the movement and dispersal of air pollutants.

In general, the air quality over the planning area is very good, with few exceptions. Most impacts to air quality, outside of wildfire or prescribed fire emissions, are from the greater Phoenix metropolitan area. With predominant SW winds, pollutants from Phoenix flow over the area and may contribute to increased air quality impacts. With the distance from Phoenix large particulate matter is generally low. There are no large industrial facilities within close radius of the project are so most localized emissions are from recreationalists on forest lands. They contribute emissions in the form of vehicle use and campfires; however, campfires have been prohibited in Fossil Creek since 2010. Recreational use is dispersed and seasonal and is not a point source type of emission. In the fall and winter, inversions may occur, trapping pollutants from wood burning and other local pollutants in the Verde Valley. During the summer months, industrial pollutants from Phoenix drift over the Verde Valley.

The planning area includes portions of the Mazatzal Wilderness and the Fossil Springs Wilderness. The Mazatzal Wilderness in the southern portion of the planning area is a Class I Airshed. A Class I area, designated by the Clean Air Act, is a classification that requires the highest level of protection under the act. Projects which may potentially impact Class I areas must address efforts to minimize smoke impacts on visibility. The Fossil Springs Wilderness in the northern portion of the planning area is a Class II Airshed. Both are targeted for air quality protection under the Clean Air Act and Forest Service policy.

The Mazatzal Wilderness Class one Airshed has been within air quality standards according to recent data. The Fossil Creek Wilderness Class II Airshed is not currently being monitored under any state or volunteer based program. The baseline and current condition of the airsheds overlapping the project area and cumulative effects boundary are below the national standards for all criteria pollutants.

Environmental Consequences

While many of the actions proposed in this plan are designed to improve the condition of individual river values, this section examines the collective impact of all actions to ensure that the consequences of actions to protect one resource do not have unintended impacts to others. The combination of actions included in each alternative to protect river values, coupled with the user capacity management program and actions related to land use and facilities, are evaluated here for their overall net effect on the resources evaluated in this report. These effects are compared with the measures of adverse impact and degradation to determine whether the alternatives would protect and enhance river values assessed in this report and meet the intent of WSRA.

To prevent future adverse impacts, the FS would regularly monitor river value conditions and take management action when specific conditions exist that indicate the need for a change in management to protect resource conditions. A comprehensive monitoring program is a component of all action alternatives.

Direct and Indirect Effects of Alternative A - No Action

Without a comprehensive river management plan and associated management direction, the river's outstandingly remarkable values may not be adequately protected or enhanced, even with continued implementation of interim management measures. Under this alternative, a Comprehensive River Management Plan would not be adopted and existing interim management measures would continue to be implemented as funding allows. Under the no action alternative, the forest-wide direction found in the forest plans would continue to guide management of the Fossil Creek Wild and Scenic River corridor.

Under the no action alternative, there would be no formal monitoring plan specific to the river values of Fossil Creek and therefore no consistent or effective way to determine when changes in management (adaptive management) are needed in order to eliminate adverse effects to river values. Education and interpretive materials would be provided to support the current management system but would not be guided by consistent and comprehensive direction that would be in the action alternatives.

Free Flowing Condition

The free-flowing condition of Fossil Creek is currently protected on a segment wide basis. All new water resources projects proposed in the bed and banks of Fossil Creek would be analyzed in accordance with Section 7 of WSRA to ensure that water resources projects would not lead to "direct or adverse effects" on free flow, or that projects on tributaries to the river do not invade or unreasonably diminish the river's free flowing condition. Proposed projects in the bed or banks of Fossil Creek, or proposed projects in the bed or banks of a river located above, below, or on a stream tributary to Fossil Creek, would be subject to the Section 7 process under all action alternatives.

Under the No Action alternative, water quantity would continue to be protected from groundwater development on FS-managed lands that could impact surface flow as directed by the regional supplement (2500-2001-1) to Forest Service Manual (FSM) 2500, Chapter 2540, Water Uses and Development. This supplement identifies a process for screening and approval of proposals for development of groundwater resources on FS-managed lands. Most importantly, it explicitly identifies that proposals to pump or transport water must not impair National Forest System (NFS) resources.

Water Quality

Under the No Action alternative, without the adaptive management and monitoring plan in place, specific actions to address water quality impairments may not occur, posing a risk to water quality. In particular, additional toilet facilities would not be constructed, potentially increasing the incidence of human waste deposition in locations where it could impact water quality.

The No Action alternative would not rehabilitate user-created roads, trails, and other areas of disturbance that might be impacting water quality. User-created roads and trails are a particular problem since their creation is not planned and does not include features to prevent deterioration of the road or trail prism such as proper alignment on the landscape, and outsloping and other means to insure positive drainage of the prism. Without rehabilitation of these features, it is probable that accelerated erosion would occur and more sediment would, consequently, be delivered to Fossil Creek.

The no action alternative does not allow for the improvement of parking areas. This can result in unplanned creep and enlarging of the parking areas, as well as more runoff contributing sediment and vehicle fluids into Fossil Creek. While some of the action alternatives call for more parking spots than the no action alternative, additional parking and other recreational infrastructure under the action alternatives would be planned incorporating design features and principles that reduce impacts to resources.

Soil Resources

Under No Action alternative, areas of bare mineral soil would remain an issue and the condition of soil would remain static or decline in areas where unplanned expansion of recreation occurred. Consequently,

implementation of the No Action alternative would not improve soil condition and would not allow for the rehabilitation of bare areas using such techniques as scarifying, re-seeding, and hydromulching.

Air Quality

With no action, there would be no temporary increase in dust because there would be no construction unless it is approved through separate analysis. Vehicle traffic would continue, and air quality is expected to remain in attainment. No direct changes in short-term or long-term affects to air quality would result from a No Action Alternative. The No Action Alternative would not affect the smoke management policies in the Coconino and Tonto National Forest Plans. The FS would continue to participate in the regional air quality planning processes for ozone and visibility impairment and would continue to review applications for new or modified major stationary sources in the two airsheds pursuant to the Prevention of Significant Deterioration regulations. The FS would comply with the EPA's general conformity rule for any future actions that would occur within two airsheds, both the Class I Mazatzal Wilderness airshed and the Class II, Fossil Creek Wilderness airshed.

Direct and Indirect Effects Common to All Alternatives

Riparian Resources

Fossil Creek sustains riparian habitat with high biological integrity in all segments of the river corridor. All alternatives address concerns with riparian condition by limiting ground disturbance to designated recreation sites. Rehabilitation of unauthorized trails and other disturbed areas outside of recreation sites would occur under all action alternatives.

Riparian function can be assessed by evaluating various indicators of riparian health and resiliency such as stream system stability and overall watershed function from the standpoint of upland erosion and alterations to the natural flow and movement of sediment through the fluvial system (Dickard et al. 2015). Under all alternatives, upland erosion, natural flow, and sediment movement are not likely to be impacted owing to the limited development and disturbance that exists within Fossil Creek's drainage area. Fossil Creek exists within a drainage area that is largely free of disturbance with roughly 37% of the drainage area containing designated or recommended wilderness and inventoried roadless areas. Developed or potentially developable private lands cover less than 2% of the watershed.

The number and length of recreation sites vary by alternative; consequently the stream length immediately adjacent to recreation sites varies from about 3100 feet (Alt C) to over 8700 feet (Alt E) (see table 3-15). Because recreation sites may be heavily used and vegetative cover reduced or eliminated through physical trampling and compaction of soil, the percentage of stream length within recreation sites is useful in determining where negative impacts to stream bank stability may occur. Stream bank stability is an indicator of riparian function and is influenced by the amount of stabilizing cover, such as vegetation, large or anchored rock, and anchored wood, present along stream banks (Dickard et al. 2015). Ramifications of bank instability include increased bank erosion and consequent impacts to water quality from increased delivery of sediment to the stream as well as channel widening that could alter stream access to its floodplain, each of which may impact aquatic habitat. In the absence of site specific information, it has been determined that a minimum of 70% stabilizing cover along stream banks is necessary to maintain stream bank stability on a reach-by-reach basis (Dickard et al. 2015). To assess the vulnerability of stream banks to bank instability associated with streamside recreational use, the perennial section of Fossil Creek was delineated into 8 separate reaches based primarily on observable differences in stream channel profile and major stream confluences. Given that recreation may reduce stabilizing bank cover, it is evident that there are differences in vulnerability to bank instability for the various alternatives and reaches of Fossil Creek. Alternative D is likely to be most protective of stream bank stability since the linear distance of recreation sites immediately adjacent to Fossil Creek is less than that for all the other alternatives whereas alternatives E and F have the most linear distance of recreation sites adjacent to Fossil Creek.

Table 3-15. Riparian reaches and associated adjacent recreation sites

		Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F

		Rec-reation length	% of reach	Rec-reation length	% of reach	Rec-reation length	% of reach	Rec-reation length	% of reach	Rec-reation length	% of reach	Rec-reation length	%of reach
Upper FC Spring to Historic Dam	2055.1	1785.7	86.9%	1785.7	86.9%	0.0	0.0%	0.0	0.0%	1785.7	86.9%	1785.7	86.9%
Historic Dam to Waterfall	12156.4	580.0	4.8%	580.0	4.8%	6.2	0.1%	0.0	0.0%	754.2	6.2%	580.0	4.8%
Waterfall to Flume Trail Crossing of Fossil Creek	6573.2	2042.8	31.1%	2042.8	31.1%	2042.8	31.1%	509.7	7.8%	2552.5	38.8%	2552.5	38.8%
Flume Trail Crossing of Fossil Creek to FC Bridge	6800.6	893.9	13.1%	893.9	13.1%	893.9	13.1%	616.5	9.1%	893.9	13.1%	893.9	13.1%
Bridge to Sally May Wash	10241.2	1317.9	12.9%	1317.9	12.9%	1047.8	10.2%	1047.8	10.2%	1317.9	12.9%	1317.9	12.9%
Sally May Wash to Unnamed Right Bank Tributary	9112.9	891.0	9.8%	891.0	9.8%	651.5	7.1%	651.5	7.1%	891.0	9.8%	891.0	9.8%
Unnamed Right Bank Tributary to Hardscrabble	23065.3	None	0.0%	None	0.0%	None	0.0%	None	0.0%	None	0.0%	None	0.0%
Hardscrabble Creek to Verde River	6734.3	None	0.0%	None	0.0%	None	0.0%	None	0.0%	None	0.0%	None	0.0%

Localized disturbance to riparian vegetation, however; would occur under all alternatives including direct damage to riparian plants from trampling or riparian vegetation and exposure of the root system of woody riparian plants. Indirect effects to riparian resources could include decreased soil moisture availability to plants when compaction reduces the ability of the soils to infiltrate and store water.

Water Quantity

Under all alternatives, water quantity would be protected from groundwater development on FS-managed lands that could impact surface flow as directed by the regional supplement (2500-2001-1) to Forest Service Manual (FSM) 2500, Chapter 2540, Water Uses and Development. This supplement identifies a process for screening and approval of proposals for development of groundwater resources on FS-managed lands. Most importantly, it explicitly identifies that proposals to pump or transport water must not impair National Forest System (NFS) resources.

Under all alternatives, water quantity would potentially be threatened by groundwater development on lands not managed by NFS since such water development is beyond Federal control and would potentially be allowable under existing State law. The springs associated with Fossil Creek are largely fed by the regional groundwater system underlying portions of the southern Colorado plateau (Green 2008). Development of regional groundwater in certain portions of the southern Colorado plateau could intercept groundwater that ultimately discharges at the springs of Fossil Creek, however, management of development of these water sources off of National Forest System lands is the purview of state departments for water resources or sovereign tribal nations.

Free Flowing Condition

The free-flowing condition of Fossil Creek is currently protected on a segment wide basis. All new water resources projects proposed in the bed and banks of Fossil Creek would be analyzed in accordance with Section 7 of WSRA to ensure that water resources projects would not lead to “direct or adverse effects” on free flow, or that projects on tributaries to the river do not invade or unreasonably diminish the rivers free flowing condition. Proposed projects in the bed or banks of Fossil Creek, or proposed projects in the bed or banks of a river located

above, below, or on a stream tributary to Fossil Creek, would be subject to the Section 7 process under all action alternatives.

In all action alternatives, a new bridge would be constructed adjacent to the existing Fossil Creek Bridge. The new bridge is needed to provide safer access across Fossil Creek, particularly for heavier vehicles needed to maintain vault toilets in Middle Fossil. The existing bridge would be retained, as it is listed on the National Register of Historic Places, and would remain available for pedestrian use. In all action alternatives, the existing gabion between Fossil Creek and Forest Road (FR) 502 would be repaired and extended. These actions are needed to prevent erosion of FR 502 and potential associated water quality impacts.

The FS will finalize the Section 7 Determination process for the preferred alternative in the final Fossil Creek Plan, and the analysis and determination will be included in the Record of Decision for the plan. The 502 gabion extension and the Fossil Creek Bridge would be constructed in a manner that does not create an adverse impact on the Free-flowing condition of Fossil Creek. Repair of the existing gabion baskets should not change the existing effect of the gabion structure on free flow. Repairs would not modify the waterway more than the existing structure.

In accordance with WSRA, all future water resources projects that could have a direct and adverse effect on the values of a designated river must be: (1) redesigned and resubmitted for a subsequent Section 7 Determination, (2) abandoned, or (3) reported to the Secretary of the Interior and Congress. By conducting the Section 7 review process for all proposed projects, under all action alternative, the free flowing character of Fossil Creek would be fully protected on a segment wide scale.

Water Quality

Water quality issues of concern include exceedances of water quality standards for *E. coli* and suspended sediment. Although the most recent 305b report (ADEQ 2016) summarizing surface water quality in the State of Arizona indicates that Fossil Creek is in full attainment of water quality standards and supports all designated uses and testing for *E. coli* done under the supervision of the Coconino National Forest has not resulted in any exceedances of state water quality standards, the potential exists for bacterial and suspended sediment contamination of water from recreational use.

Recreation can increase the delivery of sediment to streams particularly when recreational activities occur streamside. Trailing along or perpendicular to a stream for access can lead to bank failure or the routing of sediment-laden runoff directly to the stream. Compaction of the soil, loss of soil organic matter, and reduction in vegetative cover by trampling can reduce the ability of the soil to infiltrate water causing increased runoff, erosion, and, ultimately, increased sediment delivery to the stream. Trampling streamside can also expose the roots of woody riparian vegetation, and reduce air porosity of the soil increasing plant mortality. Riparian plants often play a critical role in stabilizing stream banks and dissipating flood energy so their loss can lead to increased in-channel erosion (Dickard et al. 2015). More than any inherent property of the soil itself, the exposure of bare mineral soil probably has the greatest influence on soil erosion since this exposure often results in the formation of a poorly permeable crust that increases runoff and erosion. Areas of exposed bare soil connected to a stream as opposed to bare areas that drain to an undisturbed area are of particular concern as they deliver entrained sediment directly to the stream. Dispersed recreation in the streamside environment occurs under all alternatives so increased sediment delivery to the stream can be expected where this recreation compacts and exposes soil and topography directs runoff toward the stream. Erosion modeling using the Rangeland Hydrology and Erosion Modeling predicts that the increased erosion at dispersed recreation sites under any alternative would not exceed tolerable soil loss levels as identified in the Coconino National Forest, Terrestrial Ecosystem Survey. Tolerable soil loss levels are those which can occur without impacting inherent site productivity.

Although differences exist between alternatives in terms of the area devoted to developed recreational areas (see table 3-16), developed recreation sites such as parking areas are generally not a concern from a water quality, soil condition, and riparian area function standpoint due to the planned nature of this development, standards in place to limit the impacts of such development on ecological function of the surrounding area, siting of developed

recreation areas in upland settings, regulations that protect water quality from non-point source pollution associated with construction projects, and, in the case of developed recreation sites with the Fossil Creek WSR, the relatively small footprint of disturbance relative to the watershed scale.

Table 3-16. Footprint of developed recreation areas by alternative

Alternative	Developed Recreation Area (acres)
A	10.8
B	16.4
C	18.3
D	21.5
E	35.2
F	31.4

As an example of standards applied to developed recreation sites, Forest Service Handbook (FSH) 2309.13, Chapter 10, Planning and Design of Developed Recreations Sites and Facilities, establishes procedures for site analysis, selection, design, and development with an overarching goal being:

> "Developed recreation sites and facilities should be planned and designed to be sustainable, providing a broad set of recreation settings, opportunities, access, and scenic character compatible with the desired recreation opportunity spectrum (ROS) setting. Developed recreation sites and facilities should facilitate high-quality experiences promoting the visitor's connection with nature, while maintaining the ecological function of the surrounding area. Skillful application of site, facility, and interpretive planning and design is required to meet those purposes." (FSH 2309.13, Chapter 10, section 10.3).

Even under alternative E with its proposed 35 acres devoted to developed recreation areas, the footprint of disturbance is less than 0.1% of the drainage area above the development. A comparison of average annual sediment and water yield by alternatives with specific accounting for differences in developed recreation footprints at a point just downstream of Sally May wash suggests no difference between alternatives. This was based on a 10 year simulation using the Soil and Watershed Assessment Tool (SWAT) as parameterized through the Automated Geospatial Watershed Assessment (AGWA) tool.

For these reasons, developed recreation sites under all action alternatives would not result in long-term negative impacts to water quality. Short-term negative impacts to water quality could occur during periods of construction as disturbed areas are created for infrastructure such as parking areas, however; BMPs would be used to minimize non-point source pollution from such disturbance.

Proposed activities under the action alternatives such as improved drainage along designated roads and trails, withdrawal from mineral entry, repair of existing stabilization infrastructure, restoration of closed roads and unauthorized roads and trails, delineation of creek access trails that lead to armored areas, barriers to delineate sites, installation of runoff retention basins all would contribute to reducing the amount of sediment in Fossil Creek. Proper road drainage in the Fossil Creek WSR would in general reduce sediment loading and potentially improve water quality. In particular, the road drainage on the 708 and 502 roads near Fossil Creek would be improved so that road segments would be more frequently drained and, where possible, road runoff would be routed to detention basins when it otherwise would discharge directly to Fossil Creek. FR 502 road improvement and maintenance work is specifically planned near Purple Mountain, where existing road drainage issues are contributing sediment to Fossil Creek.

Because of the relative ease of its measurement versus other potentially harmful micro-organisms that may be present in water, *E. coli* is used an indicator for fecal contamination of water. There are many potential sources of *E. coli* in water including human and non-human waste and there are varying conditions that may lead to exceedances of water quality standards (OCWC 2012). *E. coli* and by extension, fecal contamination, is common in recreational waters and it has been established that recreation can influence the bacteriological quality of surface water, particular that which is impounded (Varness et al. 1978). Recreation may impact bacteriological water quality either directly through the deposition of human and/or pet waste in or near surface waters or

indirectly through the resuspension of bottom sediments harboring bacteria (Poff and Tecle 2002). Stephenson and Rychert (1982) found *E. coli* concentrations in the bottom sediments of streams to be 2 to 720 times greater than in the overlying water column. Numerous other studies have noted the role of bottom sediments as reservoirs of bacteria. In particular, the resuspension of bottom sediments through recreation activities and with an increase in river discharge during storm events has been identified as a primary means by which state water quality standards for *E. coli* have been exceeded in Oak Creek, a spring-fed perennial stream very popular among recreationists not unlike Fossil Creek (OCWC 2012). Sediments may enhance survival of bacteria by increasing the availability of soluble organic matter and nutrients, providing protection from bacterial predators, and shielding bacteria from exposure to UV sunlight (Cho et al. 2010).

Exceedances of water quality standards for *E. coli* have been an ongoing problem at Slide Rock State Park on Oak Creek where concentrated recreational use typically occurs during the summer and Monsoon storm events produce flow events that stir up bottom sediments. Recreational use of Oak Creek Canyon and Slide Rock in particular has dramatically increased over the past several decades yet attempts to statistically correlate numbers of human visitors to exceedances of water quality standards for *E. coli* have been inconclusive (Poff and Tecle 2002; ADEQ 1999). For example, a linear regression analysis of weekly summer fecal coliform levels, of which *E. coli* is one constituent, as a function of visitor use at Slide Rock State Park produced a correlation coefficient of only 0.2, suggesting only a weak relationship between these variables (ADEQ 1999). Poff and Tecle (2002) have attributed this to multiple causes including but not limited to the intermittent and varied nature of recreation, the delayed effect of recreation use on E. Coli levels (i.e., recreation use doesn't necessarily produce an instantaneous water quality response at the point of sampling), as well as the contribution of E. Coli from non-recreational activities/sources. The latter case is exemplified by studies indicating higher levels of coliform bacteria in surface waters relatively free of human disturbance versus those where public use occurs (Varness et al. 1978).

From a water quality perspective, the critical element under all action alternatives is to limit unplanned disturbance. Planned disturbance is distinguished from unplanned disturbance in that planned disturbance occurs under rules, standards, and guidelines. Unplanned disturbance occurs outside of developed and designated dispersed recreation areas and typically manifests itself as non-system trails and instances of human waste disposal outside of toilet facilities. This unplanned disturbance results in the trampling of vegetation, exposure of bare mineral soil, exposure of roots associated with woody riparian vegetation, streambank shear (i.e., sloughing of streambanks that occurs when accessing the creek at unhardened locations or trailing along the creek at unhardened locations), and instances of human waste deposition (i.e., fecal matter and trash). This unplanned disturbance has the potential for increasing erosion and consequent transport of sediment to Fossil Creek, and bacterial contamination of surface water particularly when it occurs within the aquatic management zone established around Fossil Creek. Aquatic management zones (AMZs) are an administratively designated zone adjacent to stream channels and other water bodies as a best management practice aimed at maintaining and improving water quality or other water- and riparian-dependent values (USDA FS 2012). All action alternatives include an administratively designated AMZ for Fossil Creek. Monitoring and adaptive management would be specifically focused on identifying and mitigating instances of unplanned disturbance as discussed more fully in Chapter 6 of the CRMP.

Access to recreation sites is at least partially a function of available parking spaces, although historically visitor use in Fossil Creek has been focused more heavily at the waterfall and on the Waterfall Trail than at other recreation sites in the river corridor. Availability of actual use data is currently limited; however, manual counts in July 2017 estimated about 65% of visitors in Middle Fossil entered the Waterfall Trail. This aligns with observations of visitor use in the past. It is anticipated that a disproportionate number of visitors would continue to desire to visit the waterfall compared to other recreation sites in the river corridor.

There are many factors that influence the ability to prevent or limit unplanned disturbance associated with dispersed recreation such as management presence, infrastructure, and visitor capacity limits. The deterioration of public lands in some areas has led to speculation as to whether a maximum carrying capacity exists at which recreational access should be limited (Wagar 1964). This topic has led to the formation of the Interagency Visitor Use Management Council, an entity consisting of representatives of six land management agencies including the

U.S. Forest Service. The council was formed in 2011 in order to provide consistent recommendations to assist member agencies with visitor use management within their independent legal authorities (accessed online at https://visitorusemanagement.nps.gov/). In addressing the question of visitor capacity, a position paper developed by the council notes that "effective visitor use management is often more about managing factors such as the types, timing, and location of visitor activities and associated visitor behaviors. Site design and the types of recreation facilities are also important factors in managing visitor use to be consistent with desired conditions". The action alternatives present a range of options for managing visitor use and recreational experience.

The provision of restroom facilities as a means of preventing unplanned human waste deposition (i.e., human waste deposition outside a restroom facility) where such deposition may impact surface water quality occurs under all alternatives but the number of existing or proposed toilet facilities varies by alternative as summarized in table 3-17. In some alternatives, there are fewer proposed toilet facilities at particular recreation areas because access to the areas would be restricted (for example, alternatives C and D where trail access would no longer be provided to the historic dam and Fossil springs area). Because of physical limitations of the site, the Waterfall location is not suitable for development of recreation infrastructure, including toilet facilities. Alternative D directly addresses this issue by eliminating access to this popular recreation site. Aside from eliminating access, protecting river values under such circumstances would include messaging (signage, visitor contacts, media), promoting recreation at other sites in the river corridor, Leave No Trace and low-impact recreation practices, and proper waste disposal. Further, infrastructure at other recreation sites that provide river access points would be improved to increase their visitor capacity and attractiveness. Other adaptive management actions could be implemented to address the potential for human waste degradation of river values during times of high recreation demand at high use dispersed recreation sites such as the waterfall including the following:

- Additional management presence to direct visitors to other locations in the river corridor
- Requiring a separate reservation or permit for access to the waterfall and/or Fossil Springs locations
- Limiting access to the waterfall and/or Fossil Springs to guided groups
- Requiring use of portable toilet kits (such as "WAG bags") at the waterfall and/or Fossil Springs
- Short-term closures if determined necessary to protect public health

For those recreational areas that would remain open under all alternatives, the proposed provision of toilet facilities does not differ and so conclusions about the potential for instances of unplanned human waste deposition would be based on differences in capacity for each alternative.

Table 3-17. Comparison of the number of toilets for each recreation area by alternative

	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Mazatzal	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet
Purple Mountain	Double portable toilet	Double portable toilet	No parking. Site rehabilitated.	No parking. Site rehabilitated.	Double portable toilet	Double portable toilet
Sally May	Double portable toilet	Double portable toilet	No parking. Site rehabilitated.	No parking. Site rehabilitated.	Double portable toilet	Double portable toilet
Junction	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet
Cactus Flat	Site does not exist.	Site does not exist.	Double stall vault toilet	Site does not exist.	Double stall vault toilet	Double stall vault toilet
Homestead Upper Loop	Double stall vault toilet	Double stall vault toilet tables	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet
Homestead Lower Loop	Walk-in only.	Walk-in only.		Walk-in only.		
Homestead West Loop	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet

	Alternative A (No Action)	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Heinrich	Site does not exist.	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet
Fossil Creek Bridge	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet	Single stall vault toilet
Tonto Bench	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet
Irving	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall toilet plus double stall alt toilet.
Lewis Trailhead and Trail	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet
Bear/Rim Trailheads	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet	Double stall vault toilet
Historic Dam and Fossil Springs area	No Toilet	Double stall alternative toilet if needed.	No trail access. No Toilet	No trail access. No Toilet	Double stall alternative toilet if needed.	Double stall alternative toilet if needed.
Total Stalls	**18**	**22**	**18**	**16**	**24**	**26**

Visitor use capacity expressed as persons at one time (PAOT) varies among alternatives. It stands to reason that more visitors may translate into more instances of unplanned human waste deposition but this relationship is somewhat speculative. The number of PAOT per proposed toilet stall is summarized in table 3-18.

Table 3-18. User capacity (expressed as PAOT) and toilet facility provision by alternative

	Alt A No Action	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Persons at one time (PAOT)	810	640	720	905	1510	2580
Total Toilet Stalls	18	22	18	16	24	26
PAOT per toilet	45	29	40	57	63	99
Recreational Access description for the Waterfall site where a toilet at the end of the trail, located at the waterfall, is not possible outside of the 100 year floodplain.	Approximately 21 parking spaces; vault toilet; trail access and kiosks.	Approximately 5 parking spaces; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No vehicle access during high-use season; approximately 5 parking spaces during low-use season; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No long-term parking. Trailhead and trail rehabilitated. Roadside vault toilet available, with temporary parking.	Approximately 21 parking spaces; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.	No vehicle access during high-use season; approximately 21 parking spaces during low-use season; vault toilet; kiosks; trash receptacles; bike racks; armored access points to creek along trail.
Historic Dam and Fossil Springs area	Accessible via foot trails.	Accessible via foot trails. Alternative toilet if needed.	No trail access.	No trail access.	Accessible via foot trails. Alternative toilet if needed.	Accessible via foot trails. Alternative toilet if needed.

Though specific standards or guidelines have not been developed for the provision of toilets in dispersed recreation areas, Forest Service Handbook (FSH) 2309.13, Chapter 10, Planning and Design of Developed Recreations Sites and Facilities, provides such information as copied below:

"Provide a sufficient number of toilets to accommodate the site's capacity. As a general rule, provide one toilet riser for every 35 PAOT, including camping units intended for RV use".

Only alternative B meets this developed recreation toilet provision general rule; however, the situation is more complex as visitors would not be evenly distributed among recreation sites. Nevertheless, a comparison of alternatives suggests that Alternative F presents challenges related to managing unplanned human waste deposition as this alternative would have the highest proposed user capacity and therefore, the largest ratio of PAOT per toilet.

Other action alternatives have much lower proposed capacity as an initial management action. Capacity management is an important tool in managing recreational impacts.

Alternative F stands out among alternatives because of its much higher proposed planned capacity of 2580 PAOT. It would be much more challenging to manage for unplanned disturbance under this alternative in which planned visitor capacities would be roughly tripled over the existing conditions of roughly 810 PAOT. Although there are designated creek access trails in this alternative and camping within the Aquatic Management Zone is prohibited, disturbance to banks and floodplain riparian areas is likely to increase as increased numbers of users look for space in which to recreate along the creek.

The popular recreational activity of swimming can have impacts on water quality through the resuspension of bottom sediments that may act as reservoirs for bacteria (OCWC 2012). Though correlating the number of recreational users of a recreational water to fecal bacteria indicators such as *E. coli* has proved elusive (ADEQ 1999), it stands to reason that more people swimming or wading in a water body would cause more resuspension of bottom sediments. Assuming this sediment harbors *E. coli*, then alternative F could lead to more instances of the violation of state water quality standards for *E. coli*. Additionally, the resuspension of bottom sediments would increase suspended sediment concentrations thus increasing stream turbidity at and downstream of recreation sites where swimming and wading occur. The distance downstream where impacts would occur is a function of many variables including but not limited to the bottom sediment particle sizes (i.e., nature of stream substrate), water velocity, and type and persistence of activity causing suspension of bottom sediments. One study found that turbidity levels downstream of four unimproved motorized road crossings (stream fords) followed a decay curve in which turbidity declined to about 90% of the peak value at a distance of roughly 1000 feet downstream of the last ford (Clarkin et al. 2006). Swimming is unlikely to impact the stream bottom in the same way as motor vehicles but information about the persistence of turbidity below swimming and/or wading sites is lacking. The author has noted that swimming in Fossil Creek causes suspension of fine calcium carbonate particles in the water column at least in the vicinity of the activity. The persistence of these particles in suspension and the distance downstream over which water clarity may be impacted is not known.

Soils

General effects to soils from all action alternatives include exposure of bare mineral soil, compaction, and loss of soil organic matter at developed and dispersed recreation sites including trails, parking areas, dispersed recreation areas, and the road system. The extent to which this exposure causes accelerated soil erosion, defined as erosion exceeding natural rates of erosion under the potential plant community, depends on such factors as inherent properties of the soils, rainfall intensity, slope, and connectedness of bare areas. Connected bare areas oriented downslope are most likely to result in accelerated erosion when rain intensity exceeds the soil's ability to infiltrate water. An example of this would be a social trail oriented parallel to the fall line of a slope. Soils in system trails generally do not erode at an accelerated rate if trail drainage features such as lead out ditches are adequately maintained and trails are constructed to Forest Service standards, which specify such attributes as maximum slopes, and outsloping and frequent grade changes of the trail surface to achieve positive drainage. Compaction of the soil is also expected to occur under all alternatives to varying degrees depending on the extent and type of disturbance as well as the type of soil. Compaction of soils is most likely to be greatest in system roads and parking areas owing to the pressure exerted on the soil by the passage of motor vehicles. In an otherwise undisturbed forest setting, storm runoff is often confined to the road system because of soil compaction as well as the exposure of bare mineral soil on road surfaces. Compaction by human trampling would also occur in areas of

human use such as trails and dispersed recreation sites. Compaction alters the ability of the soil to infiltrate water and exchange gases with the atmosphere. The amount of disturbance, however, is not predicted to negatively impact the inherent productivity of soils within the Fossil Creek WSR corridor.

The action alternatives propose to rehabilitate disturbed soils at unneeded campsites, pullouts, parking areas, spur roads and unauthorized trails accessing Fossil Creek. This is anticipated to locally improve soil conditions in these disturbed areas. Proposed rehabilitation by alternative is summarized in table 3-19. The slight difference in restored area between alternatives has to do with differences in recreation site access among alternatives. Alternative D provides for the greatest area of soil rehabilitation because it limits access to recreational areas that would then be rehabilitated. A more thorough description of disturbance by alternative is provided in Direct and Indirect Effects Specific to Action Alternatives.

Table 3-19: Summary of Disturbed Acres in the Project Area by Veg Type and Alternative

Alternative	Alt A (No Action)	Alt B	Alt C	Alt D	Alt E	Alt F
Total Acres disturbed	152	120	107	102	141	135
Total Acres Restored	0	41.2	43.7	46.4	40.6	40.05

Air Quality

Areas of construction result in soil disturbance. There would be the potential for localized areas of airborne dust generated in the vicinity of areas of construction. The dust generated would result in a short term impact to air quality, increasing levels of particulate matter. Dust generated from construction activities would be controlled and minimized using BMPs. All of the action alternatives as well as the no action alternative meet forest plan standards and guidelines in regards to air quality because of the application of best management practices (BMPs).

Traffic congestion and associated air pollutant emissions and dust could approximate current congestion during peak periods. Increases in visitation during peak periods could also occur, and to the degree that such increases do happen, traffic congestion and air pollutant emissions would marginally increase. These local mobile sources would continue to include automobiles and trucks and would remain subject to state and federal emissions control standards and programs.

Under all alternatives air quality is expected to remain in attainment and implementing the alternatives would have no permanent adverse effect on air quality. The inclusion of construction BMPs is further expected to minimize disturbance to particulate matter. As a result, Class I air quality and Class II air quality is expected to be maintained in the Mazatzal and Fossil Creek wilderness areas. Implementing the action alternatives with the stated BMPs in addition to existing and foreseeable future projects are not expected to violate National Ambient Air Quality Standards (NAAQS) PM 10 standards in the Mazatzal and Fossil Creek Airsheds and the NAAQS are being met and would continue to be met under the action alternatives as well as the No Action Alternative. The FS is anticipated to continue to participate in regional efforts to monitor air quality throughout Fossil Creek.

Programmatic Actions for Action Alternatives

Programmatic actions common to all action alternatives include a CRMP and adjustment of the Fossil Springs botanical area. The CRMP lays out desired conditions, standards, guidelines, objectives, and management approaches for Fossil Creek WSR river values and other resources and uses occurring in the area. The comprehensive river management provides management direction to fully protect water quality, free-flowing condition and its outstandingly remarkable values.

Implementation of the CRMP under the action alternatives, including direction in the CRMP related to management direction, monitoring, adaptive management, education, interpretation, research, refugia, and mineral and water rights, will have an overall positive effect on soil and water resources in comparison to the no action

alternative. Soil and water resource-specific desired conditions outlined in the CRMP strive toward protecting and maintaining free flow, water quality and other soil and water resources. Standards in the management direction require protection of river values, of which soil and water resources are a component. Soil and water resource guidelines ensure desired conditions are maintained in the Fossil WSR corridor. Soil and water objectives can be utilized to monitor and manage for an improved trend in all soil and water resource values.

The guidance specific to soil and water resources will provide a long-term benefit to the Fossil WSR corridor. As a result, CRMP guidance will result in the protection and enhancement of the free flow and other river values including water quality.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Cumulative Effects for all Alternatives – Water Quantity, Water Quality, and Riparian Area Function

This cumulative effects analysis focuses on those activities that overlap in time and space in such a way as to alter hydrologic response at the watershed scale. The resource areas of water quantity, water quality, and riparian function are analyzed together because of their interconnectedness. Hydrologic response refers to the response of the drainage area to precipitation events in terms of timing, quantity, and quality of runoff.

Numerous land management activities are conducted by the U.S. Forest Service, its contractors and permittees, and the public on lands managed under the public domain by this agency including but not limited to prescribed fire, management and suppression of wildfires, road and trail maintenance, new trail construction, mechanical thinning, and livestock grazing. Many other activities occur on public lands as authorized under various permits including construction and operation of telecommunication sites and other telecommunications-related infrastructure, construction and maintenance of electric utility and water infrastructure, and fuelwood harvesting to name a few. Appendix B of the EIS provides a description of past, present, and reasonably foreseeable future actions within the four 6th Code watersheds (Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek) of the Coconino and Tonto national forests considered in the cumulative effects analysis for the Fossil Creek Wild and Scenic River Comprehensive River Management Plan. Future actions of the CRMP will be consistent with the Land and Resource Management Plans for the Coconino and Tonto national forests.

In the absence of obstructions (e.g., dams) or flow diversions, human alterations to the hydrologic response of a watershed are usually caused by activities that change the type and distribution of land cover. These alterations can effect channel morphology, water quality, and peak flow with important implications for downstream ecosystems such as riparian areas which function within a certain flow regime.

The roughly 89,000 acre Fossil Creek drainage exists in a relatively undisturbed state with approximately 37% of the drainage area encompassing designated and recommended wilderness and inventoried roadless areas. The two primary land uses within the Fossil Creek drainage include recreation and livestock grazing. Recreation is primarily concentrated along the Fossil Creek WSR corridor and is largely associated with the current analysis of alternatives. Residential/commercial development on private property within the drainage area is confined to the unincorporated community of Strawberry; roughly 1,800 acres are privately owned with the remainder under the management of the U.S. Forest Service, Coconino and Tonto National Forests. Private development in Strawberry is within the Hardscrabble Creek watershed, the outlet of which is located roughly 1 mile upstream of the Fossil Creek/Verde River confluence. Because of the limited area and location of private development, the impacts of this development to the overall hydrologic response of the Fossil Creek drainage area are negligible.

The Coconino National Forest signed a record of decision (ROD) in September, 2011, implementing new travel management rules as required under the 2005 Federal travel management regulations (Travel Management Rule

or TMR) (USDA Forest Service 2011). Under these new rules, off-road vehicle access is restricted to designated routes and areas, and undesignated areas are prohibited for public motor vehicle use. The Tonto National Forest is finalizing a Travel Management Rule Environmental Impact Statement that is expected to result in a system of designated roads, trails, and areas that will more closely coincide with limitations and approved uses currently in place on the Coconino National Forest. The current total footprint of roads within the Fossil Creek drainage is estimated to be 365 acres or roughly 0.4% of the total drainage area. Of this area, only about 231 acres are associated with roads open to the public whereas the remainder are associated with roads that are decommissioned, in long term storage, or use is limited to Forest Service administrative purposes only. Of the total road area within the Fossil Creek drainage, only about 56 acres is within 200' of a stream. Research indicates that road drainage culverts (i.e., cross-drains) that discharge to the forest floor more than 200' from a stream do not deliver sediment to that stream (Washington Department of Resources 2007). Roads that are known to introduce sediment to Fossil Creek include segments of Forest Roads 502 and 708. Segments of these roads either drain directly to Fossil Creek or have drainage features (cross drains or lead out ditches) that convey runoff and sediment to Fossil Creek by virtue of their proximity to the creek and/or lack of an adequate buffer between the road prism and creek. The input of sediment from these roads is likely to be a small portion of the total sediment transported to Fossil Creek during a storm event, however; this sediment input could be minimized through management action whereas sediment derived from the larger watershed during a storm event is beyond management control.

Grazing has occurred on allotments within the Fossil Creek drainage in the past and will continue to occur in the future. The Ike's Backbone Allotment has recently been closed within the Fossil Creek drainage area. In addition, the Deadman Mesa Allotment on the Tonto National Forest, which occurs along the majority of the perennial section of Fossil Creek on the Tonto side, has been vacant for 19 years and there are no foreseeable plans to reauthorize livestock grazing at this time. Five other allotments occur in the Fossil Creek drainage area. Livestock grazing on these allotments is managed and monitored to ensure livestock use levels stay within allowable intensities and utilizations so there are no adverse effects to vegetative ground cover. The establishment of use levels protective of vegetative ground cover insures that grazing would not alter the hydrologic response of the drainage area. Because there are no riparian pastures along Fossil Creek, grazing will not have direct effects on water quality and riparian function.

To restore forest resiliency and ecosystem function in ponderosa pine forests across four national forests in Arizona, a variety of actions are described in a June 2016 scoping letter titled *4FRI Rim Country Project Proposed Action*. Vegetation treatments, incorporating proposed thinning and fire hazard mitigation, and grassland and meadow restoration (that includes prescribed burning), would be likely to occur within the Upper Fossil Creek and Hardscrabble Creek 6th Code watersheds; however, no burning actions are expected to occur within the next five years. Mechanical thinning activities would produce a short-term disturbance to vegetative ground cover through the creation of landings, skid trails, and temporary roads. Establishment of aquatic management zones around active stream channels would prevent establishment of landings, main skid trails, and temporary roads in the near stream environment. Thinning would benefit the Fossil Creek drainage area by reducing the risk of uncharacteristic fire in those areas where tree densities exceed pre-settlement conditions (i.e, conditions under which frequent fire maintained open canopy conditions and stand-replacing crown fires were not likely to occur).

There have been a number of studies of the hydrogeology of areas within the Mogollon Rim highlands, which includes Fossil Creek. These studies have been motivated by the need to improve an understanding of the regional groundwater system that has been virtually the only source of water to the communities of Pine, Strawberry, and Payson that lie within the Mogollon Highlands area (Parker et al. 2004). These studies provide some sense of the vulnerability of Fossil Springs to the ongoing use of groundwater in the region.

One of the more focused studies concerning the hydrogeology of Fossil Springs was conducted by Green (2008). The author concluded that the source of water discharging at Fossil Springs is the regional limestone aquifer. This aquifer consists of portions of the Martin Formation, Redwall Limestone, and possibly Naco Formation (Parker et al. 2004). Groundwater moving through the regional limestone aquifer is directed to Fossil Springs by a series of northeast-striking faults and forced to the surface where groundwater encounters the Diamond Rim fault, which

acts as a barrier to flow (Green 2008). Where erosion or faulting hasn't removed or displaced overlying strata, the regional limestone aquifer is overlain by the regional "C" aquifer which includes all or portions of the Kaibab Formation, Toroweap Formation, Coconino Sandstone, Schnebly Hill Formation, and Upper and Middle Supai Formation (Bills and Flynn 2002). Recharge of the regional limestone aquifer is primarily through vertical movement of groundwater originating in the overlying C aquifer whereas the C aquifer is recharged through precipitation occurring over a narrow recharge zone along the Mogollon Rim (Parker et al. 2004).

In writing about the hydrogeology of the Coconino Plateau, Bills and Flynn (2004) had this to say about groundwater flow: "The flow characteristics of the regional aquifer are poorly understood because the aquifer is deeply buried, which limits exploratory drilling and testing, and because the geologic structure, which controls the occurrence and movement of ground water, is complex." This is certainly the case regarding groundwater movement in the area of Fossil Creek where flow is largely controlled by large-scale fracture and fault systems or by karst features in carbonate rocks (Parker et al. 2004; Green 2008). The occurrence of large openings that convey groundwater through the carbonate rocks of the regional limestone aquifer was readily apparent when an exploratory borehole was drilled starting in May 2000 near the Fossil Springs trailhead west of Strawberry (Corkhill 2000). Numerous cavities and fractures were encountered below a depth of 980 feet below ground surface (BGS) resulting in loss of drilling fluids and suspension of drilling operations when a large fluid loss occurred at a depth of 1,461 feet BGS (Corkhill 2000). Drilling was eventually resumed with a total borehole depth of 1,872 feet BGS placing the bottom of the borehole at roughly the elevation of Fossil Springs. Although a shallow groundwater zone was encountered at about 170 feet BGS, regional groundwater associated with the limestone aquifer was not encountered until a depth of about 1,380 feet BGS.

Drilling of the aforementioned borehole was done under the supervision and oversight of the Northern Gila County Water Plan Alliance (NGCWPA), a group which formed to address the need for a more reliable water supply for northern Gila County, with U.S. Bureau of Reclamation personnel serving as site geologists and technical advice provided by Arizona Department of Water Resources (ADWR) (Corkhill 2000). The communities of Pine and Strawberry have experienced historic water shortages with existing groundwater derived largely from water-bearing units within the Schnebly Hill Formation and Supai strata (Parker et al. 2004). These water shortages highlight the inadequacy of existing groundwater resources let alone future demand for water projected to increase from an estimated 298 acre-feet/year in 2002 to an estimated 1,947 acre-feet/year in 2040 (BOR 2008). The town of Payson and nearby communities have undertaken a multi-decade effort to develop the infrastructure to convey and treat surface water from the C.C. Cragin reservoir. A similar water supply is not currently available for the communities of Pine and Strawberry and various alternatives have been considered including development of a deep production well that would draw groundwater from the regional limestone aquifer potentially causing impacts to streams and springs including Fossil Springs (BOR 2008). At this time, groundwater use from the portion of the regional limestone aquifer that supports perennial flow in Fossil Creek is extremely limited or absent. Development of a production well in the vicinity of the deep exploratory borehole that was drilled under the supervision and oversight of the NGCWPA would likely impact discharge at Fossil Springs since groundwater would be withdrawn from the same regional limestone aquifer that supports springs discharge and groundwater extraction would be in close proximity to Fossil Springs.

Summary

Cumulatively, the implementation of the different action alternatives when combined with past, present and future actions in the Fossil Creek, would not result in adverse effects to the outstandingly remarkable values associated with Fossil Wild and Scenic River. In particular, the hydrologic response of the drainage area defined in terms of the timing, quality, and quantity of runoff would not be altered. This, in turn, would not result in adverse effects to riparian function, water quantity, and water quality.

Cumulative Effects for all Alternatives – Soils

Within the project area, effects to soils are mainly attributed to recreation including the roads that provide access to recreation areas. Recreation within the project area is largely confined to those areas previously identified under the alternatives. It is not anticipated that any other management actions by the Forest Service or other

entities would affect soils in the project area. There are no recent past or future actions that cumulatively effect soil in the project area. Soil disturbance currently in the project area would continue as is under the no action alternative without any emphasis and decision authority to actively rehabilitate disturbed areas. Under the various action alternatives, unplanned soil disturbance, such as is associated with social trails, would be addressed through active rehabilitation which could include reshaping to improve drainage in areas of unplanned disturbance, soil scarification, seeding, and mulching. Areas of planned disturbance such as designated parking areas would include the use of BMPs to limit negative impacts to soils such as accelerated erosion.

Summary of Environmental Effects

Table 2-5 provides a summary of the effects (direct and indirect) of all alternatives to free flow, water quantity, water quality, soil condition, riparian function, and air quality. From the perspective all free flow and water quantity, there is no difference among alternatives. All alternatives are protective of free flow and water quantity. From a water quality perspective, only alternative B includes enough toilet facilities to meet the toilet provisions of 35 PAOT/toilet as recommended in FSH 2903.13. These recommendations, however; apply to developed recreation sites. Much of the recreational use within the Fossil Creek WSR would be within dispersed areas for which these recommendations do not apply. Alternative F has the highest ratio of PAOT per toilet facility suggesting that instances of unplanned waste deposition that could impact water quality would be greatest under this alternative. One measure of riparian function is bank stability. Bank stability is a function of the percentage of stabilizing bank cover including riparian plants, anchored or large rock, and anchored wood. Other than flood events, disturbance from recreation adjacent to bank streams is the only activity likely to reduce the vegetative component of stabilizing bank cover. In the absence of site specific information, it has been determined that a minimum of 70% stabilizing cover along stream banks is necessary to maintain stream bank stability on a reach-by-reach basis (Dickard, et. al., 2015). Recreation sites are adjacent to no more than 10% of the total length of the perennial section of Fossil Creek under any alternative.

Both soil condition and air quality are related to disturbance as disturbance can expose bare mineral soil leading to accelerated erosion and dust emissions. Alternative E has the least amount of soil disturbance whereas alternative B has the least amount of new disturbance from expansion of recreational infrastructure, the latter of which is most likely to increase fugitive dust emissions.

Geology

This section focuses on the dynamic geologic processes that affect a travertine system within the Fossil Creek WSR corridor, and the geologic hazards and mineral potential within the larger watersheds to assist in the establishment of management directions and site-specific improvements for protecting and enhancing river values of Fossil Creek.

The presence, extent, and high deposition rate of calcium carbonate that forms travertine in Fossil Creek are the key elements of Fossil Creek's Geology ORV. In particular, the formation of travertine dams in certain reaches of Fossil Creek contributes to an extraordinary stream channel morphology, creating a complex aquatic habitat. Impacts due to visitor use to these dams, such as persistent notching and scraping from repeated boat passage or trampling of algae associated with the deposition of travertine on dam crests, may alter the flow of water and indirectly affect travertine deposition, dam formation, and aquatic habitat.

Prior to restoration of full flows in 2005, Fossil Creek was a highly impacted environment for almost 100 years due to the presence of a diversion and transport system for hydro-electric power generating facilities at Irving and Childs. Public recognition of a travertine system at Fossil Creek became evident when small flows were released at the Irving hydroelectric generating facility due to diminished water transport capacity between Irving and Childs hydroelectric facilities. With restoration of full flows, travertine dams began to quickly form. The development of these travertine dams and clear pools created a new and popular recreational opportunity.

Methodology

The Geology ORV analysis includes examination of scientific literature, geologic maps on hazards and mineral resources of the area, and field reconnaissance to determine where travertine dam forming deposition is occurring in the corridor and how management and recreational activities affect these structures.

The effects analysis discusses the different components of management activities (programmatic management direction, design features, monitoring, adaptive management and amendments to both forest plans), the acres disturbed by construction of infrastructure within recreation development areas, the acreage affected by roads and trails, the acres designated for visitor access, and the level of visitor use allowed in the recreation reach of Fossil Creek.

Information Sources

- Geochemical literature on calcium carbonate deposition in natural waters
- Kinetics of deposition forming travertine dams and structures in streams
- Regional stratigraphy and geology of Colorado Plateau, Transition Zone, and Basin and Range provenances
- Research specific to Fossil Creek travertine system
- Geologic and mineral maps of central Arizona
- Report of geologic hazards and slope stability

Analysis Indicators and Measures

The following indicators and measures include physical disturbance by visitor use such as kayaking or trampling of travertine dams and structures, potential landslides and rockfall along travel or stream corridors, and potential for mining activities along the stream corridor or the contributing watersheds (table 3-20).

Table 3-20. Indicators and measures used in the analysis

Resource Element	Resource Indicator	Measure
Geology	Travertine disturbance to relict and contemporary travertine deposits within the stream corridor.	Narrative description of management direction and actions that may affect travertine system of deposition and destruction.
Geology	Geologic hazards such as landslide and rockfall	Narrative description of programmatic management direction and actions to mitigate hazards due to landslides and rockfall.
Geology	Mining exploration or extraction within the Fossil Creek WSR corridor	Protections under the Wild and Scenic Rivers Act
Geology	Mining exploration or extraction within the Fossil Creek watersheds	Administrative withdrawals that could affect Fossil Creek ORVs

Area of Analysis

The analysis of geological resources (travertine), geological hazards and minerals is conducted at two spatial scales, the project area and the watershed. The project area is that described in the *Affected Environment Common to All Resources* section above. The effects to travertine formations within the recreational segment of Fossil Creek WSR corridor are considered on an annual basis. Within each year travertine formations can be negatively affected by physical impacts from visitor use or erosive flood events, yet the rapid depositional potential of travertine within the recreational segment allows repair and reconstruction to also occur. The zone of active travertine dam formation can also be altered from year to year depending on changes in turbulence due to altered channel morphology or addition of large debris with the greatest affect following large flood events.

The watershed scale of analysis includes the entire watershed area of four subwatersheds (sixth code or HUC6 watersheds) listed below. The effect of landslides, rockfall, or other mass wasting events within the watershed scale on the geology resource will be analyzed over a 5-10 year period. Mass wasting events that happen within the river corridor could permanently alter the channel morphology and ultimately travertine dynamics. Mass wasting events within the larger watershed scale may not impact the geology resources, but could alter recreational opportunities if they cause impacts to roads or trails.

Affected Environment

One of several Verde River tributaries, Fossil Creek originates in central Arizona forming the boundary between the Coconino and Tonto National Forests. It is located between West Clear Creek and the East Verde River along the Mogollon Rim on the southern margin of the Colorado Plateau (Figure 3-7.). The Transition Zone, lying between the Colorado Plateau and the Basin and Range, is approximately 62 miles wide comprised of Tertiary volcanic and sedimentary rocks overlying Proterozoic basement and Paleozoic strata to the north (Leighty 1998). Erosion of the dominant flat-lying volcanic and sedimentary geologic units has created the mesa/canyon morphological setting so prominent in this boundary area.

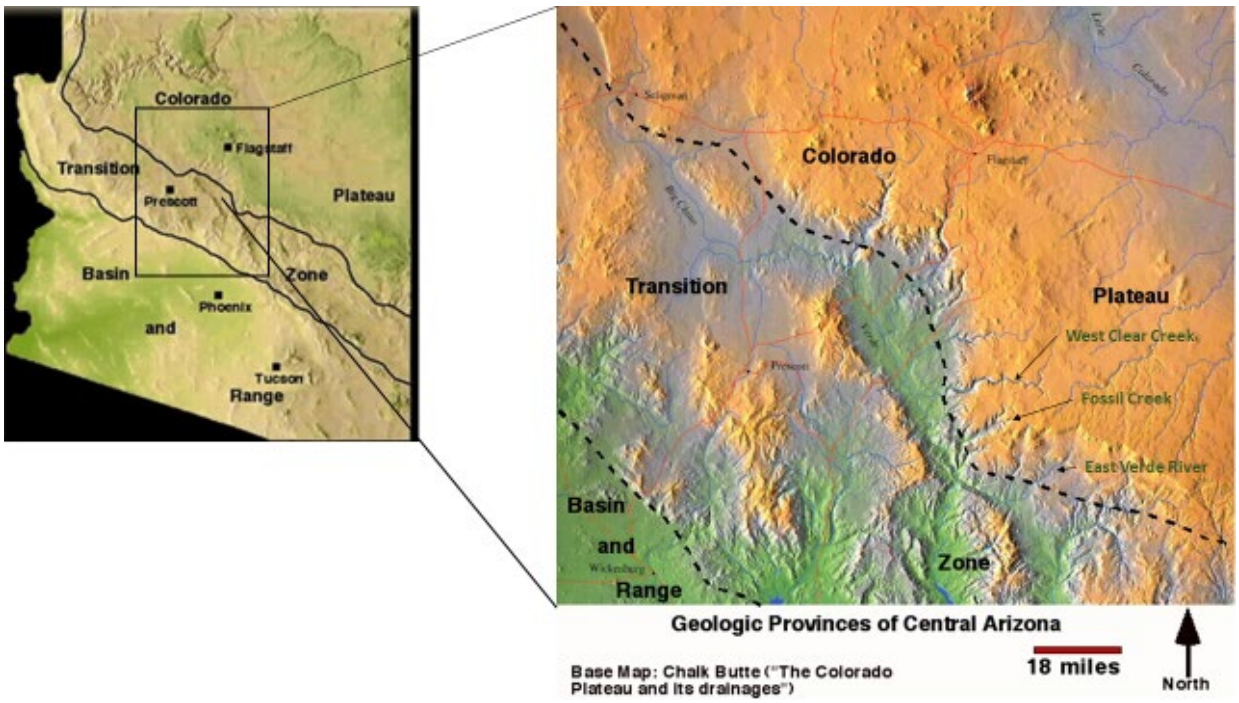


Figure 3-7. Location of Fossil Creek in Arizona's geological provinces

Bedrock Stratigraphy

Sedimentary strata of the Fossil Creek WSR corridor and the Fossil Creek watershed are from the Paleozoic era ranging in age from Mississippian (359-323 million years ago) to Permian (299-252 million years ago) and are classified as: limestones, redbeds (mudstone, siltstone, shale, sandstone and conglomerate), and aeolian to coastal dune sandstones. The various sedimentary formations are bounded by regional unconformities, time gaps in the rock record created by erosion. Cenozoic volcanics and sediments including relatively recent Tertiary basalt flows, volcanic ash flow tuffs and older and younger gravel deposits of Paleocene to Miocene age (66-23 Ma) overlay the Paleozoic sedimentary rocks (Twenter 1962). The large gap between the Paleozoic and Cenozoic strata represents the major erosional period known as the Great Unconformity. Surficial deposits include Quaternary age (2.6 Ma-present) travertine deposits, landslide and colluvial deposits and alluvium (Blakey 1990, Cook et al. 2010, Weir et al. 1983, Weir and Beard 1984).

The combined thickness of the Paleozoic and Cenozoic rocks is more than 3,000 feet. To the northwest of Fossil Creek, on the Colorado Plateau, the volcanic rocks are tens to a few hundred feet thick. South of Fossil Springs

the volcanic rocks thicken to more than 2,000 feet bounded against an ancestral Mogollon Rim that was cut into the Paleozoic section by erosion before the volcanoes erupted. A basalt flow at an elevation of 1250 ft above the floor of the Fossil Creek canyon has an approximate age of 10 Ma, which provides a minimum age for the formation of the ancestral Mogollon Rim and deposition of the rim gravels. The Paleozoic rocks dip at a low angle toward the north or northeast. The Fossil Creek area is broken into several fault blocks that are high angle normal faults which have displacements from 50 to 400 feet. The strata within the fault blocks dip westerly or southerly. Most of the faults cut both the Paleozoic and Tertiary basalt rocks so that they are relatively young, approximately 10 million years or younger (Weir and Beard 1984). Fossil Springs emanates from the "lower Limestone Aquifer" and the junction of the Fossil Springs Fault zone and the Diamond Rim Fault Zone (figure 3-8).

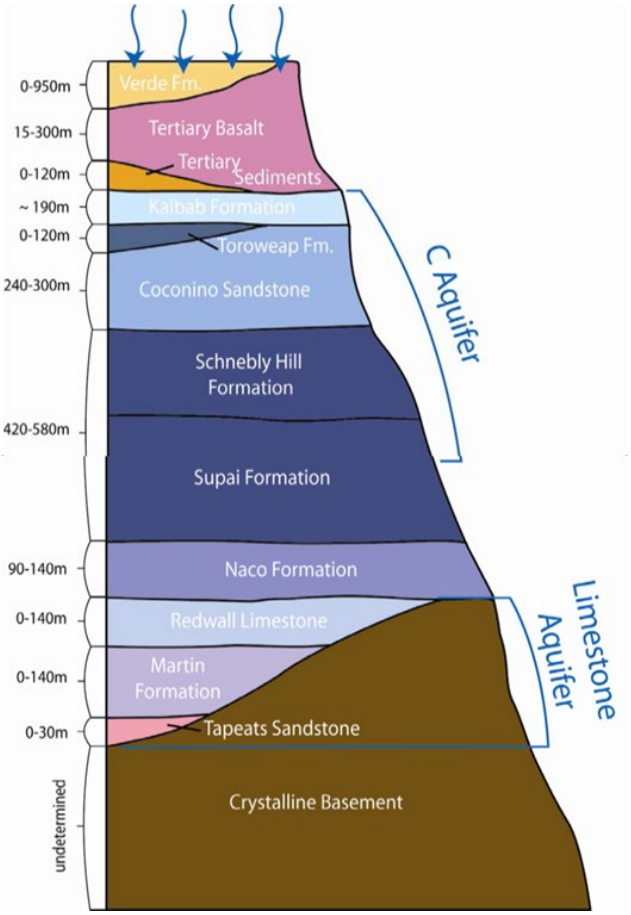


Figure 3-8. Bedrock stratigraphy in the Fossil Creek area (Green 2008)

Surficial Geology

The surficial deposits along Fossil Creek were recently mapped by geologists from the Arizona Geologic Survey (Cook et al. 2010). Their report and geologic map are part of a study of five large tributaries into the Verde River: Oak Creek, Wet Beaver Creek, West Clear Creek, Fossil Creek and the East Verde River. The purpose of the study was to provide detailed geologic information to the Arizona Department of Water Resources to delineate subflow zones in the Verde River watershed and to map channel alluvium and over bank floodplain deposits. Subflow is the legal definition defined as "waters which slowly find their way through the sand and gravel constituting the bed of the stream, or the lands under or immediately adjacent to the stream and are themselves a part of the surface stream…water contained within the saturated floodplain Holocene alluvium (AZ Supreme Court legal decision 1931)".

The bed elevation of Fossil Creek ranges from 4,573 feet above sea level (asl) at the confluence of Calf Pen and Sandrock Canyon to 2,546 feet asl at the Verde River confluence. The total length of the channel is approximately

17 miles. The headwaters of Fossil Creek are bound by Permian and Pennsylvanian sedimentary rocks, which includes the Mississippian Redwall Limestone, Pennsylvanian Naco Formation, Pennsylvanian/Permian Supai Formation, Permian Schnebly Hill Formation, Coconino Sandstone and Permian Kaibab Formation (Blakey 1990). Similar to the canyons to the north such as West Clear Creek, upper Fossil Creek is very narrow, yet is less dramatically incised. Bedrock walls are more gently sloping and slot canyon reaches are uncommon. The canyon bottom and associated Holocene river deposits in the upper canyon rarely exceed 328 ft across. Upstream of Fossil Springs, the channel is dry except during monsoonal and winter storms and a brief spring snow-melt (figure 3-9).



Figure 3-9. Stream channel above Fossil Springs (photo courtesy Cook et al. 2010).

Fossil Springs consists of several vents along a 200 m reach of Fossil Creek, at or near channel level (Feth and Hem 1962). It is the largest concentration of spring-water discharge in the Mogollon Rim region. Perennial flow in Fossil Creek is derived from discharge emanating from Fossil Springs (figure 3-10). Flow beginning at the springs alters Fossil Creek from an ephemeral to permanent drainage, and creates a more sinuous morphological structure. The most recent terraces of Pleistocene to Holocene age are generally preserved on inside channel bends, yet on the north side of the canyon, an extensive (over 1969 ft across) early to middle Pleistocene river terrace is preserved (figure 3-11). This is the oldest of the relict terraces within Fossil Creek and the only such terrace in the canyon. This relict travertine dam is located several hundred feet above the current channel signifying that Fossil Creek has been incising into bedrock since the Pleistocene epoch. The smaller more numerous terraces of this age are located closer to the modern creek elevation within the canyon walls. On the photo below, the outline locates the Pleistocene travertine river terrace, as the photo looks north to the junction of Calf Pen and Sandrock Canyon.

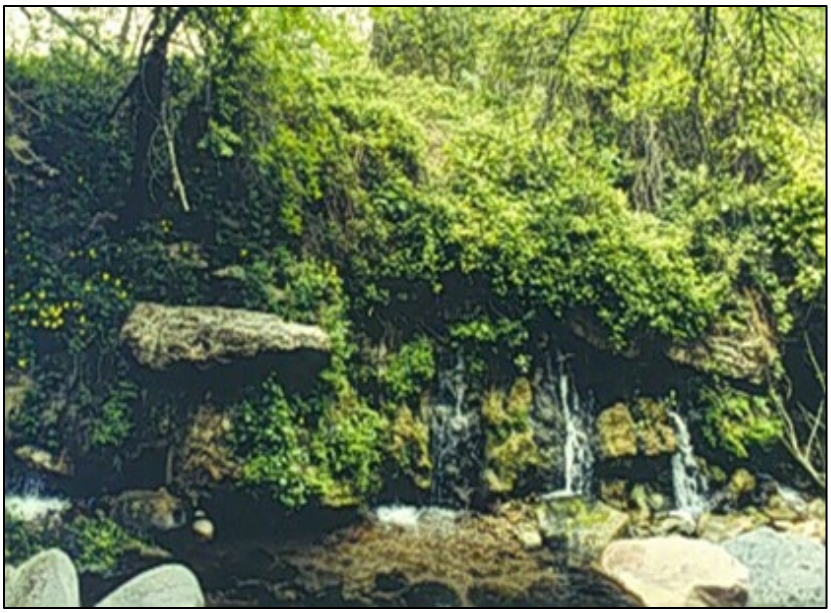


Figure 3-10. Fossil Springs (photo courtesy of S.T. Overby, 1999)

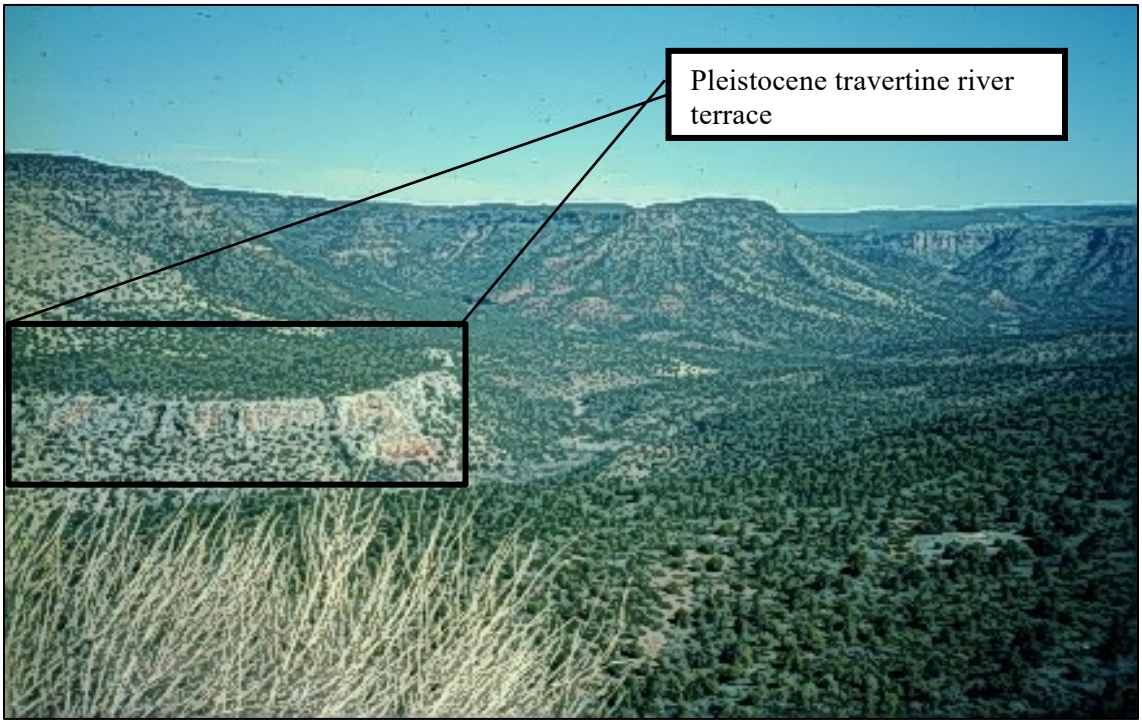


Figure 3-11. Pleistocene travertine bench above Fossil Springs (photo courtesy of S.T. Overby, 1999)

From the Fossil Springs diversion dam that was lowered, to the confluence with the Verde River, Fossil Creek is entirely bound by Tertiary basalts. In this stretch some travertine-coated waterfalls with deep plunge pools are encountered. Below the old Irving power plant extensive Holocene to latest Pleistocene river terraces are preserved in a brief wider section of the canyon. Just downstream, Fossil Creek abruptly narrows at a southward bend on the east side of Ike's Backbone, a formidable N-S trending basalt ridge separating Fossil Creek from the Verde River. Narrow Pleistocene river terraces are perched on basalt benches along this stretch of Fossil Creek. The canyon bottom remains narrow and extremely large boulders choke the channel, creating numerous rapids. The canyon floor is alternately composed of scoured bedrock, deep pools, or covered by extensive cobble to boulder bars. Hardscrabble Creek joins Fossil Creek from the east, creating a large side canyon. At the confluence

with the Verde River, numerous Pleistocene age alluvial deposits are inset into the basalt walls on the south side of the canyon (figure 3-12).

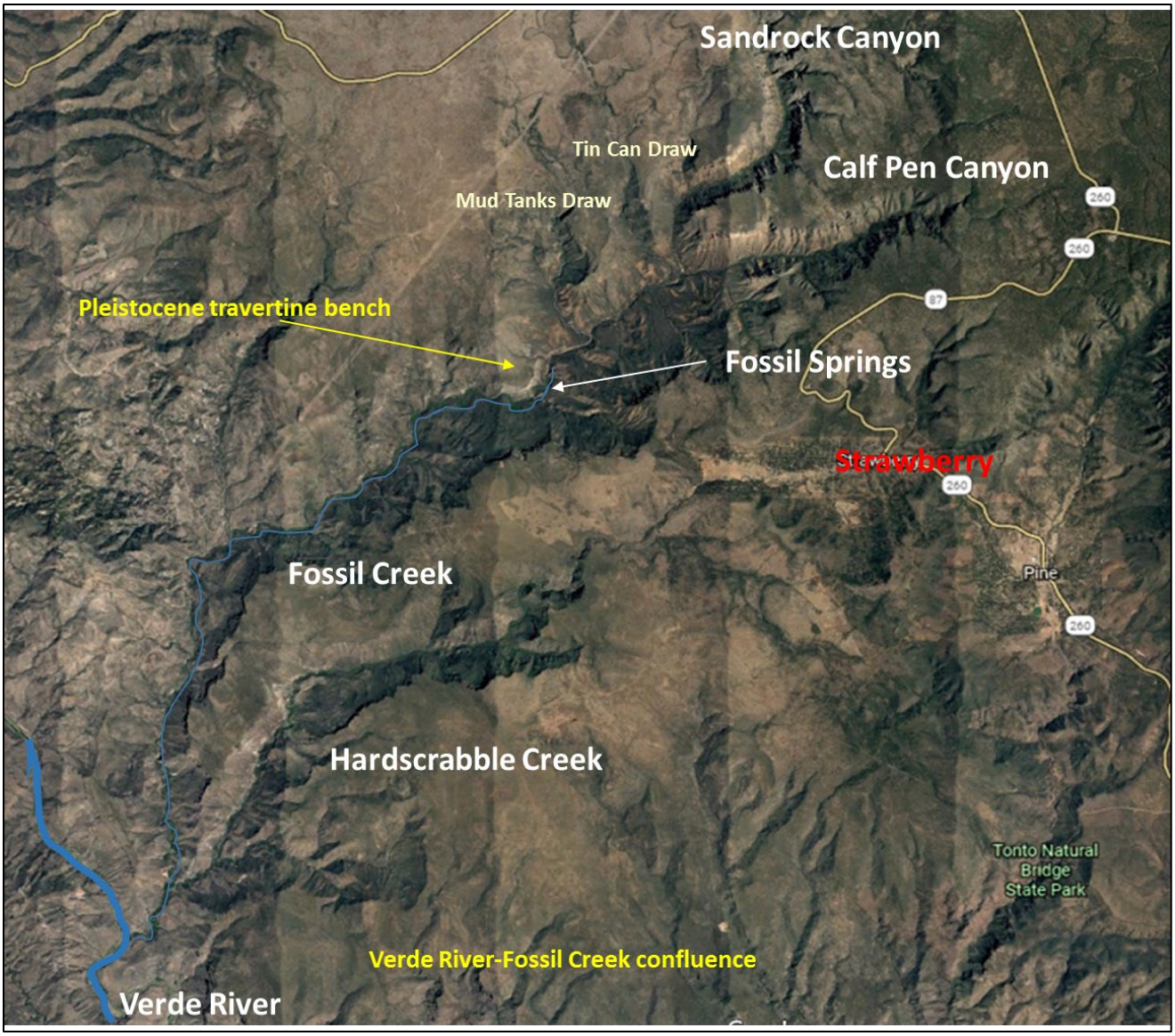


Figure 3-12. Fossil Creek and associated canyons

Landslide and Slope Stability Hazards

During field visit in 2014, Stephen Romero (PE, USDA Forest Service) noted many jointed, loose rocks and rockfalls including large talus piles from landslides. Landslides or mass wasting describes a wide variety of processes that result in the downward and outward movement of rock, soil, and detritus driven by gravity (figure 3-13). These materials may move by falling, toppling, sliding, spreading, or flowing down slopes and channels. Numerous Pleistocene age landslides have been documented in the Fossil Creek watershed (Weir and Beard 1984). These range from fast-moving debris flows, rockfall, and slow-moving creep to larger volume rotational landslides and debris avalanches and smaller volume earthflow. Landslides are typically associated with steep terrain, but can occur in low relief areas. Landslides are often initiated by heavy rain and rapid snow melt, yet earthquakes, volcanic eruptions, and freeze and thaw cycle can also trigger these events. Channelized debris-flows following intense rainfall are also common in Arizona's mountains and have been correlated with mass wasting events (Krautblatter and Moser 2009). The largest rainfall events typically occur during the “monsoonal” season (July-September), which is also the peak visitor time at Fossil Creek.



Figure 3-13. Landslide above Fossil Creek in central Arizona (courtesy of Mike Conway, 2016).

Due to landslides and rockfalls, the road (FR 708) that accesses Fossil Creek and the former Irving hydropower generation station from Strawberry, AZ has often been closed (SHB Geotechnical Engineering 1988). A Forest Service gate located approximately 5 miles west of Strawberry serves as a control point just past the Bear Trail (Fossil Springs) trailhead. The section of road (~4 miles) just past the control gate as the road enters into Fossil Creek canyon is at greatest risk from geologic hazards (USDA 2014). Romero (USDA 2014) noted "many jointed, loose rocks along the road" along with rockfalls and large talus piles (figure 3-14). Little opportunity exists to mitigate these hazards located immediately adjacent to the road.



Figure 3-14. Red highlights indicate areas of recent rockfall, rock avalanche, and debris flow activity (coutesy Stephen Romero, P.E. US Forest Service).

Faulting and Seismicity

Paleozoic tectonic activity in Arizona consisted of the Kaibab and Defiance uplifts that covered very large areas. Little activity occurred during the Mesozoic era, but by the late Cretaceous to early Tertiary the subduction of the Farallon Plate under North America lifted the Basin and Range and Transition Zone relative to the Colorado Plateau during the Laramide Orogeny (Dickenson et al. 1988). As subduction waned extensional tectonics in central Arizona dominated (Spencer and Reynolds 1989). The Mogollon rim scarp was formed and started to retreat at 30 Ma (Mayer, 1979) as a result of movement along the Diamond Rim Fault. Miocene volcanism along with extensional faulting thinned the Transition Zone crust along with regional subsidence. Tertiary extensional faulting, Diamond Rim and Verde Faults (Geaeorama Inc. 2006), result in the present day geologic structures of Transitions Zone in central Arizona (Reynolds et al. 2001, Green 2008)

The Diamond Rim fault represents the physical break that defines the structural edge of the Colorado Plateau, resulting in the Little Diamond Rim, a prominent ridge just a few miles south of the edge of the much larger Mogollon Rim. The Diamond Rim fault system has resulted in the displacement of large blocks of Paleozoic strata down towards the south in the areas of Fossil Springs, Hardscrabble Mesa, Tonto Natural Bridge, and south of Beaver Valley. This regionally extensive fault system cuts across most of central Arizona greatly influencing the region's hydrogeology, particularly with regard to Fossil Springs. The offset along the Diamond Rim fault in the vicinity of Fossil Springs is estimated to be 2,000 feet. The interaction between the Diamond Rim Fault with the Fossil Springs Fault may have been instrumental in the formation and evolution of Fossil Springs. (USDI 2008).

Mineral Resource Potential

The Fossil Springs Roadless area was investigated for mineral resources in 1980-1981 (Weir et al. 1984) as part of the implementing the Wilderness Act of 1964. The mineral surveys that were undertaken are one part of the suitability analysis made for areas under consideration for wilderness designation. The study consisted of general geological reconnaissance, geophysical studies, geochemical analysis and surveys of prospects and mineralized areas. The Roadless Area studied includes Fossil Springs down to just below Irving Powerplant and areas on the south side of Fossil Creek downslope of the FR 708.

The study found that the mineral resources potential of the study area is low. Below Nash Point, they found several mineral prospects within light-gray conglomerate and carbonaceous shale of the Supai Formation that contained discontinuous spotty copper mineralization and coaly layers within the shale that are radioactive. The geochemical studies showed anomalies of copper, barium and beryllium from the upper reaches of Calf Pen Canyon. The anomalies indicate possible barite vein deposits. Barite is a nonmetallic mineral that is the principal source of barium. Another suite of geochemical anomalies consisted of chromium, nickel and cobalt which suggest the presence of ultramafic rocks at depth. These samples were from about one mile upstream of Fossil Springs. The findings concluded that though there have been mineral prospects and geochemical anomalies, the mineral resources are not proven or in sufficient quantities for mining or development. Oil and gas potential of the area is low; the formations within the Fossil Creek area do not produce oil or gas.

Construction and aggregate material sources of basalt, limestone, dolomite and sandstone are commonly found outside of the roadless area. Travertine deposits exist outside of the wilderness area and within the Wild and Scenic River corridor in the vicinity of Fossil Springs and upstream of the decommissioned diversion dam, but are not accessible by road. Travertine is not considered a locatable mineral, but a mineral material for use in construction and landscaping, therefore falls under 36 CFR 228 Part C regulations for Disposal of Mineral Materials. Mining and development of travertine as a resources would also be subject to rules under FSM 2816.3. The only nearby rock pits are in basalt or sandstone on Forest lands and the material sites are not presently active.

Geothermal potential – low but mention source of hot water e.g. Verde Hot springs.

Currently there are no past or presently active mining claims in the Fossil Creek WSR corridor or within the watershed, which indicates no interest in locatable mineral prospecting or extraction.

Travertine Formations

The American Geological Institute defines travertine as “biotic and/or abiotic precipitated calcium carbonate (predominately calcite and aragonite) from spring-fed, heated and/or ambient-temperature waters” (American Geological Institute). Travertine is chemically identical to the mineral calcite, which is distinguished from other forms of calcium carbonate by its banded and often porous structure resulting from its mode of deposition. A rare combination of natural processes is required for the calcium carbonate-rich spring water to form travertine dams (Malusa et al. 2003). Travertine deposition initially forms as a soft porous deposits, which recrystallize over time to form travertine, a durable form of calcite (Gandin and Capezzuoli 2008).

Travertine dams or terracing is the dramatic geological phenomena that makes Fossil Creek both aesthetically and scientifically valuable and contributes to the finding that geology is an ORV. Travertine terrace occurrences worldwide have been places of great interest throughout human history, yet scientifically have received little attention to understand this patterned landscape formation (Hammer et al. 2010). Considerable geochemical study has been done on calcium carbonate dissolution, yet the precipitation of calcite under saturated conditions in streams is scarce (Lu et al. 2000).

The geochemical conditions for calcite precipitation begin with atmospheric precipitation interacting with the soil zone, carbonate aquifers, organic material, or regional geothermal activity to absorb gaseous CO_2, which transfers to aqueous CO_2 and H_2CO_3 (Malusa et al., 2003). The H_2CO_3 increases dissolution of carbonate rocks, further elevating dissolved inorganic carbon concentrations in the water. The steep concentration gradient between atmospheric CO_2 and the higher dissolved CO_2 in water emerging from an aquifer initiates outgassing (Jacobson and Langmuir, 1970 and Langmuir, 1971). As the water’s CO_2 concentration moves toward equilibrium through outgassing, the water becomes supersaturated with $CaCO_3$, eventually reaching a level high enough to begin precipitation. When this level is exceeded, a kinetic barrier is surpassed and $CaCO_3$ precipitates to form travertine deposits (Stumm and Morgan 1996, Dandurand et al. 1982). The unknown piece of the puzzle in terrace formations is what site-specific processes are responsible for enhanced calcite precipitation that create these rare morphological features.

Effects to the dynamic constructive-destructive cycle of a travertine system can occur from either changes in the constructive aspect, such as loss of a water source, or the destructive phase in which flood events outpace the formation of travertine dams. Installation of power generating facilities, dams, reservoirs, and a water conveyance system (Arizona Power Company) began in 1908 at the Childs location on the Verde River (Monroe 2001). Water used to drive the turbines at Childs facility came from a series of flumes, tunnels, and temporary storage at Stehr Lake. This early water withdrawal likely had little impact on travertine deposition as it was below the stream reach actively producing travertine dams. Beginning in 1914 until April of 1916, construction of the Irving generating facility was completed along with a diversion dam and flume for water conveyance (Monroe 2001). The Irving facility and its operation depleted the water that emanated from Fossil Springs except during flood events. During the flood events water diversion to the power plant was released back into the channel to prevent damage to the diversion flume. These flood waters were allowed to flow through the natural channel in the reach where travertine dams had historically formed. From 1916 to 2005 the destructive processes due to flooding were allowed to function without the constructive phase of travertine dam formation, eliminating the channel-width travertine dams found in a naturally functioning Fossil Creek system. Evidence of dam destruction since cessation of channel flow was documented by Overby and Neary (1996) with approximately 81 relict features that stretched the full width of the channel. What has not been determined was how many of these relict dams where in place prior to water diversion beginning in 1916. What we do know is that this historical travertine reach no longer had the ability to build new travertine dams. Also, at some time during power generating operations the capacity to withdraw all of the water from Fossil Creek diminished, which allowed very small flows to seep past the upper diversion dam and to be released at the tailrace at Irving. The flow that was released below the Irving tailrace developed an active travertine system in miniature. The release of water at the tailrace also created a new area for people to recreate. Unmanaged as a recreation site, this stream reach not only created, but also demonstrated destructive impacts that recreation can have on newly forming travertine. Impacts from trampling were the most observable, but there were numerous places where individuals created dams by stacking rocks across the channel

knowing that travertine would fill spaces and grow over the crests creating larger and larger pools. Also observed were travertine dams that had been notched by boaters to allow easier passage.

Conditions Prior to 1915

Historical accounts describe large travertine formations in Fossil Creek prior to construction of the Childs-Irving Project. In 1891, Charles F. Lummis (1892) described waters "so impregnated with mineral that they are constantly building great round basins for themselves and for a long distance flow down over bowl and bowl". In 1904, F.M. Chamberlain reported dams "from several inches to a few feet in height, the highest is said to be 10 feet" and pools, the largest of which were "50 to 60 yards long, 20 to 30 feet wide, and approximately 20 feet or more deep" (Chamberlain, 1904).

In the vicinity of Fossil Springs on the north side of the canyon, an extensive (over 2,000 feet across) early to middle Pleistocene travertine river terrace is preserved. The Fossil Creek Canyon has deepened more than 200 feet since this travertine terrace was deposited. At one time the terrace bench stretched across the entire canyon and has been eroded since. This is the only such terrace in the canyon; all others are far less extensive, are located closer to modern creek elevation, and are located within canyon walls. This large travertine terrace is associated with junction of the Fossil Springs and Diamond Point fault zones and records the existence of a very large travertine dam. The age is suggested to be on the order of hundreds of thousands to several millions of years old (Gaeaorma Inc. 2006).

Conditions Prior to Flow Restoration in 2005

Degraded conditions occurred prior to restoration of free-flows in Fossil Creek in 2005. Streamflow was diverted from the creek at the diversion dam, causing a decline in travertine dam formation downstream of the springs. Various studies of travertine formation processes were conducted prior to dam and flume decommissioning in order to evaluate the consequences of restoration of natural flows to Fossil Creek (Malusa et al. 2003). Base flow of Fossil Creek was diverted to the Irving power plant constructed at Irving in 1915. The diversion of flows prevented the formation of travertine features below the springs, while flood flows eroded travertine dam structure that existed prior to the development of the power generating facilities. Overby and Neary (1996) recorded the presence of 81 remnant travertine structures that spanned the creek in the four mile reach of Fossil Creek from the diversion dam below the springs to Irving.

The stream reach just below the Irving power plant tailrace allowed a portion of the water used to operate the turbines to be discharged back into the channel (Malusa et al. 2003). Below this tailrace the amount of flow was variable and when it began is not recorded. During the period prior to cessation of power generating activities an active travertine forming segment existed and was utilized recreationally by many locals. This reach caught the attention of several private and public entities to the potential for travertine formations of Fossil Creek.

Baseline Conditions-2009

Baseline conditions are those at the time of Wild and Scenic River (WSR) establishment by law on March 30, 2009. Restoration of base flows to the creek in 2005 has stimulated deposition of new travertine features below the springs. By spring of 2009, there was more than three years of natural travertine dam formation and development. In the fall of 2008, the upper portion of the diversion dam below the springs was removed lowering the dam approximately 14 feet, resulting in erosion of sediments stored behind the dam and some channel adjustments, but had minimal effects to travertine dam growth and deposition. One research study was conducted between 2005 and 2009 which provides data on travertine dam growth, development and formational processes (Fuller et al 2011).This study provides information on travertine dam formations at the time of WSR establishment in 2009. This analysis draws heavily from this research for the description of baseline conditions.

After dam decommissioning, measurements of travertine dam growth rates and erosion rates found that net positive growth rates averaged 43 ± 4 mm/year and the median growth rate was 25.5 mm/year (n=611 data points) (Fuller et al. 2011). Many locations showed more than 10 cm/year sustained over the two year study

period (2006-2008). The four dominant growth mechanisms of travertine dams observed at the small scale (decimeter) were calcite precipitation, algal growth, growth of emergent plants and trapping of organic material including leaves, litter, branches and logs. The travertine dams and bedrock steps trap and entrain large quantities of organic and inorganic debris, which is then incorporated into new travertine deposition. Growth rates were shown to decline systematically downstream from the diversion dam consistent with the progressive loss of dissolved calcium carbonate and biotic processes such as algal growth and trapping became the dominant mechanism enabling travertine dam growth further downstream from the dam.

Abiotic factors of channel constrictions, bedrock steps and turbulence drive the process of travertine deposition. Decreased turbulence and temperature also result in decreased outgassing and travertine precipitation. Biotic factors of algal growth and emergent plants on dam crests along with trapping of floating organic material, leaf litter, branches and logs allow for dam growth. With flow restoration, dam growth and deposition will gradually increase over time, punctuated by periods of erosion from flood flows. Fuller et al. (2011) speculated that disturbance created by travertine erosion during floods could have a rejuvenating effect as new sites for organic matter accumulation can create a positive feedback on dam renewal and growth.

At the baseline year of 2009, in-channel travertine dam formation processes were restored below the diversion dam following restoration of full flows and partial removal of the diversion dam. The spring discharge and calcium carbonate content are in a natural condition that was found both before and after the power generating facilities were decommissioned. Spring discharge has been measured over several time periods, 1946-1952 and 1996. Perennial and steady base flow discharges of ~ 1,200 liters per second (42.4 cfs) have been measured from Fossil Springs (Feth and Hem 1962; Malusa et al 2003). Geochemical modeling based on chemical analysis of stream water predicted a potential for calcium carbonate precipitation of 26,290 pounds per day over a distance of 4.2 miles downstream of the springs (Malusa et al. 2003).

Existing Conditions

After the diversion dam was lowered in the fall 2008, it was expected that channel adjustments would take place both upstream and downstream of the dam in response to flood flows and as sediment that was deposited above the dam became mobilized and was re-deposited through the channel downstream. Flood flows in fall and winter of 2009-2010 scoured the channel upstream of the lowered dam resulting in loss of riparian vegetation, channel bank erosion and deposition of sediment and bed load materials. The channel in this area rapidly recovered from this event. Another major destructive flood occurred again in February of 2017. A new field survey of the travertine deposition segment needs to be performed to determine rate of travertine deposition process and distance downstream of the new formations. Communications from field personnel imply that new dam formations are above the waterfall, with little to no dams reforming below the waterfall.



Figure 3-15. Fossil Creek channel above the diversion dam in 2009 and 2010 showing changes in the channel after a large flood flow. Channel in August of 2009 with willows and aquatic vegetation. Same channel after flood flows in 2010. Note loss of channel vegetation (Photograph courtesy of Haessig 2010)

Environmental Consequences

Unplanned activities that threaten travertine dams and deposits both within and outside the active channel are mining, rock collection and removal of or damage to travertine formations. Development of social trails, walking up and down the creek, trampling sensitive formations, graffiti on rock outcrops, removing or damaging riparian vegetation and woody debris all can contribute to damage or loss of travertine formations. The quantity and quality of biotic inputs into the stream that contribute to travertine dam growth can be altered by decreases in vegetative cover and increased bare soil. Increased erosion and sedimentation from bare soil can lead to increased turbidity resulting in less algae productivity and higher sediment loads. This in turn results in decreased travertine growth and greater abrasion to existing travertine structures.

Kayaking and rafting are a small component of overall recreation activity in Fossil Creek (12% from survey Hancock et al. 2007). Kayaking/rafting during base flows can damage surface growth of travertine at dams, but is less likely at high flows when the kayaking and rafting recreation is highest.

Flood events are a natural process that erodes travertine formations and dams and could also change channel morphology, resulting in dam destruction or channel aggradation. During the study periods of 2006-2008 there were several winter storm flood events that eroded travertine in the measured sites. However, there was a net positive travertine accrual. Fuller et al. (2010) also noted the annual peak flood events that abraded dams on an annual basis, but also witnessed the much larger event that caused extensive destruction to travertine dams. This larger event was determined to have a frequency of approximately every 4 years. There is a need to quantitatively correlate flood flows with potential dam destruction.

Natural or human-caused fires along with insect epidemics and drought can alter watershed vegetative cover. The loss of vegetative cover can decrease slope stability and increase potential landslides or other mass wasting events (Chirico et al. 2013). Landslides and rockfall have the ability to alter channel morphology and negatively impact roads and trails.

Fossil Springs and other large springs of the area derive their water almost entirely from the deep regional aquifer up-gradient beneath the Mogollon Rim. In the Pine-Strawberry region this water table is at about 4,400 to 4,600 feet in elevation and is only about 50 to 200 feet above Fossil Springs in elevation. The water rights for Fossil Creek are discussed in detail in the Free Flow, Water Quality, Water Quantity, Riparian Function, Soil Condition and Air Quality Report.

Programmatic Analysis of the Effects of Management Direction on Geology

Implementation of the CRMP under the action alternatives, including Management Direction and Monitoring, Adaptive Management will result in reduced effects to the Geology ORV compared to the no action alternative. As is the case throughout this analysis, Management Direction for river resources is articulated from the perspective of the Geology ORV. Below is a summary of the effects of management direction for other program areas on the Geology ORV. This analysis summarizes all aspects of Management Direction regardless of alternative.

Table 3-21: Summary of programmatic level effects of the CRMP on Geology ORV

Program Area	Anticipated Effects to the Geology ORV
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, and rehabilitating denuded areas outside of recreation sites, all contribute to the protection of the Geology ORV.
Riparian Function	Implementing management direction for proper functioning riparian areas will maintain the deposition and formation of travertine dams and protection of the Geology ORV.
Vegetation	Intact terrestrial vegetation will reduce erosion and sediment inputs that can inhibit travertine deposition and dam formation, thereby protecting the Geology ORV.
Soil Condition	Minimizing bare area impacts due to visitor use, particularly outside of recreation sites, and restoration to reduce erosion will result in greater channel stability, increased travertine dam strength, and protection of the Geology ORV.

Program Area	Anticipated Effects to the Geology ORV
Geology	Protection of travertine dams, the unique structural and vegetative habitat they create, and the natural processes of development and destruction ensure the protection of the Geology ORV.
Wildlife, Fish and Aquatic Species	Maintaining Wildlife, Fish, and Aquatic species Habitat is essential to sustaining the seasonal dynamics of travertine formations and the Geology ORV.
Traditional Cultural Practices	Maintenance of a "natural and untrammeled feel' will reduce disturbance to vegetation and minimize bare soil due to visitor use that protects the Geology ORV.
Recreation	Impacts to the Geology ORV will be reduced when appropriate infrastructure is in place, visitor capacities are appropriately set to minimize or eliminate recreation use outside of recreation sites, entry is managed, developed camping is limited to outside the 100 year floodplain, and dispersed camping is limited. In addition, there will be no new trails across springs or paralleling Fossil Creek to connect recreation sites. Recreation fees and partnerships will ensure resources to implement the CRMP, monitoring, and adaptive management. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience, which will typically mean their behavior supports protection of river values including the Geology ORV. Most visitors will recreate responsibly, and the majority of visitors will stay within the designated areas. As a result, the refugia in between recreation sites will be largely free of human presence and maintains presence of travertine dams where biochemically possible, thereby protecting the Geology ORV. Appropriate design will ensure that roads, trails, recreation sites and infrastructure will not increase erosion and degrade water quality or result in adverse effects to the geology ORV.
Recreation/Lands Special Uses	Vegetation under powerlines is kept mainly free of tree canopy and this may include riparian vegetation, reducing stream bank cover which could impact the Geology ORV. Permit holders and filming permitees should provide an education component to their content and should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values, including the Geology ORV. While outfitter/guided activities have the potential to increase erosion and sedimentation, impacts will be less than unguided recreation because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities are likewise screened, tailored to reduce impacts to the Geology ORV and Water Resources, and contribute data needed to make informed management changes.
Roads and Facilities	Proper construction and maintenance of roads and facilities, and decommissioning of unauthorized roads would avoid and mitigate adverse effects of erosion and sedimentation to the Geology ORV.
Scenery Resources	There are no negative effects from scenery guidance on the Geology ORV. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare ground areas outside of recreation sites, trails and roads will reduce erosion and sedimentation that contribute to the stability of Riparian Resources and to the Geology ORV.
Special Areas	Act-driven restrictions in special areas indirectly benefit the Geology ORV through minimizing the use of motorized equipment and mechanized travel thereby reducing erosion and sedimentation, as well as protecting and enhancing river values. Expansion of the Fossil Springs Botanical Area would increase the area in which the protection and maintenance of physical and biological processes unique to the Fossil Springs area is emphasized. This would benefit the Geology ORV by supporting protection of the area around the springs that are the source of super saturated water that creates travertine structures in the Fossil Creek channel.
Interpretation and Education	Interpretation and education will directly benefit the Geology ORV. These benefits can include reducing of trampling vegetation and physical destruction of travertine dams.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Direct and Indirect Effects of Alternative A – No Action

Under the No Action alternative, the river's ORVs may not be adequately protected or enhanced, even with continued implementation of interim management measures. The Geology ORV and the travertine system of dams could be degraded by physical impacts from unplanned visitor use such as trampling of the dams and biotic communities associated with the dams. Adams et al. (2015) measured increased overall vegetation coverage by 18%-21% relative to reference conditions in the middle reaches of Fossil Creek, yet the results were driven by large increases at a few sites while some sites declined. An increase in trampling of vegetation was measured

(Adams et al. 2015), which correlated with a substantial increase in visitor use (Rotert 2013). Subjective evidence of surface erosion and/or notching by kayakers and rafters has been noted, yet no formal monitoring of disturbance to travertine dams has been performed to date. Under the No Action alternative existing interim management measures would not formally monitor the physical impacts from visitor use and no formal management direction to alter visitor use or timing that could allow the natural cycle of construction-destruction of the travertine formations is in place. Visitor demand and use have increased over the entire Fossil Creek area (Rotert 2013). With increased visitor use and a lack of comprehensive management provided by the CRMP, the potential to negatively impact the Geology ORV is likely to occur.

Direct and Indirect Effects Common to Action Alternatives

Under all alternatives the ability of Fossil Creek to form travertine dams is secure as long as the quantity of water emanating from Fossil Springs remains unchanged. The Fossil Springs flow comes from the Limestone Aquifer underlying the C Aquifer. Surface flows sourced from these aquifers within FS-managed lands will be protected as directed by the regional supplement (2500-2001-1) to Forest Service Manual (FSM) 2500, Chapter 2540, Water Uses and Development. Both of these aquifers are part of the larger regional groundwater system, therefore portions of these aquifer fall under jurisdiction other than the FS that would allow development of groundwater withdrawals potentially diminishing flows emanating from Fossil Springs and ultimately negatively impacting travertine deposition in Fossil Creek.

Direct effects to travertine dams can occur when physical contact from recreational activities such as swimming, wading, and boating fractures and abrades the soft porous calcite of newly formed travertine. The action alternatives would support protection of travertine dams by providing environmental education and interpretive information on travertine structures and focusing recreational use in areas that are less susceptible to impacts. Recovery periods during the fall and winter when visitor use is lowest also allow time for travertine deposition to form a dense crystal structure that is much more durable. The reach within the recreational segment of Fossil Creek having the greatest potential for travertine dam formation, the historic diversion dam to ¼ mile above the waterfall, does not have designated recreation sites, which also limits the potential physical contact by visitors at travertine dams. Potential for travertine dam formation below the high travertine deposition reach is greatly diminished, yet there are relicts within this reach documenting that under certain conditions travertine dams can form. This reach within the recreational segment of the creek between the waterfall and the Mazatzal recreation site is where the majority of designated recreation sites are located. Each action alternative also provides infrastructure to support education and interpretative information focused on supporting management activities, wild and scenic rivers, the unique Fossil Creek environment, and promoting visitor stewardship to protect the geology ORV.

All action alternatives designate recreation sites and armored creek access points to be located that limit sediment inputs, while decommissioning and restoration of trails and roads will also reduce sediments inputs that can decrease travertine deposition rates and increase abrasion during flood events (table 3-22).

The action alternatives also encourage research efforts to better understand the interaction among water chemistry, precipitation kinetics, channel morphology, turbulence, carbon dioxide degassing, biology, erosion and sedimentation that produces the dynamic spatial and temporal arrangement of travertine dams. This information would greatly assist in further development of adaptive management actions that protect and enhance the Geology ORV.

Direct and Indirect Effects Unique to Action Alternatives

The recreational and scenic values of Fossil Creek and its proximity to the Phoenix metropolitan area result in high levels of recreation demand. Physical contact with travertine dams during recreational activities such as hiking, swimming, and boating have the potential to abrade, trample, and notch newly formed travertine deposits, especially at the crest of the dams. The action alternatives differ in the number of recreation visitors allowed at one time (PAOT) in the recreation segment of Fossil Creek, therefore the potential to come in contact with travertine dams. Alternative B would restrict PAOT by almost 21%, while alternative C restricts use by 11% when

compared to alternative A (table 3-22). Alternatives D, E, and F all increase PAOT respectively (12%, 86%, 219%) compared to alternative A (table 3-22). Alternative B, C, and D eliminate trail access to Fossil Springs further reducing the potential of visitors coming in physical contact with travertine dams. Alternative B does not increase recreation sites, roads, or trails providing the greatest amount of protection. Alternative E and F allow access to Fossil Springs, with alternative E also allowing camping in designated sites at Fossil Springs, which raises the potential for contact with visitors at active travertine formations.

The indirect effect of sediment inputs from roads, trails, and recreational sites for all the action alternatives are comparable. Decreases in total acres disturbed and increases in acres restored are greater for all action alternatives compared to the no action alternative (A). With the proposed improvement to the infrastructure for all action alternatives sediment will be reduced compared to alternative A. Alternatives C, E, and F propose more trail mileage than alternatives A, B, and D, with Alternative E proposing the greatest extent of trails. Alternative D reduces recreation site area by more than 50%.

The creek reach with the greatest potential for travertine formation is from the historic diversion dam downstream to ¼ mile above the waterfall, yet this reach does not have any designated recreation sites under any of the action alternatives. With the improvement to infrastructure, providing education and interpretive information, and cooperative outreach to user groups there is very little difference in the potential negative impacts from any of the action alternatives to the geology ORV. If a flood event alters deposition conditions (turbulence), allowing for travertine dam formation below the waterfall, monitoring activities and adaptive management for each of the alternatives would be in place to protect the geology ORV.

Table 3-22. Summary of effects of implementing the alternatives

Resource Element	Resource Indicator/ Measure	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Geology							
Geology Resources	Recreation site capacity (PAOT)	810	640	720	905	1510	2580
Geology Resources	Total acres of disturbed area	126.3	94.1	97.2	95.9	114.4	108.7
Geology Resources	Total acres of restored bare areas, roads, and trails	0	41.2	43.7	46.4	40.6	42.0
Geology Resources	Roads in project area	16.4 mi 72.1 ac	15.6 mi 72.0 ac	15.4 mi 71.7 ac	15.4 mi 71.6 ac	15.6 mi 71.4 ac	15.6 mi 70.6 ac
Geology Resources	Decommissioned roads	0 ac	3.7 ac	3.8 ac	3.8 ac	3.7 ac	3.9 ac
Geology Resources	Acres of disturbed designated trails creek access Sites	7.1	5.7	7.2	2.8	7.8	6.7
Geology Resources	Acres of restored trails	0	1.9	2.7	4.5	2.1	3.4

Cumulative Effects Analysis

In 1999 APS agreed to decommission the hydroelectric power generating system associated with Fossil Creek. This resulted in free flow down the natural channel beginning in June of 2005 and initiated travertine dam formations in the downstream reach historically known for these features. APS's final withdrawal from the Fossil Creek channel occurred in April of 2009 when the diversion dam was lowered approximately 14 feet. This lowering of the diversion dam resulted in sediment previously impounded behind the dam to be released during flood events and channel incisement above the historic dam site back to approximately the channel bed prior to power generating facilities being constructed (Monroe 2002). The release of full flows back into the natural channel also altered the small reach below Irving that over several decades formed travertine dams. The potential

for dam formation in this reach either no longer exists or is greatly diminished as precipitation of travertine in the historic travertine reach lowers the saturation indices for $CaCO_3$ and the potential for deposition. Visitor use in recreational segment of Fossil Creek will likely continue to impact travertine formations that developed below the Irving tailrace. However, because these travertine formations were the result of altered deposition dynamics, it is not anticipated that the Geology ORV will be adversely impacted by visitor use. A more natural pattern of deposition is occurring in the historic travertine reach of Fossil Creek that will receive little visitor use under the CRMP. Over time the travertine dams below Irving will be destroyed by flooding and only relicts left to memorialize the time when dams existed in this reach. The building and destruction of travertine dams in Fossil Creek is the process that creates the dynamic geologic system designated as an ORV. While abrupt flood events can decimate several years of travertine building it also destroys evidence of human impacts to travertine dams. Implementation of the CRMP will provide direction to minimize human impacts, and over time flood events will obscure past human impacts.

Beginning in January of 2011 a series of interim decisions by the Forest Service were made for visitor safety and protection of resources through defined parking area, trails and creek access, education information, and rehabilitation of overused areas. These interim measures were needed as the obvious unmanaged visitor use and lack of facilities was degrading this popular recreation area, including obvious physical impacts to travertine dams. Further measures beginning in February of 2016 instituted a seasonal reservation system throughout the river corridor with soil and water best management practices, cultural design features, and monitoring requirements, followed the next year with the installation of eight vault toilets within the Fossil Creek wild and scenic river corridor to minimize the impact of human waste on resources. These short-term measures were implemented until the CRMP could be developed and approved. Imbedded within these measures were management activities to help mitigate the abrasion, trampling, and notching caused by visitor use (e.g. swimming, hiking, and boating) of the fragile newly formed travertine typically found at the crests of these dams. The beneficial effect of the interim management measures are anticipated to continue when the CRMP is implemented and many of these measures will continue under guidance of the CRMP. As a result, these past actions in combination with those proposed under the CRMP will result in beneficial effects to the Geology ORV.

Designation of Fossil Creek as a Wild and Scenic River, implementation of the CRMP, and inclusion of management direction for Fossil creek into the Land and Resource Management Plan for both the Coconino and Tonto National Forests will protect the Geology ORV into the foreseeable future. Travertine systems are very resilient. The ability to reconstruct dams after devastating flood events is well known. During the Euro-American historical period, Fossil Creek has experienced what will be the greatest future threat to the Geology ORV. This threat is diminished or completely eliminated flows within the Fossil Creek channel. Water is a precious commodity within the Southwest region. If population growth continues, the need for this precious commodity may lead to water withdrawals from deep aquifers such as the one that feeds Fossil Springs. Currently, withdrawal plans from this aquifer are exploratory at best and limitations due to the very nature that creates the Geology ORV, the super saturation with respect to $CaCO_3$ also creates limitations for municipal water use. Implementation of the CRMP will protect the formation of travertine dams in Fossil Creek that creates the extraordinary step-pool morphology and complex aquatic habitat punctuated by destructive floods, therefore the CRMP will protect the Geology ORV of Fossil Creek.

Wildlife and Vegetation

This section summarizes the affected environment and environmental consequences of the actions described in Chapter 2 for the Fossil Creek CRMP on threatened, endangered, candidate and proposed species; Bald and Golden Eagle Act species; Regional Forester’s sensitive species; Forest Service locally important species (LIS), Management Indicator Species (MIS); neotropical migratory birds and vegetation. This section includes all but fish and macroinvertebrates, which are covered in a separate section below. However, Fossil springsnail is analyzed in this section.

The Biological ORV in Fossil Creek is comprised of both habitat and populations of fish, aquatic invertebrates, and wildlife, including birds, mammals, reptiles, and amphibians. Fossil Creek is at a crossroads of several

regional geographic elements and floristic provinces, which support a high diversity of indigenous flora and fauna species.

Due to its length, continuous and abundant flow, elevational gradient, unfragmented nature, and presence of travertine, Fossil Creek provides outstanding habitat for a high diversity of fish and wildlife species and is the only pure warm water native fishery in Arizona. Fossil Creek is the only uninterrupted system between the Verde River and the Mogollon Rim, spanning and connecting a number of biotic communities from upper Sonoran desert scrub up through ponderosa pine forests. The elevational gradient and length of the Fossil corridor is significant compared to other perennial systems in Arizona, especially in terms of protection during climate change. Since wildlife species will experience environmental stressors as a result of climate change, large areas with unfragmented habitat will be even more important for long-term population survival and growth. This unfragmented system not only provides contiguous habitat for species that can only survive in aquatic and riparian habitat, it also provides a contiguous corridor for wildlife species moving through during dispersal or migration and will be important in the face of climate change for species' long-term population survival and growth. It is one of only a few major north/south riparian corridors in Arizona which is important for many mammalian and avian species. In the travertine-dominated reaches, the deposition of travertine and creation of travertine dams has resulted in the impoundment of sediments and the formation of terraces that support a variety of submergent, floating, emergent, herbaceous, and shrubby habitat components. The floristic diversity of aquatic and riparian vegetation provides a variety of physical structures, which in turn supports a wider diversity of wildlife species. In addition to the floristic diversity, the presence of travertine has greatly increased the diversity of pools, riffles, glides, runs and backwaters, all of which provide a diverse array of habitat for numerous wildlife species. The diversity of this unique habitat demonstrates the outstandingly remarkable fish and wildlife habitat of Fossil Creek.

Special status wildlife and plant species that are known to occur, or have existing or potential habitat, include: 6 federally-listed species; 14 Forest Service sensitive species; 2 locally important species; 19 Forest Service management indicator species (MIS); 19 federal and state designated neotropical migratory birds (NTMB), and Bald and Golden Eagle Act species.

Refer to table 3-23 for a list of all special status species included in this analysis. Note that species lists are updated and over time, new special status species may be added or removed, and species may be re-introduced into the Fossil WSR corridor for recovery purposes. Additional background information for the wildlife and vegetation analysis can be found in the specialist report.

Table 3-23: Special status species included in this analysis

Common Name	Scientific Name	Status	Critical Habitat
Birds			
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened	Yes
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	Yes
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Threatened	Proposed
Common Black-hawk*	*Buteogallus anthracinus*	LIS, MIS, NTMB	N/A
Bald Eagle	*Haliaeetus leucocephalus*	Sensitive, MIS, and Eagle Act	N/A
American Peregrine Falcon	*Falco peregrinus anatum*	Sensitive	N/A
Northern Goshawk	*Accipiter gentiles*	Sensitive, MIS	N/A
Golden Eagle	*Aquila chrysaetos*	Eagle Act	N/A
Juniper Titmouse	*Baeolophus ridgwayi*	MIS	N/A
Ash-throated Flycatcher	*Myiarchus cinerascens*	MIS	N/A
Gray Vireo	*Vireo vicinior*	MIS, NTMB	N/A
Townsend's Solitaire	*Myadestes townsendi*	MIS	N/A
Northern Flicker	*Colaptes auratus*	MIS	N/A
Spotted Towhee	*Pipilo maculatus*	MIS	N/A
Black-chinned Sparrow	*Spizella atrogularis*	MIS, NTMB	N/A
Savannah Sparrow	*Passerculus sandwichensis*	MIS, NTMB	N/A
Horned Lark	*Ermophila alpestris*	MIS	N/A
Black-throated Sparrow	*Amphispiza bilineata*	MIS	N/A

Common Name	Scientific Name	Status	Critical Habitat
Canyon Towhee	*Melozone fusca*	MIS	N/A
Lucy's Warbler	*Oreothlypis luciae*	NTMB	N/A
Bell's Vireo	*Vireo bellii*	MIS, NTMB	N/A
Summer Tanager	*Piranga rubra*	MIS	N/A
Hooded Oriole	*Icterus cucullatus*	MIS	N/A
Bendire's Thrasher	*Toxostoma bendirei*	NTMB	N/A
Black-throated Gray Warbler	*Setophaga nigrescens*	NTMB	N/A
Chestnut-collared Longspur	*Calcarius ornatus*	NTMB	N/A
Common Nighthawk	*Chordeiles minor*	NTMB	N/A
Elf Owl	*Micrathene whitneyi*	NTMB	N/A
Ferruginous Hawk	*Buteo regalis*	NTMB	N/A
Flammulated Owl	*Otus flammeolus*	NTMB	N/A
Grace's Warbler	*Setophaga graciae*	NTMB	N/A
Lark Bunting	*Calamospiza melanocorys*	NTMB	N/A
Phainopepla	*Phainopepla nitens*	NTMB	N/A
Virginia's Warbler	*Oreothlypis virginiae*	NTMB	N/A
Wood Duck	*Aix sponsa*	NTMB	N/A
Yellow Warbler	*Setophaga petechia*	NTMB	N/A
Amphibians			
Chiricahua Leopard Frog	*Rana chiricauhensis*	Threatened	Yes
Lowland Leopard Frog	*Rana yavapaiensis*	Sensitive	N/A
Arizona Toad*	*Bufo microscaphus microscaphus*	LIS	N/A
Reptiles			
Northern Mexican Gartersnake	*Thamnophis eques*	Threatened	Proposed
Narrow-headed Gartersnake	*Thamnophis rufipunctatus*	Threatened	Proposed
Mammals			
Western Red Bat	*Lasiurus blossevillii*	Sensitive	N/A
Allen's Lappet-browed Bat	*Idionycteris phyllotis*	Sensitive	N/A
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Sensitive	N/A
Spotted Bat	*Euderma maculatum*	Sensitive	N/A
Pronghorn	*Antilocapra americana*	MIS	N/A
Arizona Gray Squirrel	*Sciurus arizonensis*	MIS	N/A
Snails			
Fossil Springsnail	*Pyrgulopsis simplex*	Sensitive	N/A
Plants			
Arizona Phlox	*Phlox amabilis*	Sensitive	N/A
Cochise Sedge	*Carex ultra*	Sensitive	N/A
Metcalfe's Tick-trefoil	*Desmodium metcalfei*	Sensitive	N/A
Mt. Dellenbaugh Sandwort	*Eremogone aberrans formerly Arenaria aberrans)*	Sensitive	N/A
Eastwood Alumroot	*Heuchera eastwoodii*	Sensitive	N/A

*Common black-hawk and Arizona toad were on the Regional Forester's Sensitive Species list up until 2013. These species continue to be analyzed as locally important species because of possible risks to their viability identified in the Coconino National Forest plan revision process and, in the case of the common black-hawk, connection to the Biological ORV.

In addition to special status species, there are hundreds of other species of mammals, birds, reptiles, amphibians, and invertebrates in the Fossil Creek WSR Corridor. Based on actual observations during limited wildlife surveys, Fossil Creek and its associated riparian habitat support roughly 200 known bird, mammal, reptile, and amphibian species. There is potential for an additional 300 species of mammals, birds, reptiles, and amphibians to be present along Fossil Creek based on the diverse habitat available.

The vegetative diversity of the Fossil corridor is represented by seven biotic communities: riparian, semi-desert grassland, pinyon/juniper woodland, juniper/grassland transition, alligator/Utah juniper savanna, ponderosa pine forest, and mixed conifer forest. Riparian is comprised of mixed deciduous and cottonwood/willow low elevation streams, springs, and wetlands. Non-native invasive plant species do exist in the Fossil corridor. The main species include giant reed, tamarisk, Himalayan blackberry, and tall fescue.

This analysis will focus on the following components: management direction in the CRMP, ground-disturbing activities associated with each of the alternatives (including mitigation measures, design features, and best

management practices), the monitoring plan, adaptive management, amendments to both the Coconino and Tonto forest plans, and other past, present, and reasonably foreseeable actions in the area.

Methodology

The Biological ORV analyzed in this report is comprised of wildlife habitat and representative species for which there is sufficient data to understand where they occur in the corridor and how management and recreational activities affect them (springsnail, black-hawk, lowland leopard frog, and invasive species). It is these species for which WSRA-specific analysis is conducted (indicators, measures, adverse effect thresholds, degradation thresholds, enhancement thresholds, monitoring). Also, for these species baseline condition is required as per WSRA. Baseline is defined as the state of species population at the time of designation which was 2009. Not all of the species had survey data in 2009, so the next best available information was used.

The effects analysis, however, covers all special status species. The effects analysis discusses the different components of management activities (programmatic management direction, design features, monitoring, adaptive management and amendments to both forest plans), the acres of habitat that could be lost due to construction of infrastructure within recreation development areas, the amount of habitat that can be impacted within recreation dispersal areas, the amount of habitat affected by roads and trails, the amount of acres that will be restored, and the overall amount of refugia (particularly riparian habitat) protected. Definitions for these various categories are described next.

Measures that quantitatively describe alternative effects include acres of disturbed habitat by specific vegetation type, acres of refugia habitat, acres of restored habitat, acres of full potential habitat (refugia plus restored), number of dispersed recreation sites with creek access, stream lengths with recreation access, percentage of stream length with recreation access, PAOTs, and feet of stream per person within recreation sites.

Analysis Questions

Analysis questions for the Fossil Creek Wild and Scenic River corridor are connected both to programmatic direction the CRMP will provide for future management of the corridor and to specific actions proposed under the action alternatives.

- How do management actions protect and enhance indicators of the biological ORV?
- Which activities affect wildlife, plants, and their habitat and how?
- How do management actions protect other biological values that are not river ORVs?
- How do management actions promote and move towards sustainable recreation and resource management?

Analysis Indicators and Measures

The biological ORV is comprised of both habitat and populations of fish, aquatic invertebrates, and wildlife, including birds, mammals, reptiles, and amphibians. This analysis covers all but fish and macroinvertebrates, which are addressed below. The biological indicators used to analyze the effects of the programmatic management direction and specific management actions proposed under the CRMP include wildlife habitat, springsnail habitat, black-hawk habitat, black-hawk population, lowland leopard frog, and invasive species. These species are, by proxy, indicators for suites of wildlife; their ability to thrive in Fossil Creek are indicators that conditions are acceptable for other species. Refer to table 3-24 for the measures associated with each of the biological indicators.

Table 3-24. Wildlife indicators and measures for assessing future effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Wildlife Habitat	Hydrologicaly connected unplanned bare soil	Miles of unauthorized trails or area (acres) of bare soil from dispersed recreation	Y	Biological/Habitat
Invasive plant species	Presence of Class A and E non-native invasive plant species.	Acres occupied by class A and E non-native plant species	Y	Biological ORV/Habitat
Springsnail Habitat	Habitat condition assessment rating on occupied springs	Numeric habitat condition ratings for various habitat parameters	Y	Biological ORV/Habitat
Black-hawk Habitat	Understory vegetation remains intact	Human-caused ground disturbance within proximity of occupied nest and number of sites abandoned.	Y	Biological ORV/Habitat
Springsnail Population	Viable population as indicated by relative abundance	Number of individual snails counted (catch per unit effort) during timed count surveys.	Y	Biological ORV/Wildlife
Black-hawk Population	Number of active black-hawk nests from Fossil Springs down through Mazatzal site.	Number of black-hawk pairs or fledged young	Y	Biological ORV/Wildlife

Information Sources

Species occurrence information was obtained by:

- Compiling past Forest survey results into an Access database.
- Compiling survey results from agency, academia, and citizen science efforts.
- Inventory and monitoring species and their habitat following established protocols.
- Querying the District Biologist's database for all species observations in Fossil Creek

Affects analysis is accomplished utilizing the following:

- The Forest Service's past recreation use numbers
- The Forest Service's bare soil inventory data
- Soils and Watershed specialist report
- GIS queries of acreages in various categories

Incomplete and Unavailable Information

Although surveys for some species have occurred, surveys have not been conducted throughout the entire corridor due to inaccessibility of the lower Fossil Creek reach. Also, thorough inventories of most species and some major taxa groups has not been completed. For example, in certain years, fairly thorough surveys have been conducted for plants, southwestern willow flycatcher, western yellow-billed cuckoo, lowland leopard frogs, black-hawks, and bats. But for Fossil springsnails, only certain springs have been surveyed and other springs and seeps still need to be investigated. The most under-inventoried taxa are the terrestrial invertebrates, followed by upland birds, upland mammals, and upland reptiles.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects to wildlife are generally the FC WSR corridor, because most recreation impact and construction of and maintenance of existing infrastructure occurs within the corridor. However, because the Mail trail connects the corridor to Hwy 260 and through Chiricahua leopard frog habitat, that species has a different analysis boundary. Likewise, visitors canyoneering in the upper part of the corridor will likely continue into Sandrock and Calf Pen canyons. Therefore the analysis area for the Mexican spotted owl will include Sandrock and Calf Pen canyons.

The temporal boundaries for analyzing the direct and indirect effects is approximately 10 years or until new information becomes available. While the effects will continue as long as recreation is allowed in the corridor, the effects analysis should be adequate for a decade or more. Monitoring will indicate need for changes in management. Should new information regarding these species become available, adaptive management changes or even additional analysis may be warranted. If new species are added to various special status species list, new or additional analysis may be warranted. For example, if a species becomes listed, consultation may be required upon listing.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects to wildlife and plants are the four 6th code watersheds (Upper and Lower Fossil, Hardscrabble, and Mud Tanks) because there may be downstream indirect effects such as sedimentation and movement of non-native species. In addition, canyoneering, cross country travel, and use of the Mail Trail connect activities in the uplands outside of the corridor to the Fossil Creek corridor. The future temporal boundaries for analyzing the cumulative effects are 10 years because we anticipate we will have implemented the selected alternative elements within 10 years.

Adverse Impact, Degradation, Protection, and Enhancement

As described in the Fossil Creek CRMP, general descriptions of adverse impact, degradation, protection, and enhancement are provided for both wildlife populations and habitat. Specific thresholds related to key components of the Biological ORV used to indicate the condition of the ORV are described in the CRMP's monitoring and adaptive management chapter.

Adverse Impact to Wildlife Populations

The wildlife population component of the biological ORV would be adversely impacted if public use, development, or administrative use negatively impact the size, structure, or requirements of wildlife species populations in the Fossil Creek corridor in a way that reduces population numbers but not to the level that affects population viability.

Degradation of Wildlife Populations

The wildlife population component of the biological ORV would be degraded if public use, development, or administrative use impact the size, structure, or requirements of wildlife populations to the extent that viability of populations in the Fossil Creek corridor is threatened.

Protection and Enhancement of Wildlife Populations

The wildlife population component of the biological ORV is protected if the size and structure of wildlife populations support long-term species viability in the Fossil Creek corridor. Opportunities for enhancement include expanding interpretation and educational programming related to wildlife intended to reduce human impacts to these species' populations; actions that would enhance water quantity and quality, riparian function, travertine formations, and prey bases; the Fossil Creek corridor contributing to down-listing or delisting of federally listed species that occur or have potential to occur in the corridor; and supporting inventories and research intended to improve the understanding of wildlife populations.

Adverse Impact to Wildlife Habitat

The wildlife habitat component of the biological ORV would be adversely impacted if water quantity or quality, riparian function, the amount or function of travertine formations, invasive species, or prey bases are affected by public use, development, or administrative use in a way that risks causing declines in wildlife populations or population viability in localized or previously unimpacted areas.

Degradation of Wildlife Habitat

The wildlife habitat component of the biological ORV would be degraded if water quantity or quality, riparian function, the amount or function of travertine formations, invasive species, or prey bases are affected by public use, development, or administrative use to the extent that long-term, segment-wide declines in wildlife populations or population viability are likely to occur as a result.

Protection and Enhancement of Wildlife Habitat

The wildlife habitat component of the biological ORV is protected if water quantity or quality, riparian function, the amount or function of travertine formations, and prey bases provide for the needs of Fossil Creek's wildlife populations and if invasive species do not result in declines in wildlife populations or population viability. Opportunities for enhancement include expanding interpretation and educational programming related to wildlife that is intended to reduce human impacts to habitat; actions that would enhance water quantity and quality, riparian function, travertine formations and prey bases; and supporting research intended to improve the understanding of wildlife habitat requirements.

Affected Environment – Baseline and Existing Condition for Vegetation and Habitat

The Fossil Creek Wild and Scenic River Corridor occurs in the Transition Zone Province and ranges in elevation from about 2,550 feet above sea level at the confluence of the Verde River and Fossil Creek to 5,000 feet. The watersheds are located in a land of extremes. Within the project area, large elevational gradient produces a wide range of temperatures and amounts of precipitation leading to a high diversity of vegetation.

Annual precipitation is distributed bimodally with peaks in the winter and summer. Fifteen to twenty inches in semi-desert grasslands, eighteen to twenty-two in pinyon-juniper woodlands, twenty to twenty-four in ponderosa pine, and up to twenty-eight in mixed conifer.

Summers are usually hot with average high temperatures exceeding 95 degrees for June, July, and August (data for Montezuma Castle NM from the Western Regional Climate Center). Winters are typically mild at low elevations.

The analysis area is comprised of four 6th code watersheds: Upper Fossil Creek, Lower Fossil Creek, Hardscrabble Creek, and Mud Tanks Draw. Based on a GIS query, there are nine major vegetation types in the analysis area (table 3-25) and seven within the corridor (table 3-26 and figure 3-16). The spatial data source for upland vegetation was Terrestrial Ecological Unit Inventory. The spatial data used for riparian was Regional 3's RMAP since this data is more recent and better represents actual riparian on the ground.

Table 3-25. Vegetation Type and Acreage within the Four 6th Code Watersheds

Vegetation Type	Acres
Mixed Conifer	6,305
Ponderosa Pine Forest	14,888
Ponderosa Pine/Gambel Oak	7,112
Alligator/Utah Juniper Savanna	6,591
Pinyon/Juniper Woodland	32,626
Juniper Woodland- Semi Desert Grassland Transition	3,872
Plains Grassland	14,208
Semi-Desert Grassland	2,329
Riparian	1,408
Total:	89,339

Table 3-26. Vegetation Type and Acreage within the Fossil Wild and Scenic River Corridor

Vegetation Type	Acres
Mixed Conifer	112
Ponderosa Pine Forest	4
Alligator/Utah Juniper Savanna	43
Pinyon/Juniper Woodland	4,275
Juniper Woodland- Semi Desert Grassland Transition	935
Semi-Desert Grassland	272
Riparian	652
Total:	6,293

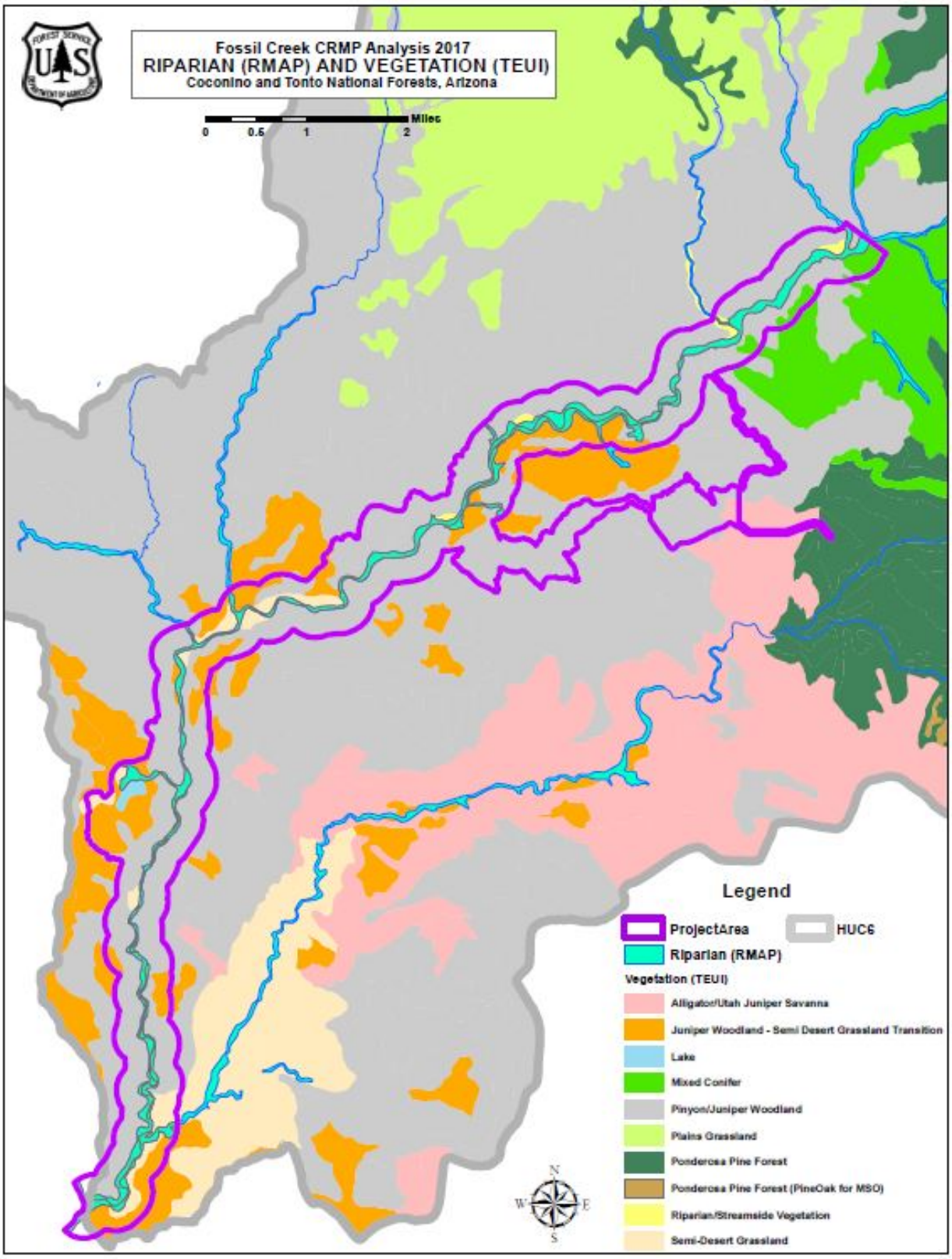


Figure 3-16. Vegetation Types within the Fossil Creek Analysis Area

Upland Vegetation

Pinyon/Juniper Woodland Conditions:

This vegetation type comprises the largest overall aerial extent, 37% of the project area and 70% of the cumulative effects area (see table 3-27). Vegetative ground cover and species composition vary according to slopes and ungulate access. Slopes greater than about 40 – 50 % have higher vegetative ground cover, species composition, diversity, and productivity than lesser slopes. The pinyon/juniper woodland type contains inclusions of turbinella oak chaparral that were too small to map at scale of the original Terrestrial Ecosystem Survey (TES) mapping. The chaparral vegetation consists of dense stands of shrubs with little herbaceous cover.

Juniper/Semi-Desert Grassland Transition Conditions:

This vegetation type exists in the ecotone between pinyon-juniper woodlands and semi-desert grasslands. It occupies only about 4% of the project area and 15% of the cumulative effects area (see table 3-27). It is characterized by low canopy coverage of juniper and shrubs with variable grass and forb understory depending on level of disturbance.

Semi-Desert Grassland:

Semi-desert grassland types occupy 4% of the project area and 3% of the cumulative effects area (see table 3-27). This type is characterized by low canopy cover of shrubs (5 – 25%) and a variable understory comprised of perennial and annual grasses and forbs. Vegetative conditions vary but generally vegetative ground cover, species composition, diversity, and productivity are less than what would be predicted in the PNC. Small inclusions of Sonoran Desert vegetation occur on steep south facing slopes at lower elevations within polygons of semi-desert grasslands.

Plains Grassland:

Plains grassland types occur at higher elevation than semi-desert grasslands, have greater precipitation, and are therefore generally more productive. They occupy 16% of the cumulative effects area; none occur within the project area (see table 3-27). This type is characterized by low canopy cover of trees shrubs and normally an understory comprised of perennial grasses and forbs often dominated by western wheatgrass and blue grama. In some areas the plains grasslands grade into pinyon/juniper woodlands where the overstory cover of trees and shrubs may exceed 25%.

Alligator/Utah Juniper Savanna Conditions:

This vegetation type normally occurs at the same elevation as the Pinyon/Juniper Woodland and comprises 7% of the cumulative area and less than 1% of the project area (see table 3-27). The canopy cover of tress in normally around 1-10% but coverage may exceed 10% where this type grades into juniper woodlands. There is normally mixture of Utah and alligator juniper but Utah juniper becomes more dominant at lower elevations while alligator juniper is more dominant at higher elevations. Parts of this type have had juniper control projects in the past that have opened the canopy.

Ponderosa Pine Forest Conditions:

This vegetation type occurs at higher elevations and north facing slopes and comprises about 25% of the cumulative effects area but less than 1% of the project area. Approximately 8% of the ponderosa pine forest contains Gambel oak forest in the cumulative effects area (no Gambel oak forests occur within the project area; see table 3-27). As mapped for the analysis, this type is highly variable and contains both cold gradient ponderosa pine (those areas having cold winters and containing Gambel oak) and mild ponderosa pine (those areas having mild winters and containing evergreen oaks). Vegetative ground cover and species composition vary according to slopes and ungulate access.

Mixed Conifer Forest Conditions:

This vegetation type occurs at highest elevations and north facing slopes and comprises about (7%) of the cumulative effects area. About 2% of the project area is comprised on mixed conifer forests (see table 3-27). Common overstory species include Douglas fir, white fir, and ponderosa pine. Most of this type within the Cumulative effects area occurs on slopes of greater than 40%. While nearly all of soils within this type are in satisfactory condition, areas that loose cover tend to be erosive. Some areas mapped as mixed conifer may have major inclusions of ponderosa pine forest.

Riparian Vegetation Conditions:

Riparian vegetation consists of lotic (riverine), lentic (springs), and wetland systems. Based on RMAP, the total of all riparian vegetation is less than 2% for the cumulative effects area and 10% of the project area (see table 3-27).

Table 3-27: Acres and Percent of Veg Types within the Project Area (PA) and Cumulative Effects (CE) Area

TES Soil Vegetation Type	Acres in PA	Percent Total PA	Acres in CE Area	Percent Total CE Area
Alligator/Utah Juniper Savanna	43	<1%	6,591	7%
Juniper Woodland - Semi Desert Grassland Transition	935	15%	3,872	4%
Mixed Conifer	112	2%	6,305	7%
Pinyon/Juniper Woodland	4,275	70%	32,626	37%
Ponderosa Pine Forest	4	<1%	14,888	17%
Ponderosa Pine Forest (PineOak for MSO)	0	0%	7,112	8%
Riparian/Streamside Vegetation	652	10%	1,408	2%
Plains Grassland	0	0%	14,208	16%
Semi-Desert Grassland	272	4%	2,329	3%
Grand Total for Project Area	**6,293**	**100%**	**89,339**	**100%**

Lotic (Riverine) Riparian

A total of 20.24 miles of stream occur in the analysis area. Of these, only Fossil Creek and the Verde River are perennial. Intermittent streams include Boulder Canyon, Sally May Wash, Mud Tank Draw, Tin Can Draw, and Hardscrabble Creek.

Numerous vegetative surveys from the 1970s through the present have provided initial baseline information for the riparian communities and general botany of Fossil Creek. Smith and Bender (1973) and Welsh and Toft (1972) described a deciduous riparian forest diverse in species composition with endemic hanging gardens around Fossil Springs (Wong, 1996). Many trees were noted to be greater than 35 feet in height forming a nearly closed canopy above the springs and stream. Ground cover was described as being more than two feet tall in places (Smith and Bender, 1973). Other reports list plant species present along Fossil Creek (Baker 1998, Phillips 1996, Phillips et al. 1979, 1982, and 1991, Menasco 1985, Collins et al. 1974, Sayers1998, Goodwin 1979, Wong 1996). All plant species in available reports were entered into an Access Database (Appendix C) up until around 2010. A query of this database revealed approximately 350 species for the greater Fossil Creek area were recorded. In 2017, Desert Botanical Garden (DBG) botanists provided a list of additional documented species that were missing from the Access dbase (Appendix C). In total there are approximately 537 plant species known from Fossil Creek, with potential for numerous additional species to be present. After restoration of full-flows the baseline for riparian conditions was reset since full flows widened the stream, increased the wetted area, and the dynamic nature of travertine formations creates changing conditions in the reach with the most rapid deposition.

Throughout Fossil Creek, dominant tree species include sycamore, ash (*Fraxinus velutina*), alder (*Alnus oblongifolia*), Fremont cottonwood (*Populus fremontii*), walnut (*Juglans major*), and willows (*Salix* spp.). In the intermittent reach above Fossil Springs, there is an Arizona sycamore (*Platanus wrightii*) dominated overstory. Dominant substrate is bedrock, followed by boulders, and cobble. Perennial pools persist in a few locations, but

mainly this section is dry. A complex of many springs begins the perennial portion of Fossil Creek. Beginning at Fossil Springs and continuing down through the entire perennial portion of Fossil Creek, there is a diverse deciduous riparian forest. Above the historic Fossil Springs dam, there is little travertine deposition and as a result, the creek is purely riverine, and the substrate is slick. The reach located a short way below the historic Fossil Springs dam and continuing downstream for several miles contains the most rapid-growing and well-formed developed travertine formations. There, travertine formations that have survived flood events have continued to build to heights of 6-8 feet resulting in deep and long pools. The tops and downstream sides of the dams are covered in aquatic vegetation and the edges of the pools contain aquatic and emergent vegetation. Newer developing travertine formations create complex aquatic and riparian habitat by supporting more aquatic vegetation (submerged, emergent, and floating), broader wetted areas, much more step pools, more areas with slower water, and pools of varying depths. From the springs downstream through the middle portion of Fossil Creek the majority of the riparian herbaceous vegetation is dominated by tall fescue (*Festuca arundinacea*). Around Irving, active travertine dam formation is greatly reduced and dams that formed from the last few decades of water release at Irving are no longer functioning as dams. The mixed broadleaf riparian forest continues downstream until closer to the confluence where a transition from mixed deciduous forests to cottonwood/willow riparian forest occurs. Closer to the Verde River, tall fescue becomes less common and native emergents (*Carex, Equisetum, Juncus*) become more common. Even at the confluence of Fossil with the Verde, the substrate is coated in a layer of travertine.

The riparian corridor along Fossil Creek has changed from before construction of hydropower infrastructure, through the years of hydropower operation and after restoration of full flows in 2005. Two areas have had notable change: below the dam and below Irving. Prior to restoration of full flows in 2005, APS had to discharge 10-15 cfs of flow from the Irving power plant back into Fossil. This created a section of travertine formations. However, since full flows were restored up at Fossil Springs, a new travertine section began forming below the historic Fossil Springs dam. The change in travertine formation below the historic Fossil Springs dam is documented through a series of photos (figure 3-17). Soon after restoration of full flows, travertine deposition below the dam created a complex network of floating dams. In this section during the several years after restoration of full flows, the stream channel was covered in watercress and monkeyflower. However some dams continued to develop but softer, more vulnerable dams were impacted by flood events. Surviving dams grew in height and more significant pools became evident. The following figures demonstrate changes in travertine development below the historic Fossil Springs Dam from 2007 to 2017.



Figure 3-17. Newly forming travertine structures below the historic Fossil Springs dam in 2007



Figure 3-18. Further developed travertine formations below the historic Fossil Springs dam in 2012



Figure 3-19. Mature, well-developed travertine formations with deep, long pools below the historic Fossil Springs dam in 2017

At Irving, the travertine formations that had formed there in the last few decades of hydropower operation (when 10-15 cfs were released from Irving in the 1990s and early 2000s), have persisted over recent years. However, recent floods (between October 2016 and Sept 2017) have breached some of these dams. During a fall 2017 site visit to known travertine pools below Irving and at Homestead, the pools were drained and full flows were back in one main channel (personal observation, Janie Agyagos). The more complex habitat supported by these travertine formation and pools was lost. In essence, recent floods are resetting this reach to its natural potential which is for less travertine deposition, much fewer and smaller travertine structures, and deeper and swifter water due to a narrower channel.

Lentic (Springs) Riparian

The majority of springs in the project area are associated with the spring complex termed collectively as Fossil Springs. This series of springs includes at least 60 individual spring orifices. There are other springs and seeps in

the Fossil corridor that are not associated with the Fossil Springs complex. Some occur adjacent to Fossil Creek while others occur well in the uplands, such as those along the Flume Trail.

Fossil Springs Botanical Area

The richness of species diversity around Fossil Springs led to the creation of the Fossil Springs Botanical Area in 1987 (Wong, 1996). The Botanical Area is proposed to be increased to approximately 33 acres in size (Map X). Many endemic species were identified within the Botanical Area in the proximate uplands as well as immediately adjacent to the springs, and many of those endemic species were specific to individual springs and to the geology of the canyon containing Fossil Creek (Appendix C). A query of the Fossil Creek plant database revealed approximately 187 species from the Fossil Botanical Area were recorded.

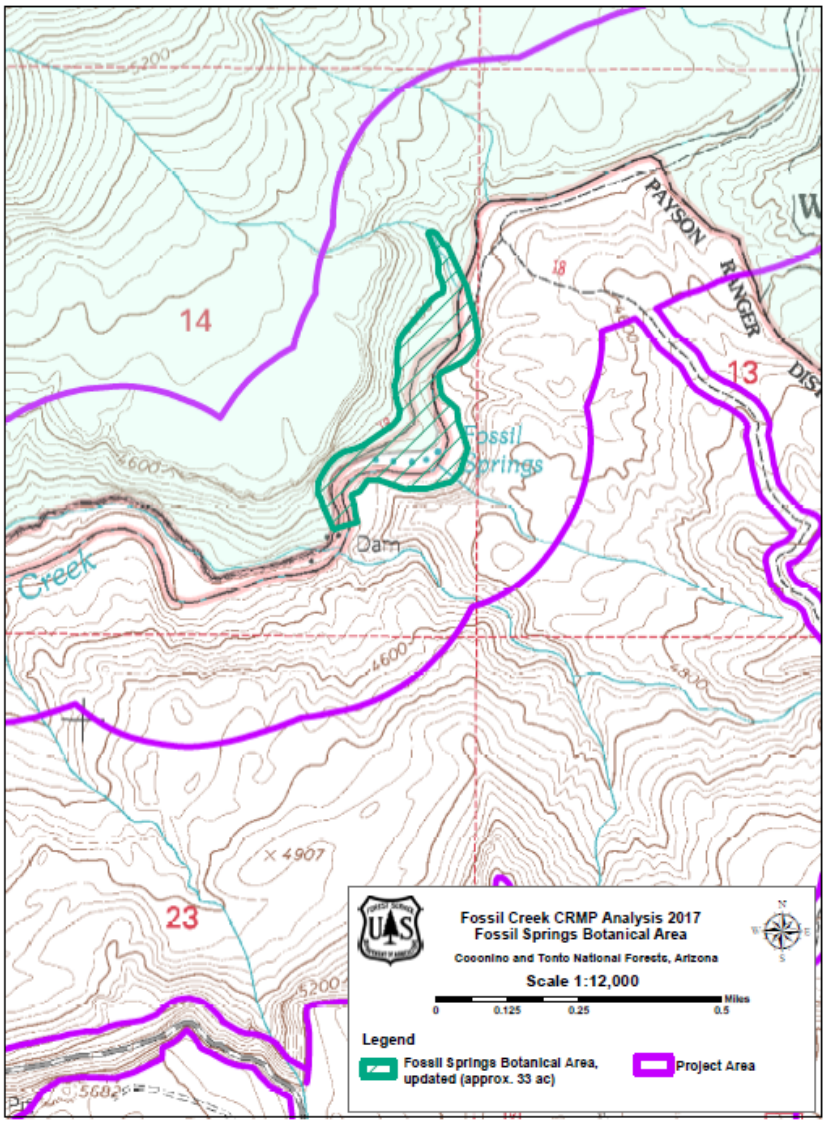


Figure 3-20: Fossil Springs Botanical Area boundary (recommended updated boundary)

Bare Soil Conditions in WSR Corridor

Bare soil conditions are described in the *Affected Environment Common to All Resources* section at the beginning of this chapter.

Invasive Weeds/ Non-Native Vegetation

Non-native invasive plants continue to be a concern in Fossil Creek. The Forest Service places highest priority for prevention, eradication, and containment for Class A and continuous control of Class E species. Class A species are defined as those newly established or have the potential to become established and pose unacceptable threat to watershed condition. Class E (for extreme) species have wide distribution within a particular area and pose an unacceptable, extreme hazard to watershed condition. Class B are those with limited distribution but pose substantial threat to areas and natural resources. Class C species are widely distributed but do not pose additional threats to watershed condition. Species in Class B and C have lower priority for eradication, control or restoration compared to Class A and E species. Newly emerging species that are highly invasive but have not yet been added to the list will be included in monitoring and eradication efforts. One example of such a plant is yellow bluestem. Repetitive treatments are often necessary and reflect the nature of persistent woody invasives that re-sprout after initial treatments. In between treatments seed germination often results in newly established individuals within previously treated areas; this too requires an area to be retreated on multiple entries.

A noxious weed survey of the Childs and Irving power plant sites was completed in 2003 for Arizona Public Service Company (APS) (Bouchard and Associates, 2003; Appendix D of the *Wildlife and Vegetation Specialist Report*). A total of forty eight species of invasive exotic plants were identified in the uplands and along the riparian corridor. Sixteen target species were further identified for treatment (Appendix D of the *Wildlife and Vegetation Specialist Report*). Some species, such as tall fescue and Bermuda grass (*Cynodon dactylon*), are prevalent and naturalized within the riparian corridor and would be difficult to remove. Other species were planted ornamentals, such as cultivated iris, sweetpea, periwinkle and tea rose, in areas that would be dewatered by the APS decommissioning and were monitored for persistence. APS developed a noxious weed control plan in cooperation with the Forest Service (Bouchard, 2004) to treat 16 key species identified as needing some form of control during the decommissioning process (refer to table 3-28). Herbicide, mechanical, and passive treatments were conducted by APS between 2005 and 2009 where targeted species occurred in deconstruction areas only. This included near the historic Fossil Springs dam (blackberry), along the flume and flume roads (tree of heaven, Siberian elm, giant reed), near flume tunnels (Lehmann's lovegrass), at the surge tank (malta starthistle), around Stehr Lake (salt cedar, Russian thistle, malta starthistle), Irving powerplant (tree of heaven, giant reed, Siberian elm, periwinkle, sweet pea, iris), Child's powerplant (Tree of heaven, periwinkle, giant reed, honey locust), and along the road to Verde Hot Springs (Siberian elm). Treatments of select species were monitored by FS botanists and were determined to be effective.

Since APS's involvement, the Forest Service has continued to inventory and treat invasive plant species in Fossil Creek. Class E species including tamarisk (*Tamarix ramosissima*), tree of Heaven (*Ailanthus altissima*), Siberian elm (*Ulmus pumila*) giant reed (*Arundo donax*), Himalayan blackberry, and malta star-thistle (*Centaurea melitensis*), have been targeted by the Forest Service for eradication or control.

The Forest Service has completed invasive plant surveys and has mapped the presence of target invasives from Irving to approximately four miles downstream of Purple Mountain, Stehr Lake area, and the last 0.75 miles of Fossil down to the confluence with the Verde River (figure 3-21). The Forest Service has yet to formally inventory from the confluence of Sand Rock and Calf Pen drainages (the beginning of the corridor) downstream to Irving and an approximate 2 mile remote stretch around the "narrows". However, some invasive populations are known in unsurveyed reaches. For example, it is acknowledged that the presence of non-native Himalayan blackberry (Rubus procerus) is compromising the native plant species diversity at the springs (refer to figures 3-22 through 3-26 for photographic change in blackberry invasion near the "Hanging Gardens"). Also, salt cedar is known to occur at the waterfall and Russian olive is at Waterfall trailhead.

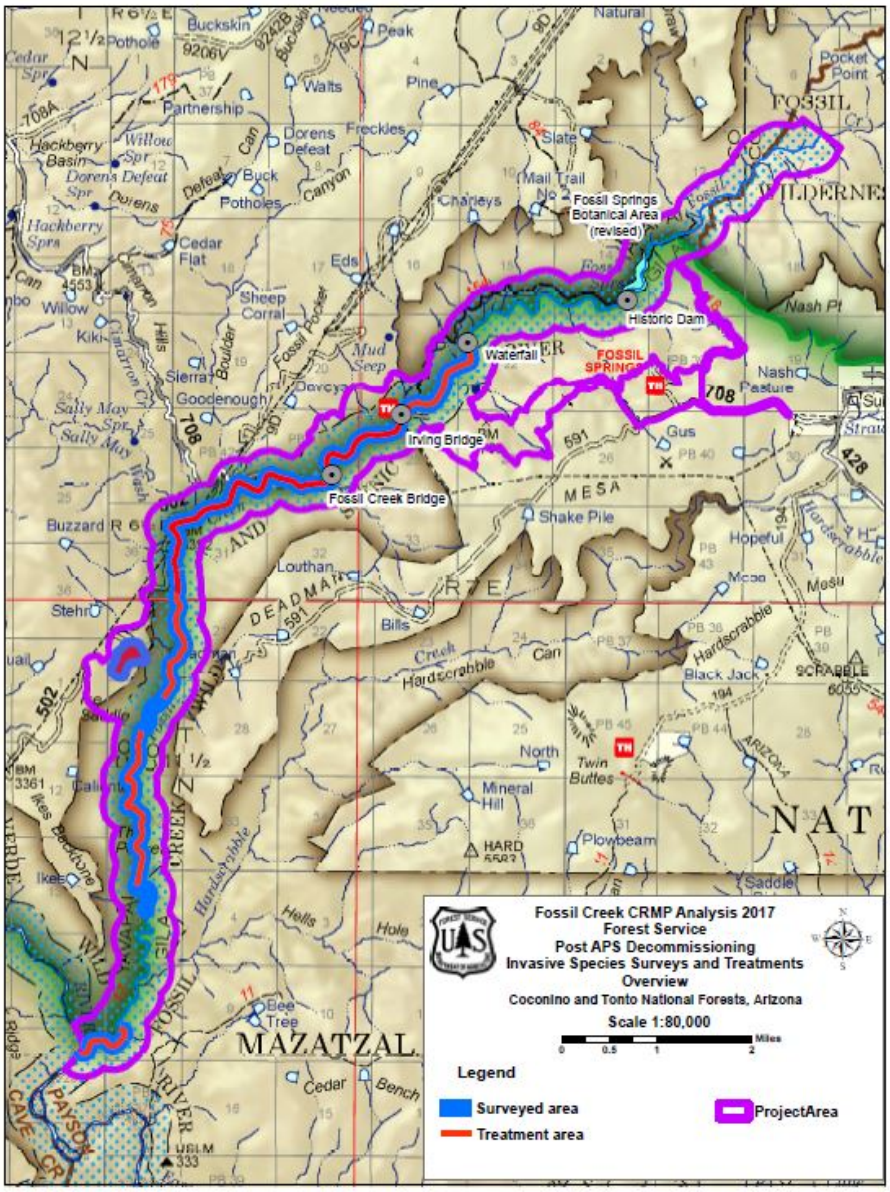


Figure 3-21: Invasive Plant Surveys and Treatments in the Fossil Corridor



"*A Wonderful Water Power*"... "the water pours in torrents from the mountainside, hedged about with columbine, maidenhair and other ferns of great variety ..."

The title of this book is taken from an article published about 100 years ago. In 1901 F.E. Santos celebrated the beauty of Fossil Creek for readers of *Electrical Review*. Yet, true to his day, Santos' focus was on harnessing the creek's hydroelectric potential, for which plans were already being laid. Santos describes the endeavors of "Three enterprising gentlemen [who] have recently secured title to these springs for electrical power purposes."

Figure 3-22. Fossil Springs, pre-hydro power era



Figure 3-23. 2007 – Ferns, monkey flower predominant – some blackberry present



Figure 3-24. 2008 – Ferns, monkey flower predominant – some blackberry present



Figure 3-25. 2010: Spring orifices still fairly visible among encroaching blackberry



Figure 3-26. 2017 –same location as 2007, 2008, 2010 and 2012 photos but obscured by wall of blackberry; note spring orifices under blackberry

Forest Service has used mechanical and herbicide treatments on the tree of heaven; salt cedar; giant reed; and Russian olive through repetitive treatments in 2010, 2012, 2013, and 2014 from the Irving to two miles below the permanent fish barrier, the Stehr Lake area, and the last 0.75 miles of Fossil Creek down to the Verde River confluence. No treatments were done in 2015 and 2016 due to lack of funding. In the fall 2017, invasives to be treated included the four species mentioned above from the waterfall downstream to Purple Mountain and test samples of Himalayan blackberry including at Fossil Springs. Stands of giant reed that are out of the water are treatable, but stands in or very close to water are not treatable with herbicide since the only approved herbicides are for upland use only; these stands instead will only be treated mechanically. Refer to table 3-28 for list of invasive known to have occurred in Fossil Creek and their control class.

Table 3-28: Invasive weed species detected in Fossil Wild and Scenic River Corridor

Scientific Name	Common Name	Objective	Control Class
Conium maculatum	poison hemlock	Eradicate/Control	A
Centaurea melitensis	Malta starthistle	Eradicate	A
Aegilops cylindrical	jointed goatgrass	Contain/Control	B
Bromus japonicas	Japanese brome	Contain/Control	B
Bromus rigidus	ripgut brome	Contain/Control	B
Bromus rubens	red brome	Contain	B
Bromus tectorum	cheatgrass	Contain	B
Cirsium vulgare	bull thistle	Contain/Control	B
Eragrostis lehmanniana	Lehmann lovegrass	Inventory/Contain	B
Rubus procerus	Himalayan blackberry	Contain/Control	B
Vinca major	periwinkle	Contain/Control	B
Avena fatua	wild oats	Contain	C

Chorispora tenella	blue mustard/ crossflower	Inventory/Control	C
Cynodon dactylon	Bermudagrass	Contain/Control	C
Hordeum murinum ssp. leporinum	hare barley	Inventory/Control	C
Medicago polymorpha	bur clover	Monitor/Control	C
Melilotus officinalis	yellow sweetclover	Inventory/Control	C
Phalaris arundinacea	reed canary grass	Inventory/Control	C
Polypogon monspeliensis	rabbitfoot grass	Inventory/Control	C
Salsola kali	Russian thistle	Inventory/Control	C
Sorghum halepense	Johnson grass	Inventory/Control	C
Tribulus terrestris	puncture-vine	Contain	C
Verbascum thapsus	common mullein	Contain	C
Tragopogon dubius	salsify	Monitor/Control	C
Marrubium vulgare	horehound	Monitor/Control	C
Ailanthus altissima	tree of heaven	Eradicate/Control	E
Arundo donax	giant reed grass	Eradicate/Control	E
Eleagnus angustifolia	Russian olive	Contain/Control	E
Tamarix ramosissima or spp.	salt cedar or tamarisk	Eradicate/Control	E
Ulmus pumila	Siberian elm	Contain/Control	E
Chloris virgata	Wooly top/Feathered Fingergrass	Not yet ranked	N/A
Cortaderia selloana	Pampas grass	Not yet ranked	N/A
Lathyrus latifolius	Perennial sweetpea	Not yet ranked	N/A
Gleditsia triacanthos	Honey locust	Not yet ranked	N/A
Eragrostis cilianensis	Stinking lovegrass	Not yet ranked	N/A
Iris sp.	Iris	Not yet ranked	N/A

Affected Environment – Baseline and Existing Conditions for Special Status Species, Critical Habitat, and General Wildlife

Mexican Spotted Owl and its Critical Habitat

Habitat and Survey Data:

The Mexican spotted owl (MSO) was listed as a federally threatened species in March 1993 (USFWS 1993). Critical habitat was established in 1995 and revised in 2012 (USFWS 2012). The Forest is encompassed by the Upper Gila Mountain Ecological Management Unit. The MSO Recovery Plan was revised in September 2012.

On the Forest, the Mexican spotted owl occupies mixed conifer and ponderosa pine/Gambel oak vegetation types, usually characterized by high canopy closure, high stem density, large trees, multi-layered canopies within the stand, numerous snags and downed woody material. Frequently, suitable nesting and roosting habitat is located on steep slopes or in canyons with rocky cliffs, where dense vegetation or crevices or caves provide cool moist microsites for nests and roosts.

No Mexican spotted owl Protected Activity Centers (PACs) occur within the Fossil CRMP project area. Since MSO only occur outside of the project area, a larger analysis area is considered and includes four six code watersheds: Upper Fossil, Lower Fossil, Hardscrabble Creek, and Mud Tank Draw. Five MSO PACs occur in the broader Fossil CRMP analysis area: Calf Pen, Horse, Sand, Sandrock, and Cove. These five PACs comprise 3,139 acres of PAC habitat within the Fossil CRMP analysis area. Table 3-29 shows the breakdown of MSO habitat within both the project area and the broader analysis area.

Table 3-29: MSO Habitat by Vegetation Type within the Project and Analysis Areas

MSO Habitat Type	Project Area Acres	Analysis Area Acres
PACs	0	3139
Mixed Conifer	112	6305
Ponderosa Pine/Gambel Oak	0	7112
Ponderosa pine (no Gambel Oak)	4	14888
Riparian	652	1408
Pinyon-juniper woodland	4,275	32,626

Figure 3-27 shows the location of the closest MSO PACs to the CRMP boundary. Table 3-30 shows the reproductive status of the four PACs.

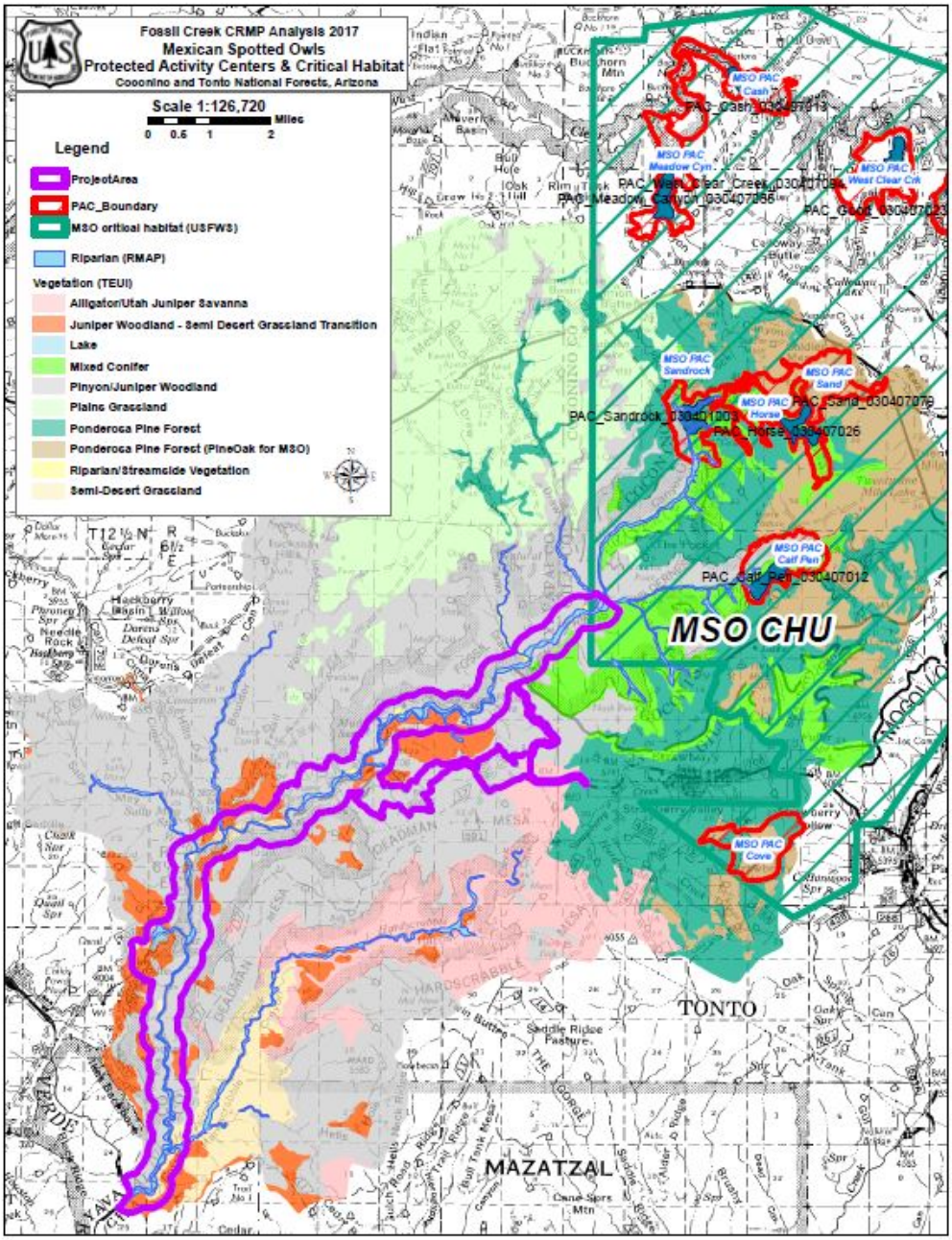


Figure 3-27: Mexican Spotted Owl Protected Activity Centers and Critical Habitat near Fossil CRMP project area

Table 3-30. Mexican spotted owl reproductive success for PACs within Fossil Creek WSR Corridor during the years monitoring occurred

PAC Name	PAC #	90	91	92	93	94	95	96	97	98	99	00	01	02	13
Sandrock	040103	NI	NI	NI	1Y	M, NU	NI	NI	M, NU	NI	M	NI	S	NI	NI
Calfpen	040421	O-NU	F-NU	O-NU	NI	O-NY	NI	NI	NI	NI	NI	O-NU	NI	NI	NI
Horse	407026	NI	NI	NI	NI	NI	NI	NI	NI	NI	O-2Y	O-NU	F-NU	O-NU	NI
Sand	407080	NI	NI	NI	NI	NI	NI	NI	NI	NI	O-NU	NI	NI	NI	NI
Cove	120405	O-NU	O-NY	A	A	A	A	A	A	A	NI	NI	NI	NI	A

O = Pair Occupancy
S = Single detected (sex unknown)
M = Male detected
F = Female detected
Y = Number of young fledged
NU = Nesting status unknown
NY = No young produced
NI = No Information (unsurveyed)
A = Absence or Unoccupied

Recovery Habitat

Recovery habitat is comprised of ponderosa pine/Gambel oak forest, mixed-conifer forest, and riparian forest outside of PACs that have the potential for becoming nest/roost habitat or could provide foraging, dispersal, or wintering habitat. The total acres of recovery habitat in the project area is 764 of mixed conifer and riparian; no ponderosa pine/Gambel oak occurs in the project area. The total acres of recovery habitat in the analysis area is 14,825 acres.

Other Forest and Woodland Types

The total acres of ponderosa pine forest (without Gambel oak) and pinyon juniper woodland habitat in the project area is 4,279 and in the analysis area is 47,514 acres.

Critical Habitat

Primary constituent elements (PCEs) described in the final rule for listing critical habitat for the Mexican spotted owl include the following:

(A) Primary constituent elements related to forest structure:

(1) A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 percent to 45 percent of which are large trees with a trunk diameter of 12 inches (0.3 meters) or more when measured at 4.5 feet (1.4 meters) from the ground;

(2) A shade canopy created by the tree branches covering 40 percent or more of the ground; and

(3) Large dead trees (snags) with a trunk diameter of at least 12 inches (0.3 meters) when measured at 4.5 feet (1.4 meters) from the ground.

(B) Primary constituent elements related to maintenance of adequate prey species:

(1) High volumes of fallen trees and other woody debris;

(2) A wide range of tree and plant species, including hardwoods; and

(3) Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.

(C) Primary constituent elements related to canyon habitat include one or more of the following:

(1) Presence of water (often providing cooler and often higher humidity than the surrounding areas);

(2) Clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;

(3) Canyon wall containing crevices, ledges, or caves; and

(4) High percent of ground litter and woody debris.

Recreation and associated activities will have no effect on PCEs related to forest structure or canyon habitats, the volume of fallen trees and other woody debris, the range of tree and plant species, prey species and their cover. No further discussion of the other PCEs will occur in this document.

MSO critical habitat normally consists of mixed conifer, pine-oak, riparian forest or canyons. The designated critical habitat in the analysis area is mainly comprised of pinyon-juniper and chaparral on canyon slopes , mixed conifer on north facing aspects, ponderosa pine forests above the rim, and riparian in the drainage bottoms. Since the Sandrock and Calf Pen PACs occur nearby, it is reasonable to assume that owls forage in the northern portion of the Fossil CRMP corridor within the designated critical habitat area, especially during the winter when owls disperse seasonally from their nesting areas.

The CRMP corridor contains 112 acres of designated critical habitat, all in the very northern portion of the CRMP corridor. There is no mixed conifer, or pine-oak in the Fossil CRMP corridor within designated critical habitat; only ephemeral riparian. The analysis area contains 24,037 acres of critical habitat.

Southwestern Willow Flycatcher

Southwestern willow flycatchers, federally listed as endangered with critical habitat, prefer dense riparian thickets in areas where perennial flow, surface water, or saturated soil is present when nesting from April through September. In most riverine situations, associated channels are wide and shallow with a well-defined floodplain and a broad valley. Streams are slightly entrenched with well-defined meanders and riffle/pool bed features. Quiet water dominates, as in backwaters, pools, beaver ponds, or non-riffle stream stretches.

Vegetative species composition and structure varies across the range of the southwestern willow flycatcher. The variation ranges from homogeneous patches of one or several species with a single canopy layer to heterogeneous patches of numerous species with existing under, mid, and over stories. Canopy covers are consistently high (>90%) throughout the range (Spencer et al. 1996). In the Verde Valley, nesting willow flycatchers occur in tamarisk and mixed riparian habitats. Patch width of breeding sites in both tamarisk and mixed riparian habitat types tend to be more linear, varying from 460 feet to 1,640 feet in maximum width (Sferra et al. 1995). Overstory canopies average between 50 and 55 feet tall (Spencer et al. 1996). Patch size varies from 5 to 121 acres in mixed riparian and tamarisk (Spencer et al. 1996).

Surveys and Habitat in the Analysis Area:

Surveys for the southwestern willow flycatcher have been conducted at several locations in the analysis area. In 1994, USFS personnel conducted surveys at Fossil Springs, “Aqueduct Spring” which was actually a leak in the flume on the other side of the road from Homestead, and at Stehr Lake. Fossil Springs was determined potential habitat. Since decommissioning, neither “Aqueduct Spring” nor Stehr Lake provide any flycatcher habitat. Environet surveyed two additional sites along Fossil Creek in 1998. These sites included from Irving downstream to the 708 bridge and from the 708 bridge downstream to the Boulder bridge. Surveys conducted in 1994 and 1998 at these sites failed to detect any southwestern willow flycatchers.

Prior to restoration of full flows, riparian habitat along Fossil Creek differed from habitats typically occupied by southwestern willow flycatcher in Arizona due to the higher gradient, the narrow band of riparian vegetation and the relatively open mid- and under-story vegetation layers. Since full flows were restored in 2005, travertine formation have formed step pools with slower water, resulting in better quality habitat for willow flycatchers. In 2011, Matt Johnson from NAU, through an agreement with the Forest Service, conducted surveys for the

southwestern willow flycatcher in Fossil Creek in various locations. Routes were placed at these locations based on the marginal flycatcher habitat that is present. Most other areas in Fossil Creek do not meet the habitat requirements. Refer to Figure 3-28. All surveys in 2011 were negative. No further surveys have been conducted since 2011.

Because even the best habitat within Fossil Creek is marginal and surveys have been negative, it is the determination that there is a very low possibility that southwestern willow flycatchers nest in the FC WSR boundary.

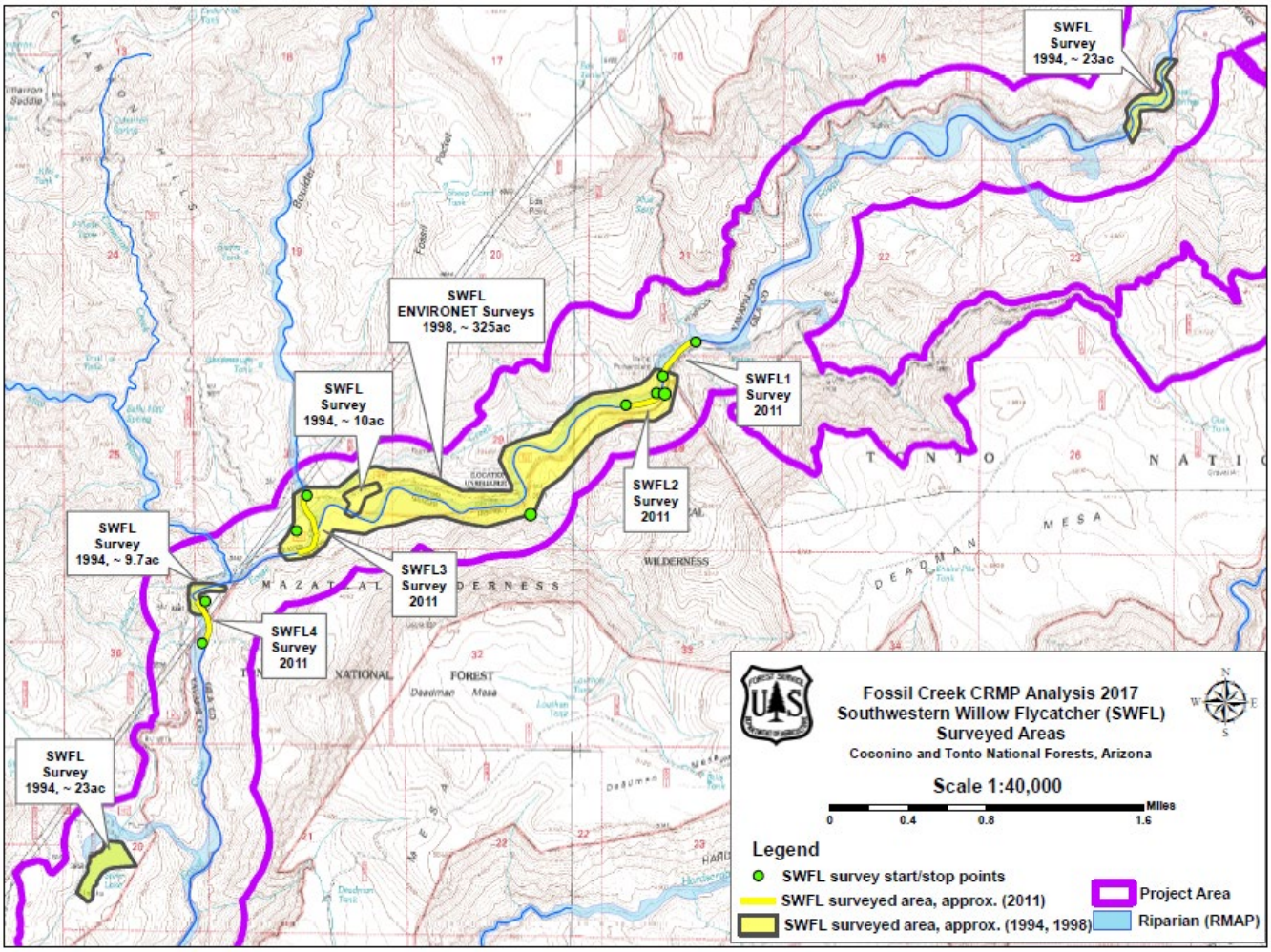


Figure 3-28: Southwestern Willow Flycatcher Survey Locations

Critical Habitat

Although revised critical habitat has been designated for southwestern willow flycatchers, there is no critical habitat near or within the Fossil CRMP boundary.

Western Yellow-billed Cuckoo

The yellow-billed cuckoo, federally listed as threatened with proposed critical habitat, is a late spring/summer migrant associated with large tracts of undisturbed riparian deciduous forest where willow, cottonwood, sycamore, or alder occur. Yellow-billed cuckoos in higher elevations may be found in mesquite and tamarisk. The yellow-billed cuckoo feeds almost entirely on large insects, and if food stressed, may also feed on berries and fruit.

Habitat and Surveys in the Analysis Area

A query of the Fossil Creek database (Appendix C) shows that a yellow-billed cuckoo was detected in the Fossil Creek riparian area in 1999 by former Coconino biologist Cathy Taylor. The exact location is unknown, however. AGFD conducted a survey for the cuckoo at Verde Hot Springs along the Verde River, however no cuckoos were detected. Although recent surveys in the most suitable habitat were conducted in three main areas of Fossil Creek from just below Irving Power Plant up through the Fossil Springs area by NAU in 2005, 2006, 2007, 2008, and 2009, there have been no detections of yellow-billed cuckoos. Surveys have not been conducted in the remaining two thirds of Fossil Creek but there is suitable habitat in areas where the channel is not canyon-bound and where adjacent mesquite woodlands occur. Mesquite bosques adjacent to riparian are important for cuckoos for foraging. Based on personal observation by wildlife biologist Janie Agyagos between 2004 and 2012, the largest patches of mesquite woodland in Middle Fossil occur at Homestead, Old Corral, Purple Mountain, Mazatzal, and Stehr Lake. Smaller, mixed stands of mesquite occur in various other locations within the middle section and may provide suitable cuckoo foraging habitat. In addition, a GIS mapping exercise combined with Google Earth mapping indicated numerous stands of adjacent mesquite woodlands in the Mazatzal wilderness that has never been surveyed. Refer to figure 3-29 for the approximate locations of mesquite woodlands that provide suitable foraging habitat for cuckoos.

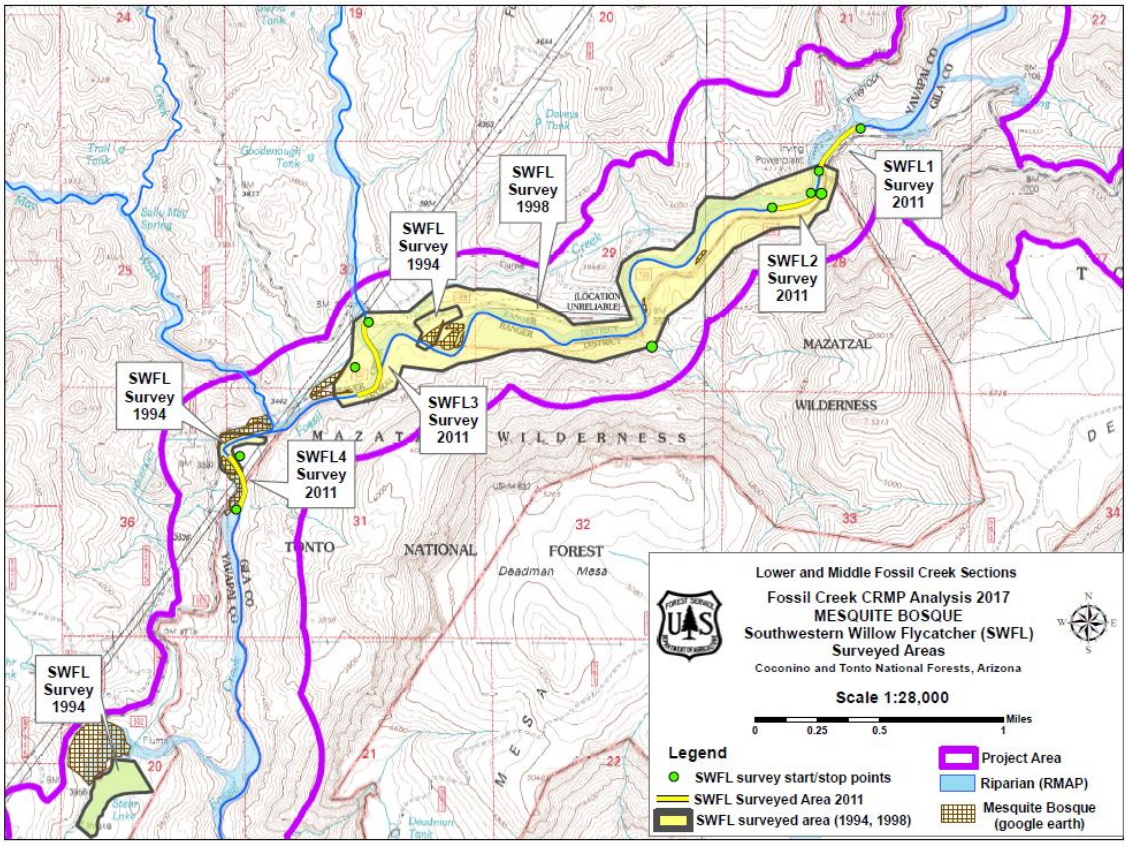


Figure 3-29: Approximate locations of mesquite bosques along Fossil Creek

The following information was obtained directly from the report "2008 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ" (Johnson et al, 2008) and provides an explanation as to why cuckoos have not been detected along Fossil despite the presence of important habitat components:

> The Western Yellow-billed Cuckoo may be experiencing what the Southwestern Willow Flycatcher is experiencing, a recent low population level at many sites in the southwest making local populations susceptible to extirpation (Sogge et al 1997, Hughes 1999, USFWS 2002). It is possible that as cuckoo populations in Arizona riparian corridors have become reduced and more fragmented than in the past, and local breeding groups may have produced

insufficient young to offset adult mortality. Similar local extirpation of Southwestern Willow Flycatchers has recently been documented (Sferra et al. 1997) and can be driven by habitat loss. As Yellow-billed Cuckoos became rarer in the region, the likelihood of recolonization of former breeding areas could be greatly reduced. Therefore, suitable habitat may currently be unoccupied because the cuckoo is now so rare that there are not enough cuckoos to disperse into and settle in all available habitats. If so, effective management and recovery of current cuckoo populations and riparian habitats may lead to increasing populations which could resettle in areas such as Fossil Creek.

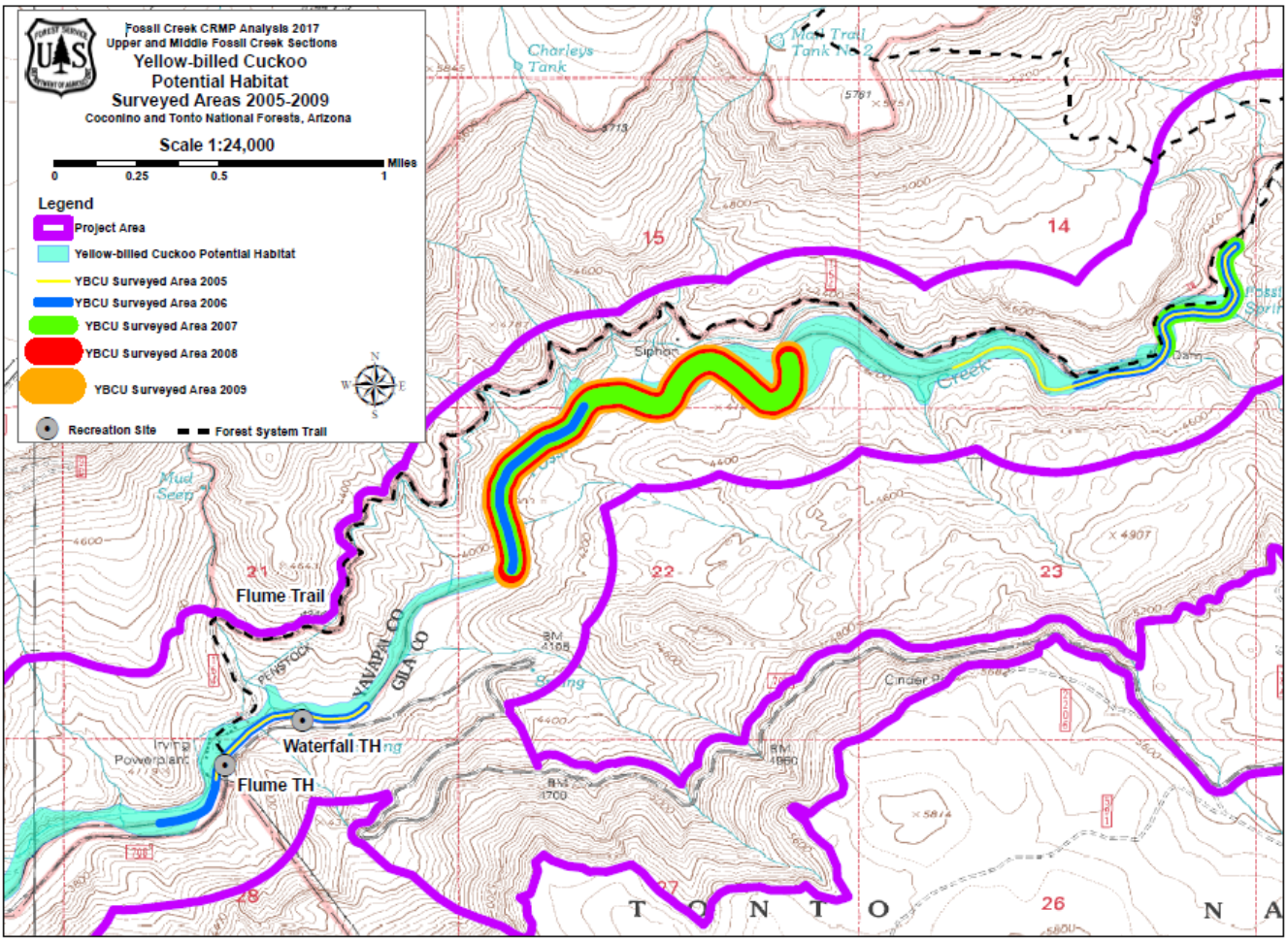


Figure 3-30: Suitable Habitat Surveyed for Yellow-billed Cuckoo

Proposed Critical Habitat

Although critical habitat has been proposed for western yellow-billed cuckoos, there is no critical habitat near or within the Fossil CRMP boundary.

Chiricahua Leopard Frog and its Critical Habitat

Habitat in the Analysis Area:

As described in Sredl and Jennings (in press), Chiricahua leopard frogs are habitat generalists, breeding in slack waters in a variety of natural and man-made aquatic systems. They are federally listed as threatened with critical habitat. Their elevational range is from 3,281 to 8,890 feet (USFWS 2002) but occur in the Buckskin Hills Conservation Management Zone (CMZ) between 5,020 and 5,780 ft. Adult frogs are found in perennial and near-perennial habitats, and reproduction is aquatic. Habitat heterogeneity is important in providing habitat for the frog's different life stages and seasonal requirements.

Egg masses of Chiricahua leopard frogs have been reported in all months except November, December and January (see Sredl and Jennings, in press). In Arizona, Frost and Platz (1983) found that egg-laying occurred in two distinct periods, depending on elevation. Populations at elevations below 5,900 feet (1,800 m) tended to lay eggs from March through late summer, with most activity occurring before June, while populations above 5,900 ft (1,800 m) bred in June July and August.

Known populations of Chiricahua leopard frogs on the Forest are referred to as the Rim form, since these populations occur along the southern edge of the Colorado Plateau and are disjunct from the southeastern form that inhabits portions of southeastern Arizona, southwestern New Mexico, and the Sierra Madre Occidental in Mexico (Sredl et al 1997b). From 1993–1997, the Rim form Chiricahua leopard frogs were documented at 15 sites, 4 of which were on the Coconino National Forest (Sredl et al 1997b), located in the Fossil watershed, but well outside of the Fossil Wild and Scenic River corridor. This represented 27% of occupied sites. Chiricahua leopard frogs are absent from many locations that previously supported populations as recently as the late 1970's and early 1980's (Sredl et al 1997b).

As natural habitats have been altered or destroyed, stock tanks constructed for watering livestock have become important habitats for Chiricahua leopard frogs (Sredl and Saylor 1998). As of 1997, 39% of known Rim form Chiricahua leopard frog sites were livestock tanks (Sredl et al 1997b). In some areas, tanks provide the only suitable habitat available (USFWS 2002). To date, the only extant populations within the Buckskin Hills/Mud Tanks area are located in stock tanks, as have all the known occupied sites on the Fossil Allotment. While important for frogs, the dynamic nature of stock tank habitats and the relatively small populations they support makes it unlikely that frog populations that occupy them will persist indefinitely at any given tank (USFWS 2002). Tanks are susceptible to drying out in drought years, and flooding may breach impoundments or cause siltation, resulting in impacts to frogs and their habitats. Tanks that provide suitable habitat have open water and at least some perimeter vegetation. While bigger tanks often provide more diverse habitats, the permanency of water is more important than the size of the tank (M. Sredl, pers. comm., Sept. 2001).

Surveys in the Project Area:

Leopard frog and other herpetofauna surveys have been conducted on the Forest since the early 1990s. Most of the early surveys have been conducted by the Arizona Game and Fish Department (AGFD) and results have been documented in several reports (Sredl and Howland 1992, Sredl et. al 1993, Sredl et al 1995, Windes et al 1997). Sredl et al (1997b) summarized the results of statewide surveys for Arizona native ranid frogs, including the Chiricahua leopard frog, to describe their current status and distribution. Surveys since 1997 have been conducted by agency biologists from AGFD, USFWS and USFS.

The only extant populations of Chiricahua leopard frogs in the analysis area occur in the southern part of the Coconino National Forest, in an area known as Buckskin Hills/Mud Tanks. Records exist from other locations along the Mogollon Rim, including East Clear Creek and West Clear Creek drainages, but these sites have been unoccupied since at least the mid-1980s. There are no records of Chiricahua leopard frogs in Fossil Creek proper; the species of leopard frog in Fossil Creek is the lowland leopard frog.

While the occupied sites occur in the broader Fossil CRMP analysis area, they do not occur near the CRMP corridor and project analysis area. Currently occupied, previously occupied, suitable unoccupied, and critical Chiricahua leopard frog habitat occurs in the upper portion of the Fossil Creek watershed, approximately 2.5 to 3 miles from the CRMP corridor; refer to Figure 3-31.

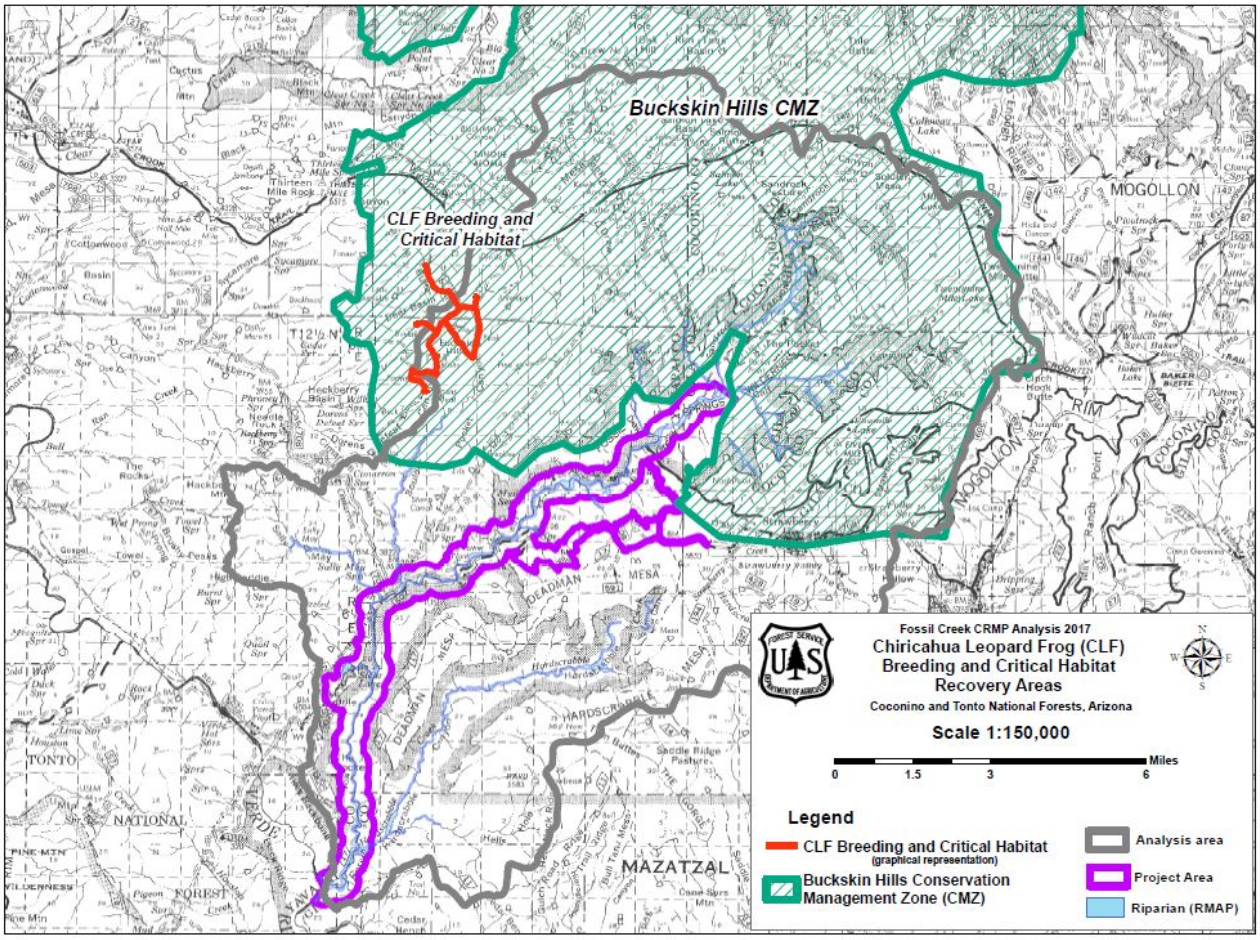


Figure 3-31: Historic, recently occupied, suitable, and occupied Chiricahua leopard frog sites near Fossil WSR Corridor

Critical Habitat

Although critical habitat for the Chiricahua leopard frog does not occur within the Fossil CRMP project area boundary, it does occur within the Upper Fossil Creek watershed and the broader analysis area.

Mexican Gartersnake and its Proposed Critical Habitat

The Northern Mexican gartersnake, which is federally listed as threatened with proposed critical habitat, is usually found in or near streams and ponds in canyons up to 6,200 feet in elevation. This gartersnake is most closely linked to shallow slow-moving or impounded waters, though it also occurs in other aquatic environments. Where Mexican gartersnakes currently exist along Oak Creek, they occur in marsh-like situations where slow water is shallow enough to support dense stands of emergent vegetation. The diet of the Mexican gartersnake consists of leopard frogs, toads, tadpoles, and various native fishes. Lizards and small rodents are taken during occasional terrestrial forays. The Mexican gartersnake is known to be associated with several species of leopard frogs which are a major prey species. As a result of telemetry work on the extant population on Oak Creek, Mexican gartersnakes have been detected in the uplands mostly during brumation where they occur under rocks but also during summer months.

Habitat in the Analysis Area:

There are no records that herp surveys occurred before the hydropower operations dewatered Fossil in the early 1900s. So, the historical record is not complete enough to say whether Mexican gartersnakes historically occurred in Fossil Creek. Due to the lack of historical and contemporary records for gartersnakes in Fossil Creek, Erika Nowak, USGS herpetologist, has indicated that Fossil Creek riparian is potential habitat for the Mexican

gartersnake. Almost one hundred years of diverting flow greatly altered habitat and inhibited travertine formation reducing the habitat potential for Mexican gartersnakes. In recent decades, years of non-native aquatic organisms (fish and crayfish) reduced, and in some cases extirpated populations of native aquatic prey species (fish, tadpoles, frogs, and toads). Since restoration of the native fisheries in 2004, abundant prey (native toads, frogs, and fish) is present in Fossil from the springs downstream to the permanent fish barrier, approximately 10 miles. Since restoration of full flows in 2005, prime suitable habitat exists especially between the historic Fossil Springs dam and the waterfall where high travertine deposition rates result in the formation of travertine formations which allows for sluggish waters with dense aquatic emergent vegetation. Various herpetological surveys in the last few decades have not resulted in the detection of Mexican garter snakes in Fossil Creek. The nearest closest sightings of Mexican garter snakes have been along the Verde River (in the upper Verde River) and several of its tributaries, particularly Oak Creek but also Houston Creek on the Tonto.

Critical Habitat

Critical habitat is proposed for the northern Mexican gartersnake along the Verde and therefore a slight amount (600 feet of Fossil Creek upstream from the Verde River) occurs within the project area boundary down by the confluence of Fossil with the Verde River.

Narrow-headed Gartersnake and its Proposed Critical Habitat

The narrow-headed gartersnake, which is federally listed as threatened with proposed critical habitat, is the most aquatic of the gartersnakes, seldom found far from quiet, rocky pools in large streams and rivers. It is primarily a Mexican species, but occurs in various areas along the Mogollon Rim. Food items include fish (native species preferred), frogs, tadpoles, and salamanders. Population declines have been attributed to loss of habitat, decline in native fish that are prey items, introduction of predaceous nonnative aquatic organisms (crayfish, bullfrogs, and fish) that eat or displace native prey species, and killing by humans (Nowak and Santana-Bendix 2002). Narrow-headed gartersnakes escape from threatening situations by diving underwater and hiding under rocks. Narrow-headed gartersnakes are highly aquatic, but move to the uplands during periods of shedding and during brumation. During brumation narrow-headed gartersnakes have been radio-tracked and found underneath rocks.

Habitat and Surveys in the Analysis Area

Agency biologists have conducted numerous herpetological surveys along Fossil Creek, particularly from the springs downstream to the Mazatzal Wilderness boundary. No narrow-headed gartersnakes have been detected. However, in 2005, an AGFD fish survey crew documented a narrow-headed gartersnake on the Verde River near the Verde confluence. This observation was validated to be an accurate identification of species (J. Agyagos pers. comm. with Bill Burger).

Like Mexican gartersnakes, it is likely that narrow-headed gartersnakes historically occurred in Fossil Creek. However, years of non-native aquatic organisms (fish and crayfish) reduced, and in some cases extirpated populations of native aquatic prey species (fish, tadpoles, frogs, and toads). In addition, almost one hundred years of diverting flow greatly altered habitat and travertine formation reducing the habitat potential for narrow-headed gartersnakes. Currently habitat conditions for narrow-headed gartersnakes are much improved due to the restoration of full flows, development of travertine formations, establishment of deeper pools, and the removal on nonnative fish species throughout nine miles of stream.

Critical Habitat

Critical habitat is proposed for the narrow-headed gartersnake along the Verde and therefore a slight (600 feet of Fossil Creek upstream from the Verde River) occurs within the project area boundary down by the confluence of Fossil with the Verde River.

Forest Service Sensitive and Locally Important Species

All species on the Coconino and Tonto National Forests Regional Forester’s Sensitive Species List Threatened, Endangered and Sensitive Species List were reviewed for this project. Of these, 16 sensitive species and locally

important species are present or have potential habitat within the analysis area and are included in this analysis. Table 3-31 summarizes these species.

Table 3-31. List of sensitive and locally important species the Fossil Creek Wild and Scenic River Corridor

Common Name	Scientific Name	Status
Birds (4)		
Common Black-hawk*	*Buteogallus anthracinus*	LIS
Bald Eagle	*Haliaeetus leucocephalus*	Sen
American Peregrine Falcon	*Falco peregrinus anatum*	Sen
Northern Goshawk	*Accipiter gentiles*	Sen
Amphibians (2)		
Lowland Leopard Frog	*Rana yavapaiensis*	Sen
Arizona Toad*	*Bufo microscaphus microscaphus*	LIS
Mammals (4)		
Western Red Bat	*Lasiurus blossevillii*	Sen
Allen's Lappet-browed Bat	*Idionycteris phyllotis*	Sen
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Sen
Spotted Bat	*Euderma maculatum*	Sen
Snails (1)		
Fossil Springsnail	*Pyrgulopsis simplex*	Sen
Plants (5)		
Arizona Phlox	*Phlox amabilis*	Sen
Cochise Sedge,	*Carex ultra*	Sen
Metcalfe's Tick-trefoil	*Desmodium metcalfei*	Sen
Mt. Dellenbaugh Sandwort	*Eremogone aberrans formerly Arenaria aberrans)*	Sen
Eastwood Alumroot	*Heuchera eastwoodii*	Sen

*Common black-hawk and Arizona toad were on the Regional Forester's Sensitive Species list up until 2013. These species continue to be analyzed as locally important species. Plus, the common back-hawk is a management indicator species on the Tonto National Forest.

Legend:
Sen = 2013 Regional Forester's Sensitive Species
LIS = locally important species

Birds

Common Black-hawk

Habitat in the Analysis Area:

The black-hawk can be found in low elevation riparian areas. The black-hawk is dependent upon a mature, relatively undisturbed habitat supported by a permanent flowing stream. Groves of tall trees must be present along the stream course for nesting. Black-hawks are still hunters, hunting from tree and cliff perches although they will also wade into water and chase after prey including crayfish, amphibians, reptiles, and fish. Streams of low to moderate gradient and less than one foot deep with scattered boulders are ideal for foraging.

The black-hawk has been observed in all reaches of Fossil Creek. Suitable nesting habitat is present from Fossil Springs downstream to the Verde. Monitoring data exists for black-hawk nest sites along Fossil creek. Refer to figures 3-32 and 3-33 for black-hawk nest locations by year.

Common black-hawks were reported to nest at densities of 0.64 pairs/mile in Aravaipa Canyon, Arizona just south of the Tonto National Forest (Schnell 1994). In New Mexico, linear nesting density was 0.93 pairs/mile (Sadoti, 2008). Linear nesting density in Fossil Creek was approximately 0.93 pairs/mile in 2006 (four nests occupied along 4.25 miles between Fossil Springs and Irving). In 2011, with six nests, linear nesting density was approximately 0.78 pairs/mile but two nest sites had been abandoned that year. If all territories had been occupied in 2011, the linear nesting density would have been approximately 1.03 pairs/mile (Sadoti 2012).

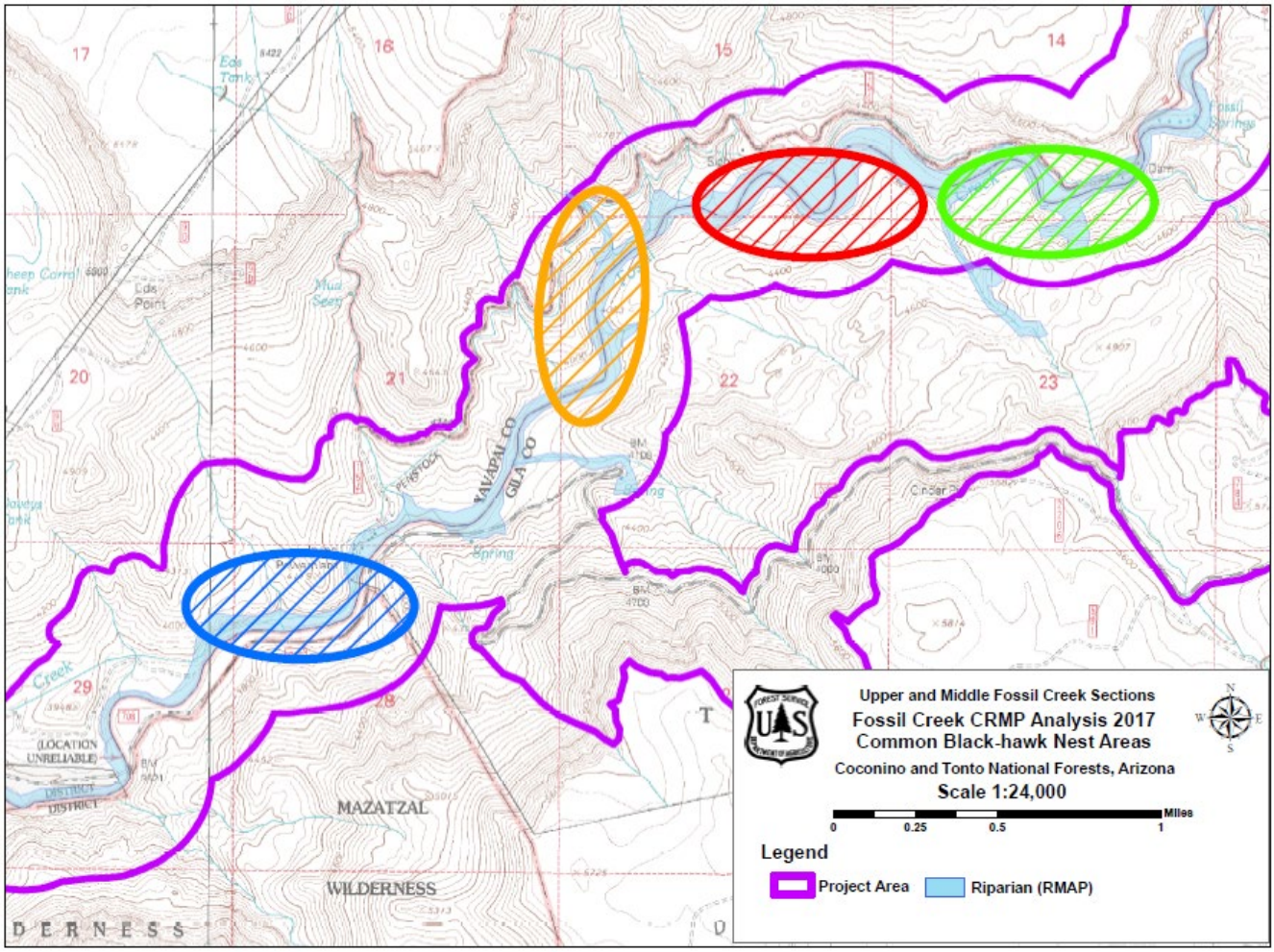


Figure 3-32. Known black-hawk nest sites in Middle Fossil from NAU monitoring

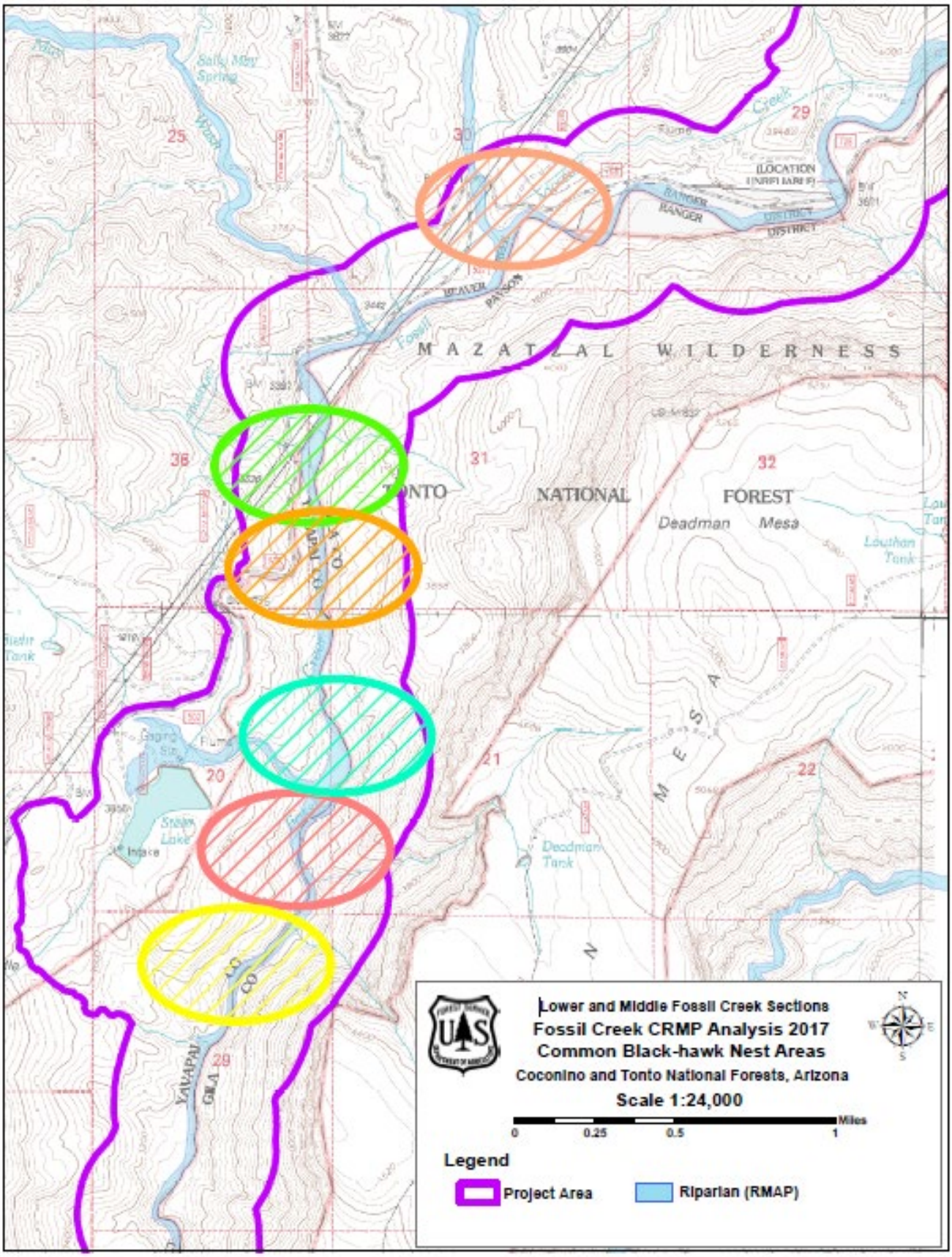


Figure 3-33. Known black-hawk nest sites in Middle Fossil from NAU monitoring

Desired condition
Recreation and recreation management activities in Fossil Creek do not result in black-hawk nest site abandonment and black-hawks continue to have high nesting success due to the abundance of native prey species and compatible recreational levels.

Black-hawk nest sites and a 200 meter buffer around nests are largely free from visual and aural disturbance during the breeding season (March 15-Aug 30). More specifically, the desired condition is to have eight or more nesting pairs from the spring source (Fossil Springs) downstream to 0.5 mile below Mazatzal. This includes the 2011 nests plus re-occupancy of nests near the waterfall and historic Fossil Springs dam. Based on the distance between known nest sites in Fossil Creek (average of 0.9 miles), theoretically, there is potential for upwards of 16 black-hawk nests throughout the entire Fossil Creek WSR corridor. Desired black-hawk nest success will be 90% or higher (higher than the 2011 levels of 83%). There would be no detections of nesting mortalities or nest failure attributed to human influences. Native prey will constitute 95% or more of black-hawk diets (Johnson et al 2009). Emergency helicopter landings occur so infrequently as to not cause nest or area abandonment.

Baseline Condition (2009)
Surveys for black-hawks were conducted in 2005, 2006, 2007, 2009, and 2011. Following is a summary of black-hawk nests through 2011. By 2009, numbers of nest sites from Fossil Springs Dam downstream to just below Irving had decreased from four to two. A nest site by the historic Fossil Springs dam and a nest site by the waterfall had been abandoned after 2007 but before 2009. Surveys in 2009 detected two additional black-hawk nests in Fossil; both downstream of the Mazatzal site.

Table 3-32. Blackhawk survey results, 2005-2009

Nest Site Location	2005	2006	2007	2009	2011
Historic Fossil Springs dam	O	O	O	UO	UO
Between Dam and Large Waterfall	UO	O	O	O	O
Large Waterfall	O	O	O	UO	UO
Irving	O	O	UO	O	O
Homestead	NI	NI	NI	UO	O
Downstream of Purple Mountain	NI	NI	NI	UO	O
0.5 mile Downstream of Mazatzal	NI	NI	NI	O	UO
Downstream of Mazatzal #2	NI	NI	NI	O	UO
Above fish barrier #1	NI	NI	NI	NI	O
Above fish barrier #2	NI	NI	NI	NI	O

Legend: O = Occupied, UO = unoccupied, and NI = No information since not surveyed

In 2008 and 2009 NAU conducted a prey delivery study (Etzel et al, 2014) and compared Fossil prey deliveries to those of other Verde Valley tributaries (Oak Creek, Wet Beaver Creek, and Red Tank Draw). They found that Fossil black-hawks delivered a much higher percentage of native aquatic prey (fish and amphibians) to nestlings than black-hawks in other systems (where prey deliveries were predominately crayfish and reptiles. This supports that the restoration of full flows and the native fish restoration efforts in Fossil has resulted in an increase in native prey. Despite this increase in native prey, monitoring results show a decrease in the number of Black-hawk detections. Areas of nest abandonment correspond to areas with increased recreational activity. Even with restored flows and restored native fish (prey), 2009 or higher recreation levels in Fossil Creek will continue to result in adverse effects to black-hawks. Sadoti et al. (2014) states that although black-hawks can persist with minor

amount of human activity, sustained disturbance may cause delayed nesting or nesting abandonment when these activities occur near a nesting pair of black-hawks.

For the two recreation sites where black-hawk nests had been abandoned (the waterfall and Fossil Springs), bare area monitoring in 2009 revealed substantial increases in the number of campsites and amount of soil disturbed by camping, as described in the *Affected Environment Common to All Resources* section at the beginning of this chapter.

After restoration of full flows, recreation numbers in Fossil Creek increased steadily between 2005 and 2009. There was almost a doubling in visitation between 2008 and 2009 alone. Refer to the *Affected Environment Common to All Resources* section for the total estimated number of people.

Existing Condition
Recreation use data from 2011 is used in the following discussion since 2011 is the last year in which black-hawk monitoring was conducted. Common black-hawks are known to be susceptible to sustained human disturbance (Sadoti et al., 2014). Sadoti et al. (2014) states that although black-hawks can persist with nimor amount of human activity, sustained disturbance may cause delayed nesting or nesting abandonment when these activities occur near a nesting pair of black-hawks. Sadoti et al. (2014) also stated that the majority of nesting black-hawks (80%) were more than 128 meters from human activity. During the seven years of black-hawk monitoring in Fossil Creek a decline in nesting activity and detections has been observed in the upper reach of Fossil Creek. Prior to increase in recreation there were four black-hawks nesting from the Fossil Springs area downstream to just below Irving, more specifically at the dam, near the sunfish barrier, at the waterfall, and just downstream of Irving. By 2011, black-hawks breeding areas in this reach decreased by 50% with black-hawks no longer nesting at the dam or the waterfall site. A likely explanation is the increase in recreational activity in this section since these nests were within the Fossil Springs and Waterfall recreation sites, as described in the *Affected Environment Common to All Resources* section at the beginning of this chapter. The period of high recreational use in Fossil Creek is from May through August and coincides with the most critical portion (1 June – mid July) of the black-hawks breeding period (April- July). There is concern that increasing levels of recreation will further alter black-nesting in areas where recreation activity is high.

While monitoring shows the upper portion of Fossil Creek supported twice as many nesting black-hawks in 2004 than in 2011, there are other inferences to be made from seven years of monitoring. First it helps to have an understanding of the current (2011) distribution of nesting black-hawks in Fossil Creek:

- From the Springs to the downstream-most surveyed area (below Mazatzal) which is approximately 7 miles, there are 6 nesting pairs of black-hawks.
- In the upper reach from the Springs down to Irving (approximately 3 miles), there is only one nesting pair.
- From Irving downstream to Purple Mountain (the last recreation area with current high use), there are only two nesting pairs occupying this three mile reach.
- From Purple Mountain to ½ mile downstream of Mazatzal (a little over a mile reach), there are three nesting pairs.

Bald Eagle

Nesting Bald Eagles:
Bald eagles in central Arizona prefer to nest on cliff ledges or pinnacles or in tall trees (USDI 1982). They mainly forage on waterfowl and fish found along major streams, however, they do hunt in the uplands and forage on various mammal species, especially in the winter. The Arizona Game and Fish Department has been conducting and coordinating surveys and monitoring of nesting eagles for many years.

No bald eagle nest sites are known to occur in Fossil Creek, although one immature bald eagle was observed constructing a nest by an agency biologist in 2004 near the Irving power plant. More recently, AGFD periodically flies up Fossil creek and has observed eagles in the area, but no nesting attempts have been observed. AGFD will continue flying up Fossil Creek to investigate (personal comm. Kenneth Jacobson 1Feb10).

Bald eagles are known to nest along the Verde River on the Prescott, Coconino, and Tonto National Forests. The Coldwater bald eagle breeding area (BA) occurs along the Verde River several miles upstream of the Fossil confluence. Nests associated with the Coldwater BA are located as far upstream as 6.0 miles upstream of the Child's power plant and downstream to halfway between the Child's Power Plant and the confluence of Fossil with the Verde. However, this breeding area has been unoccupied since 2014. The East Verde BA occurs along the Verde downstream of the East Clear Creek confluence and those eagles may forage along Fossil Creek. Refer to Table 3-33 for the reproductive success of these two bald eagle breeding areas.

Table 3-33: Nesting Results for Coldwater and East Verde Bald Eagles

Site Name	Year	Nesting Status
Coldwater	1999	Failed
	2000	Failed
	2001	Failed
	2002	2 Fledged
	2003	1 Fledged
	2004	1 Fledged
	2005	2 Fledged
	2006	1 Fledged
	2007	2 fledged
	2008	1 Fledged
	2009	Failed
	2010	Failed
	2011	2 Fledged
	2012	1 Fledged
	2013	Occupied, Nesting Success Unknown
	2014	Unoccupied
	2015	Unoccupied
	2016	Unoccupied
	2017	Unoccupied
East Verde	1995	1 Fledged
	1996	1 Fledged
	1997	Failed
	1998	Failed
	2000	2 Fledged
	2001	Failed
	2002	Failed
	2003	Occupied, Nesting Success Unknown
	2004	1 Fledged
	2005	Occupied, Nesting Success Unknown
	2006	Failed
	2007	Failed
	2008	Occupied, Nesting Success Unknown
	2009	Failed
	2010	Failed
	2011	Failed
	2012	2 Fledged
	2013	1 Fledged
	2014	1 Fledged
	2015	1 Fledged
	2016	2 Fledged
	2017	Failed

Wintering & Roosting Bald Eagles:

Bald eagles occupy northern Arizona primarily as a winter resident or migrant. Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. Numbers of eagles peak in February and March. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. Eagles are often seen perched in trees or snags near water or next to roadways where they feed on road-killed animals. However, bald eagles are highly mobile in the winter, and can fly great distances in search of aquatic or terrestrial prey and suitable nighttime roosting habitat. Wintering bald eagles could occur throughout the Fossil area, particularly along the riparian

corridor where they forage on fish and waterfowl. Wintering bald eagles may also forage opportunistically throughout the uplands.

National bald eagle winter surveys have been ongoing since 1979. They were initiated and organized by the National Wildlife Federation (NWF) from 1979-1991, and have since been coordinated by the Raptor Research Technical Assistance Center (Bureau of Land Management). The AGFD is the coordinating agency for the annual statewide survey. Mid-winter surveys were conducted on the Coconino National Forest in 1979-1985 and 1992-present.

There are no survey routes that occur close to the Fossil CRMP corridor. The nearest route, Highway 87S occurs from the intersection of Highway 87 and FH-3 at Clint's Well southeast to Highway 87 and west on Highway 260 to the Verde Ranger Station just outside of Camp Verde (both Coconino and Yavapai Counties). Bald eagles were detected in 16 of 22 years of surveys. Of the 16 years in which eagles were detected, more than one bald eagle was detected on counts in 11 different years. The average count for that route is 1.6 eagles. Refer to table 3-34 for a summary of winter bald eagle county survey results.

Table 3-34: Bald Eagle Winter Count Survey Results for Routes near Fossil CRMP Corridor

Route Name	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Hwy 87 South	2	3	2	1	n/c	1	3	1	0	0	0	n/c	2	0
Route Name	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Ave**			
Hwy 87 South	3	3	3	1	3	0	1	2	3	0	1.60			

n/c = Route was not surveyed that year.

In addition to vehicle routes already discussed, AGFD conducts annual flights along the Verde River (Yavapai County) during the mid-winter bald eagle count period. Eagles are consistently detected during midwinter surveys in the reach of the Verde River from the East Verde up to the West Clear Creek confluence (Beatty 1992, Beatty et. al 1995a, Beatty et. al 1995b, Beatty et. al 1999).

Fossil Creek above its confluence with the Verde River (Yavapai County) is not included in any midwinter survey routes. Prior to restoration of flows, the fishery supported by minimal flows in Fossil Creek provided limited foraging habitat for eagles. Now that full flows have been restored Fossil will support suitable food sources for bald eagles.

Bald eagles use night communal roosts that may be related to food finding (Hansen et al. 1980) or energetic considerations (Keister 1981, Knight et al. 1983). Night roosts are often on slopes (Platt 1976, Hansen et. al 1980, Dargan 1991) or are protected from prevailing winds by surrounding vegetation (Sabine 1981, Steenhof 1976). Individual roost trees are larger than trees in adjacent stands and have open canopies (Stalmaster and Newman 1979, Hansen et al. 1980, Anthony et al. 1982, Keister and Anthony 1983, Dargan 1991).

On the Forest, wintering eagles occupy most habitat types and elevations, but are most frequently seen within ponderosa pine and pinyon-juniper habitats, often near water. They roost at night in small to moderate-sized groups (typically 2-48) in clumps of large trees in protected locations (Grubb and Kennedy 1982, Dargan 1991). These roosting areas are ponderosa pine stands that are variable in size (less than an acre to 43 acres), are on north or northeast-facing slopes, and are close to daytime foraging areas (Dargan 1991). On the CNF, there are currently 38 eagle roosts that have been spatially identified in GIS; none of which occur near the project area boundary. In Fossil CRMP corridor, communal roosting may potentially occur where ponderosa pine forests are present, especially where suitable conditions such as steep slopes, wind protection, open canopy, and larger trees occur. Grubb and Kennedy (1982) document Fossil Springs (Yavapai County) as an area where there was either historic or reported use. Due to the presence of large trees protected from the wind by adjacent slopes along portions of the creek, potential roosting habitat occurs along Fossil Creek.

American Peregrine Falcon

The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999a) and is now a Forest Service Sensitive species. The essential habitat for the peregrine falcon includes rock cliffs for nesting and a large foraging area. Suitable nesting sites occur on rock cliffs with a mean height of 200 to 300 feet. The subspecies *anatum* breeds on isolated cliffs and is a permanent resident on the Tonto and Coconino National Forests. Peregrines prey mainly on birds found in wetlands, riparian areas and meadows within a 10 to 20 mile radius from the nest site. They also prey on doves, pigeons and passerines. The peregrine breeding season is from March 1 to August 31.

Surveys and Habitat in the Analysis Area

Suitable nesting habitat occurs in the project area where cliff faces greater than 200 feet in elevation occur. AGFD conducted habitat suitability surveys along the 708 road. AGFD biologists did not consider the cliffs along Fossil Creek from one mile below Fossil Springs to Stehr Lake as suitable nesting habitat. Surveys were not conducted below Stehr Lake yet cliffs in excess of 200 feet do occur there and along other sections of Fossil Creek. Since the peregrine's recovery, peregrine nests are being discovered in habitat previously thought to be less than suitable. Therefore, it is now believed that peregrine falcons could occur throughout most of Fossil Creek. Environet biologists identified and mapped 7,230 acres of potential nesting habitat along Fossil Creek (figure 3-34). Additionally, peregrine falcons may forage all along Fossil Creek where prey species such as swallows, swifts, and waterfowl may occur. In addition peregrine falcons may use the seasonal or semi-permanent wetlands or stock tanks as foraging areas in the surrounding uplands.

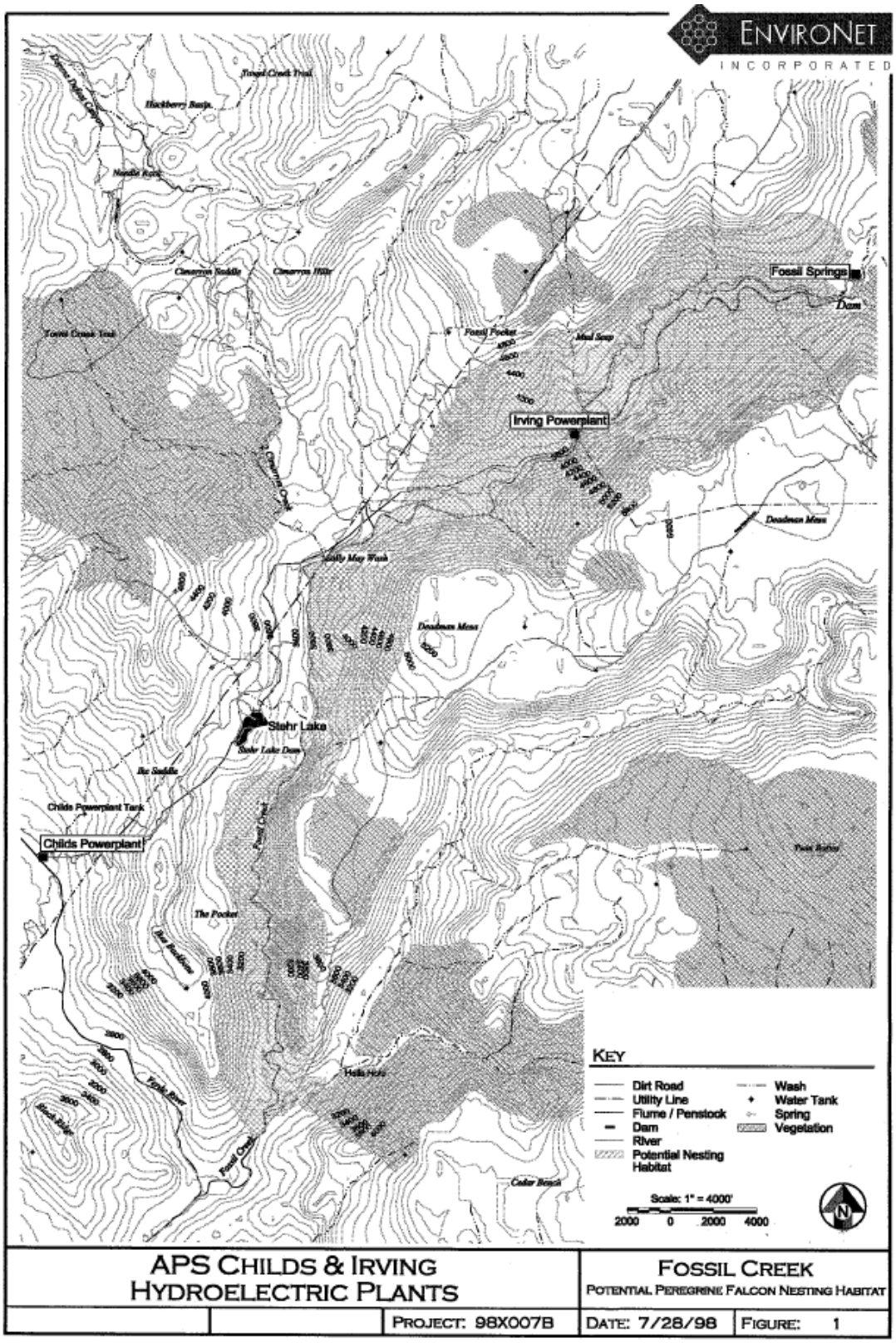


Figure 3-34: Suitable peregrine falcon nesting habitat along Fossil Creek

There are no known Peregrine falcon eyries within the Fossil CRMP corridor, however there have been reports of adults with young by biologists during black-hawk and cuckoo surveys. In addition, a pair of peregrines were seen flying into a crevice on a cliff face at Fossil Springs in March of 2014. There was no sign of whitewash during a follow-up investigation in 2015 but that occurred in October, well after the breeding season. It's possible that

whitewash was present but not visible. The nearest known eyries are Nash Point, 1.3 miles east Fossil CRMP corridor, Calf Pen 3.1 miles east, and East Verde 1.2 miles southeast of the corridor. Table 3-35 displays the known reproductive history for these three eyries during years surveyed and figure 3-35 shows the eyries in relation to the corridor. A management buffer of 900 meters is used for mapping but does not include special management requirements.

Table 3-35: Reproductive summary for peregrine falcons nearest the planning area

Eyrie Name	89	90	91	92	93	94	95	96	04	05	06
Calf Pen	NI	O	O	2F	O	O	NI	NI	NI	O	O, 1F
Nash Point	1F	2 F	O	1F	F	2Y	O	O	O	O	O

NI = No information
O = Occupied
F = # Young fledged
Y = # Young in nest

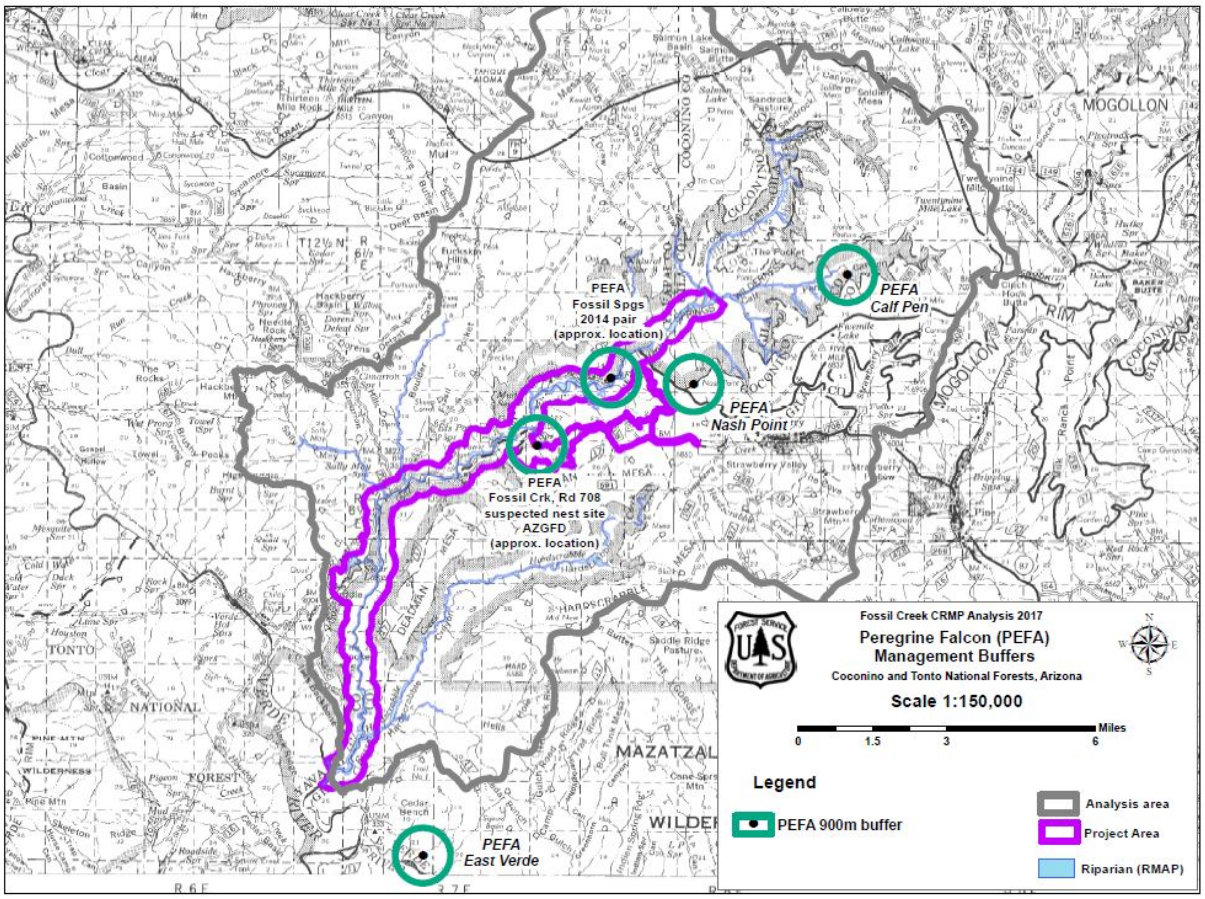


Figure 3-35: Peregrine falcon eyries near Fossil CRMP Corridor

Northern Goshawk

The principle forest types occupied by the goshawk in the Southwest are ponderosa pine, mixed conifer, and spruce-fir. The goshawk is a forest habitat generalist that uses a wide variety of forest stages. The goshawk preys on large to medium sized birds and mammals which it captures on the ground. It prefers stands of intermediate canopy cover for nesting, while more open areas are used for foraging.

Research indicates that goshawks may use pinyon-juniper woodlands for foraging in the winter. Radio telemetered goshawks on the Coconino National Forest began using the ponderosa pine-juniper woodlands

transition zone toward the end of the breeding season. Some radio-telemetered goshawks moved into the juniper woodland for most of the winter (Hall pers. comm.). One nest site in pinyon-juniper woodland has been reported from the Kaibab National Forest. There are no known nests in pinyon-juniper woodlands on the Coconino National Forest.

The nearest Post Fledgling Area (PFA) is located seven miles northeast of the analysis area. However, there is some potential for nesting within the corridor in the 4 acres of ponderosa pine. In addition, birds may use 4,275 acres of pinyon-juniper woodland during the winter. There have been no reports by agency biologists or citizen science participants of northern goshawk in the corridor.

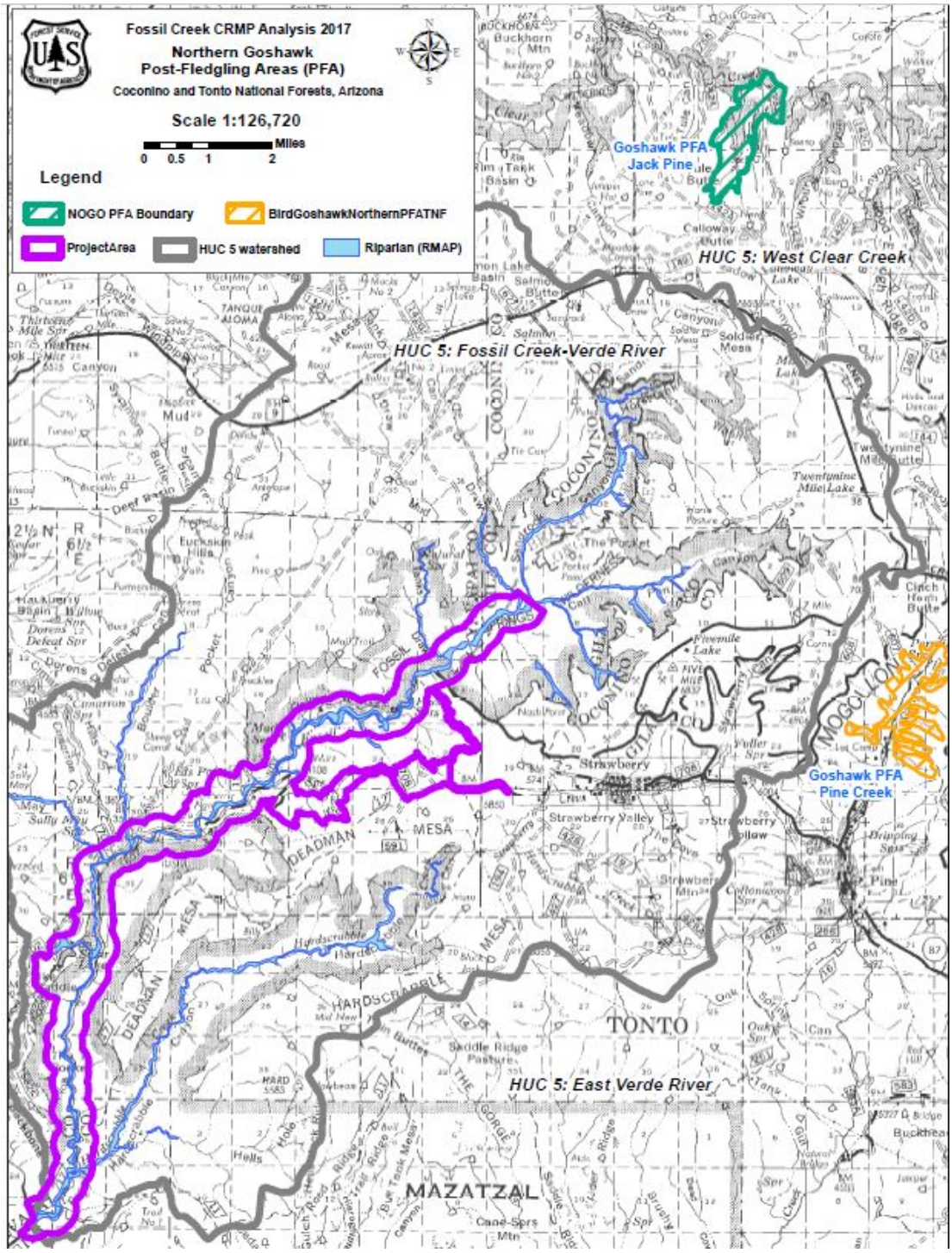


Figure 3-36. Northern goshawk PFAs near the Fossil Creek WSR Corridor

Amphibians

Lowland Leopard Frog

Habitat Requirements:
The lowland leopard frog prefers permanent stream pools, springs, stock tanks, and side channels of major rivers from almost sea level to 8,200 feet in elevation but more commonly under 6,400 feet. Leopard frogs are seldom found in association with bullfrogs or crayfish. The main cause for the decline of leopard frogs is attributed to the introduction of predacious non-native organisms including fish, crayfish, and bullfrogs, following by damming/water diversion and disease.

In Arizona, the lowland leopard frog is now only below the Mogollon Rim in central and southeastern Arizona with almost 60% of populations occur in central Arizona below the Mogollon Rim (AZGFD, HDMS 200X).

Surveys in the Analysis Area:
Arizona Game and Fish Department, Environet, and the Forest Service have conducted surveys for the lowland leopard frog in Fossil Springs, Fossil Creek, and nearby stock tanks. All life stages of leopard frogs have been observed in high to moderate abundance from Fossil Springs area down to above the waterfall and in low abundance from the waterfall downstream to above the waterfall trailhead. Based on all known surveys of lowland leopard frogs conducted throughout the Coconino National Forest, Fossil Creek supports the only viable population of lowland leopard frogs on the Coconino National Forest and is a significant population for the Tonto National Forest.

Prior to restoration of flows and the restoration of the native fishery, very few leopard frogs were found below the Fossil Springs dam. Historically, lowland leopard frogs were found near the 708 bridge over Fossil Creek in 1950 but not in 1985, 1990, 1992, or 1995. A survey in 1998 by Environet did not turn up any leopard frogs from the bridge to the Irving Power Plant and further upstream to approximately 3,840 feet.

Desired Condition:
Specifically for lowland leopard frog, the desired condition is that lowland leopard frogs are well established from Fossil Springs downstream to the waterfall and occur in lower numbers below the waterfall down to Irving and possibly even the permanent fish barrier in the Mazatzal Wilderness. Non-native fish and crayfish below the permanent fish barrier would preclude lowland populations from persisting. Withstanding flooding, introduction of non-native species, or disease, frog numbers should climb into the hundreds for each reach down to Irving.

Baseline Condition:
Post full-flow frog surveys from 2005 through 2009, conducted by USFS biologists, show that leopard frogs responded well to more flows, complex habitats created by travertine formations, and lack of non-native fish. Between restoration of full flows in 2005 and dam-lowering activities in 2009, lowland leopard frogs had recolonized Fossil Creek below the dam and reached viable population levels.

Existing Condition:
After APS lowering of the historic Fossil Springs dam in December of 2008, the new channel height above the lowered dam was very unstable with raw exposed banks and no vegetation to hold soil in place. Exacerbating this condition were several large flood events in 2009 and 2010 that further scoured the banks and channels and blew out established frog habitat below the dam. As a result frog monitoring showed much lower population levels. Combined with this was an increase in recreation at Fossil Springs and down by the waterfall. Surveyed areas after the flood of 2009 showed much reduced frog densities. However, limited surveys in 2010, 2011 and 2012 showed frog numbers were increasing as the population recovered from the floods. Surveys in 2017 showed that lowland leopard frogs were persisting and abundant in the Fossil Springs area but were not present in middle Fossil Creek below the waterfall trailhead.

As of 2017, lowland leopard frogs are known to persist in viable numbers from above the springs all the way downstream below the waterfall, but not as far downstream as the Waterfall Trailhead (See Map X). Frog densities are highest from the Fossil Springs downstream to just upstream of the large waterfall. While this reach contains

the most developed travertine formations and the most complex habitat, suitable habitat exists downstream of there. Lowlands occur in very low numbers from the waterfall downstream to an area above the waterfall trailhead. Why lowland leopard frogs have not recolonized to viable numbers from just above the waterfall downstream is thought to be a limitation of habitat. The habitat below the waterfall has fewer travertine formations, has more bedrock with swift flows, and in general has less aquatic vegetation than above the waterfall.

Figures 3-37 through 3-41 summarize survey results lowland leopard frogs (RAYA) in Fossil Creek.

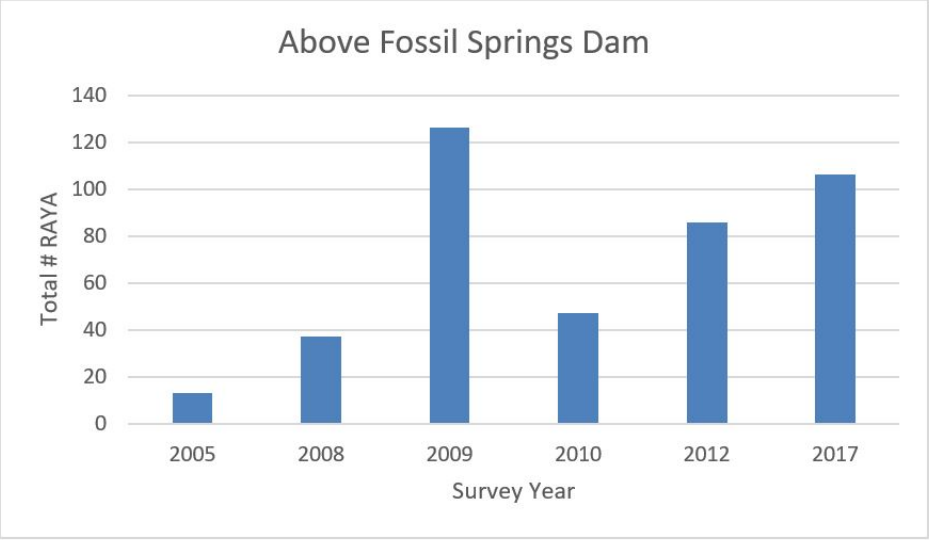


Figure 3-37. Lowland leopard frog survey results above Fossil Springs Dam

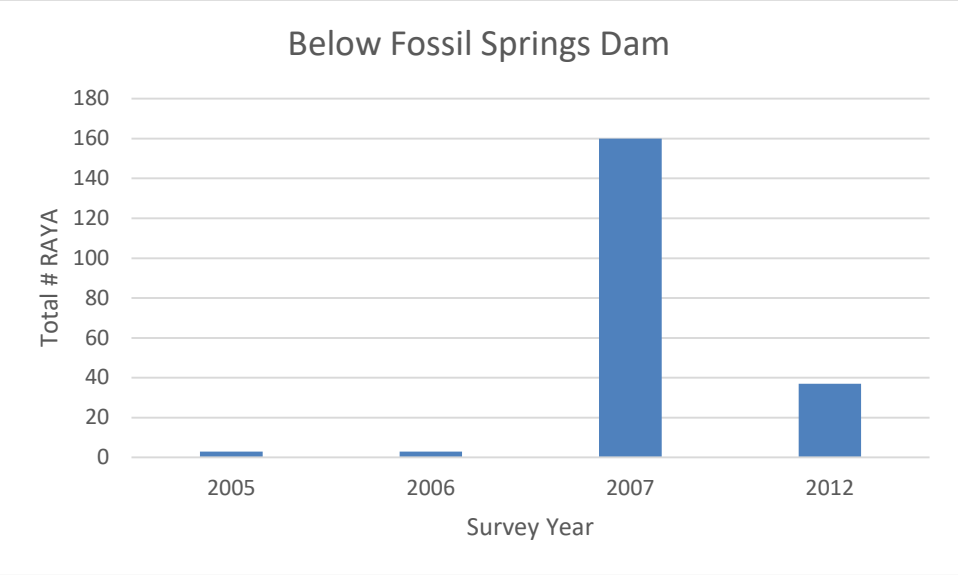


Figure 3-38. Lowland leopard frog survey results below Fossil Springs Dam

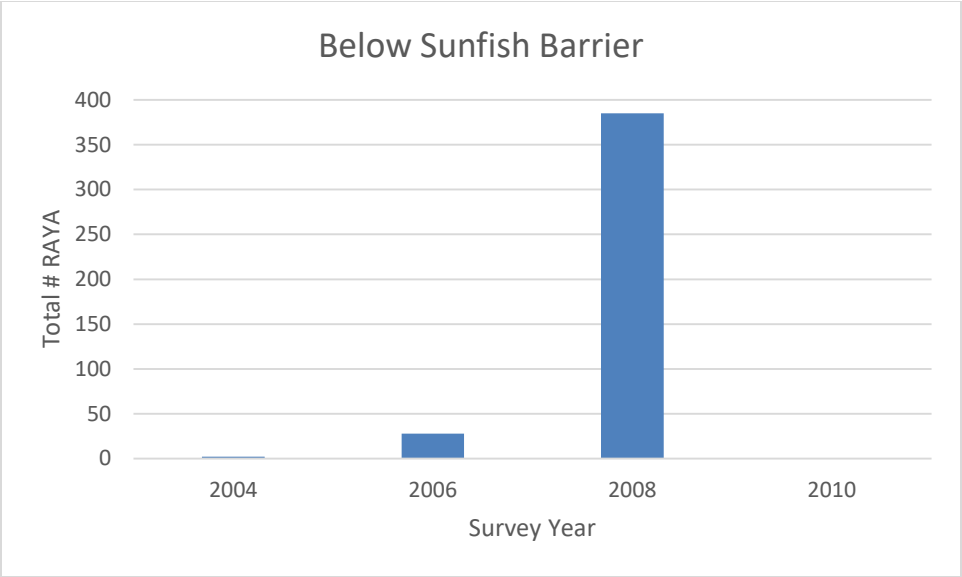


Figure 3-39. Lowland leopard frog survey results below the sunfish barrier

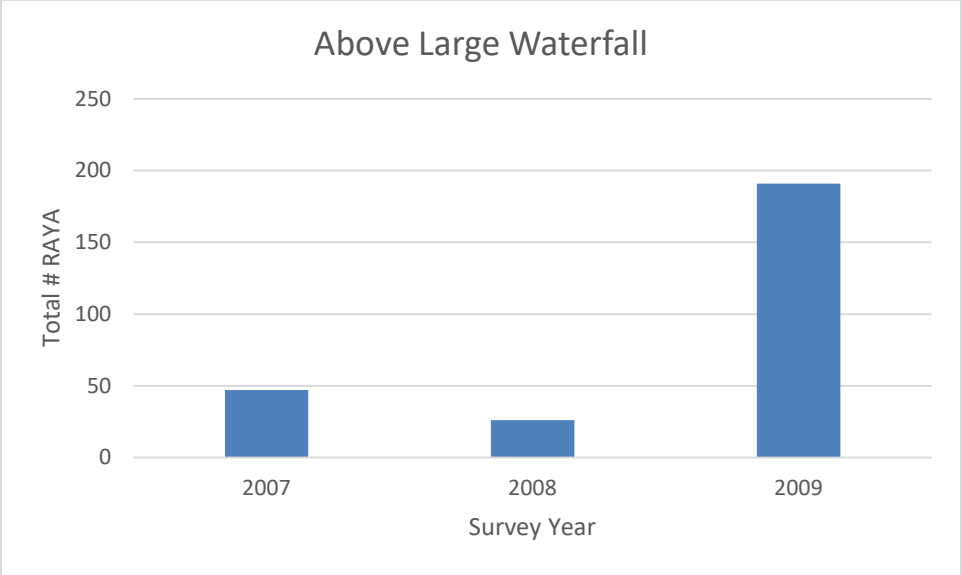


Figure 3-40. Lowland leopard frog survey results above the large waterfall

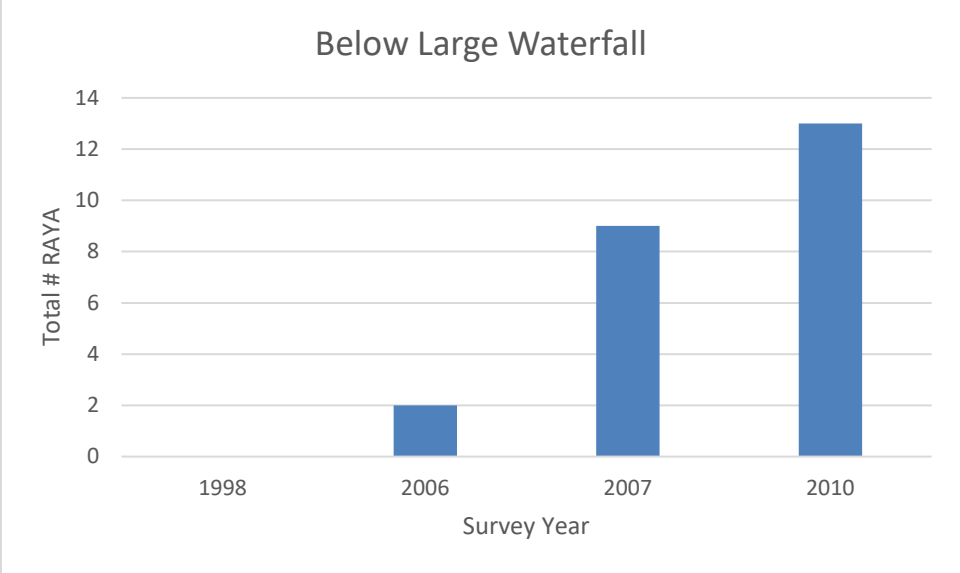


Figure 3-41. Lowland leopard frog survey results below the large waterfall

Surveys for leopard frogs below the Waterfall parking area/trailhead (now called Lewis Trailhead) have been negative (tables 3-36 through 3-40).

Table 3-36. Lowland leopard frog surveys at Irving Power Plant

Year Surveyed	Results	Notes
1994	No RAYA detected	Irving power plant
1995	No RAYA detected	Irving power plant
2012	No amphibians detected	Irving Falls to just upstream of low water crossing.
2017	No RAYA detected	PM survey of pool above low water crossing

Table 3-37. Lowland leopard frog surveys Below Irving

Year Surveyed	Results	Notes
2004	Larvae, may have been HYAR	just below Irving power plant
2006	No RAYA detected	just below Irving Power Plant
2007	No RAYA detected	below Irving
2008	No RAYA detected	above the bridge upstream to Irving
2009	No RAYA detected	Above the bridge upstream to Irving
2017	No RAYA detected	PM survey of old road crossing area below Irving

Table 3-38. Lowland leopard frog surveys at Forest Boundary (Bridge)

Year Surveyed	Results	Notes
1950	RAYA detected, no data on #s	
1985	No RAYA detected	
1990	No RAYA detected	
1995	No RAYA detected	

Table 3-39. Lowland leopard frog surveys at Reach 3: Bridge Crossing downstream to the Native Fish Barrier

Year Surveyed	Results	Notes
1998	RAYA detected, no data on #s	Bridge downstream to Barrier
2006	No RAYA detected	just below the private land
2006	No RAYA detected	last vehicle access point along Fossil Creek
2017	No RAYA detected	During PM survey at Homestead, Old Corral, and Sally May

Table 3-40. Lowland leopard frog surveys at Reach 4: Below Native Fish Barrier to Confluence with Verde

Year Surveyed	Results	Notes
1998	No RAYA detected	Barrier to confluence
2006	No RAYA detected	just below the native fish barrier
2011	No RAYA detected	Surveyed area where Deadman Mesa trail comes down to Fossil.

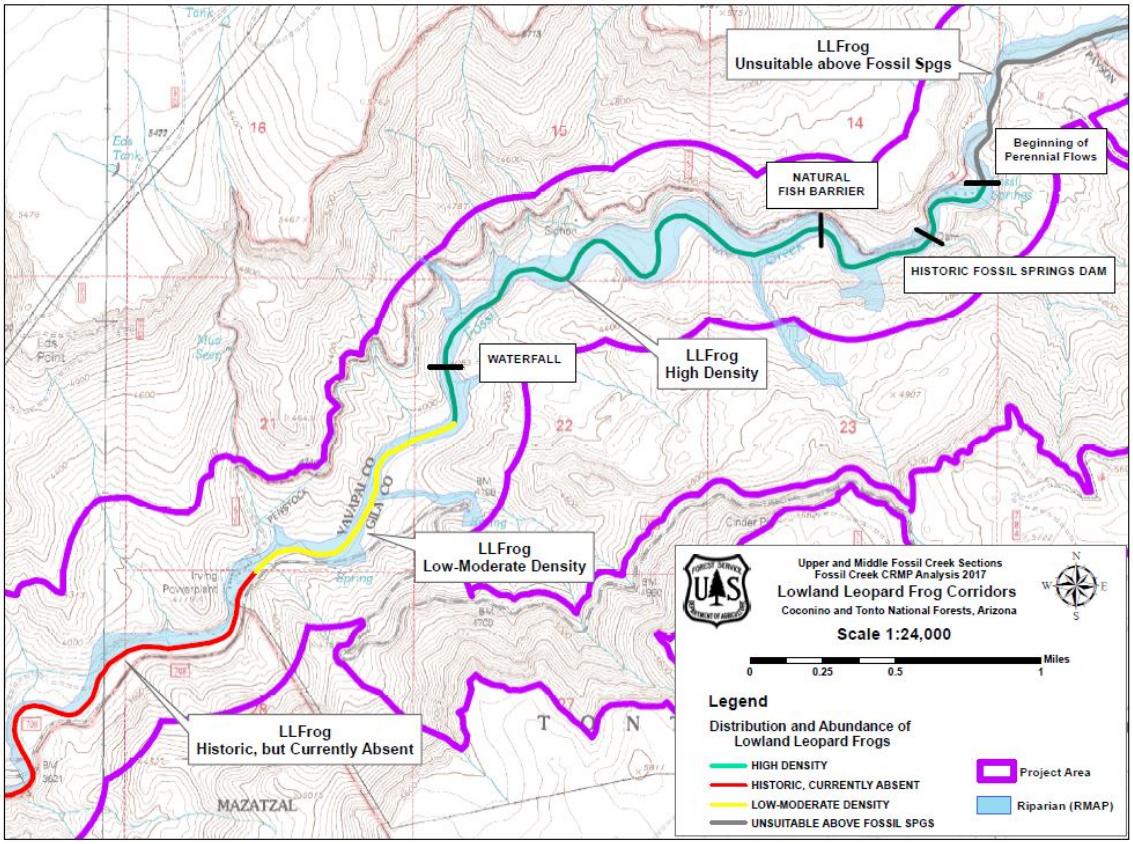


Figure 3-42: Distribution and Abundance of Lowland Leopard Frogs in Fossil Creek

Arizona Toad

The Arizona toad occurs in rocky streams, canyons, and floodplains between 2,000 and 6,000 feet. They breed in the early spring along gently flowing waters with rocky or sandy substrate. They select pools or slow water where tree canopy is relatively open. Eggs are laid in stringers on the bottom; clutches range from about 3,150-4,280 eggs. Eggs hatch in 3-6 days, and tadpoles typically metamorphose in 1-3 months. Arizona toads feed on a variety of invertebrates, including snails. They spend their days underground in burrows, loose soil, or under organic material such as leaf litter.

Habitat in the Analysis Area:

Sullivan (1991) reported Arizona toads from the Verde River just northwest of Childs power plant. Sullivan and Richardson (1993) reported that Arizona toads could potentially occur along the Verde River from West Clear Creek to the East Verde confluences. Fossil Creek offers suitable habitat for the Arizona toad. Visual encounter surveys for lowland leopard frogs have not resulted in the detection of Arizona toad, but this likely due to timing. Lowland leopard frog surveys have occurred in the summer and fall months, whereas toad surveys need to occur in very early spring when breeding toads are found along perennial stream courses. In March and April of 2017, surveys for Arizona toad were conducted once a week for six weeks by listening at pools for calling toads after dark. Call points were located at the Waterfall trailhead, Irving, Tonto Bench, Bridge, Homestead, Sally May, Purple Mountain, and Mazatzal. On the same dates, surveyors listened at call points on the Verde River down at Childs near the 1991 report. No Arizona toads were detected.

Mammals

Western Red Bat

Habitat in the Analysis Area

In Arizona, the western red bat is thought to be a summer resident only. It occurs statewide, except in desert areas, but primarily along riparian corridors among oaks, sycamores, and cottonwoods at elevations between 2,400 and 7,200 feet. Red bats typically roost in dense clumps of foliage in riparian or other wooded areas. Roost sites are shaded above and tend to be open below, permitting the bats to drop into flight. Red bats feed mainly on flying insects. The chief threats to the red bat in Arizona are its apparently low numbers and the loss of riparian and other broad-leafed deciduous forests and woodlands. Habitat for the red bat occurs at along Fossil Creek and upland springs that support deciduous riparian tree species. Red bats have been radio tracked and found roosting in Gambel oak trees on the Forest, so potential exists for red bats to roost in Gambel oak trees within the corridor. Red bats emerge from their roosts several hours after dusk to forage on a variety of flying insects. Wintering behavior of this migratory bat is unknown, but other species of tree roosting bats over-winter in leaf litter.

Surveys in the Analysis Area

Until 2011, limited bat surveys were conducted in Fossil Creek and there was no record of red bat detection from those efforts. In 2011, a multi-agency effort resulted in hundreds of mist net hours with additional efforts in 2013. Two western red bats were mist netted in the middle portion of Fossil Creek. None were captured in the Fossil Springs area or the earthen tanks in the uplands above the rim.

Allen's Lappet-browed Bat

Habitat in the Analysis Area

Although known to occur over a wide range of elevations and vegetation types, the Allen's lappet-browed bat is found primarily in ponderosa pine forests where they roost underneath exfoliating bark on standing ponderosa pine snags. On the Coconino, Allen's lappet-browed bats have been detected in pinyon juniper woodlands. While 14,888 acres of ponderosa pine forests occur in the analysis area, none occur in the project area. A total of 43,089 acres of pinyon juniper vegetation (all types combined) occur in the analysis area while 5,253 acres occurs in the project area.

Surveys in the Analysis Area

Until 2011, limited bat surveys were conducted in Fossil Creek and there was no record of Allen's lappet-browed bat detection from those efforts. Bat surveys in 2011 and 2013 resulted in mist netting one Allen's lappet-browed bat in the drainage upstream of Fossil Springs (riparian with uplands of primarily pinyon juniper with some chaparral), but not in the uplands above the rim nor the middle section of Fossil Creek.

Pale Townsend's Big-eared Bat

Habitat in the Analysis Area

The distribution of this wide-ranging bat tends to be geomorphically determined, and is strongly correlated with the availability of caves or cave-like roosting habitat e.g. mines and other man-made structures including cliff dwellings and abandoned shacks. In the Fossil area, possible roosting habitat occurs in caves, in various bat-gated APS flume tunnels, cliff dwellings near Fossil Springs, and abandoned buildings.

Townsend's big-eared bats hang from open ceilings of mines and caves during the day. They do not use cracks or crevices, and may use open abandoned buildings as a night roost. In Arizona, they hibernate during the winter in cold caves, lava tubes, and mines mostly in uplands and mountains from the vicinity of the Grand Canyon to the southeastern part of the state, south of the Mogollon Rim. The presence of suitable shelters seems to be one of the important limiting factors for this species. Townsend's big-eared bats have been mist netted on several occasions along Fossil Creek. Roost inspections of various sites (caves, bridges, and tunnels) have detected use by bats, but it is unknown if Townsend's big-eared bats used these roost. Additional suitable roost sites are unsurveyed.

Surveys in the Analysis Area
Bat surveys on the Tonto National Forest in 1993 and 1994 did not result in the detection of Townsend's big eared bats in Fossil near Flume Trailhead (which back then was the current Waterfall/Lewis trailhead) and at a tank on Hardscrabble Mesa in pinyon-juniper woodland.

In 2010, mist netting in May and June at three locations around Fossil Springs also did not result in the detection of Townsend's big-eared bats. Also, in 2010, potential Townsend's roosts were inspected. While bats were not observed, one cave had staining and guano, two caves did not have bat sign (but for one cave, the presence of an active bee hive may have been the reason for a lack of bats). One set of caves were not seen until after hiking down; roost inspections there are needed. In addition a fissure (a wide near vertical crack) was inspected at the entrance; no bat sign was detected.

In 2011, a multi-agency effort resulted in hundreds of mist net hours. Additional surveys were conducted in 2013. One Townsend's big-eared bat was mist netted in the drainage upstream of Fossil Springs, but not in the uplands above the rim nor the middle section of Fossil Creek.

On June 29, 2016, Forest Service inspected bridges along FR 708 and FR 502 within the Fossil corridor. While no bats were observed and use was not significant, there was evidence that the Boulder and Sally May bridges are being used at least as night roosts. Sally May bridge had a tiny amount of staining indicating light night use.

In 2017, volunteers mapped and scouted out the seven flume tunnels that were closed during the decommissioning phase. Nine of the tunnel entrances/exits were gated before closing the tunnels to the public. Five tunnels entrances/exits were buried and/or sealed and there was no obvious entrance or exit to these tunnels. Exit counts were conducted at a total of seven gated sites in 2017. While none of the tunnels supported large roosts, bats were using four of the seven gated sites; bats were not detected at three sites. Exit counts are still needed at Tunnel 3 entrance and exit.

Spotted Bat

Habitat in the Analysis Area
Roost site characteristics are poorly known for this species, but limited observations suggest that spotted bats roost singly in crevices, with rocky cliffs and surface water characteristic of localities where they occur. Its diet consists of moths, June bugs, and grasshoppers as well as other insects.

Spotted bats are rarely and unpredictably encountered in various habitats in scattered localities and elevations throughout Arizona, but especially in the extreme northwestern corner. It has been found from low desert areas in southwestern Arizona to high desert and riparian habitat in the northwestern part of the state. It has also been found in conifer forests in northern Arizona and other western states. Since this bat occurs in a variety of vegetation types where suitable rocky cliffs occur, the majority of the corridor, especially, Calf Pen and Sand Rock Canyons, Fossil Creek between the Fossil Springs and Irving powerplant, and the narrows, would provide suitable roosting conditions for this bat.

Surveys in the Analysis Area
No spotted bats have been detected during bat inventory efforts in Fossil Creek.

Snails

Fossil Springsnail

Fossil springsnails are found only in the headsprings and upper sections of perennial free-flowing springs and seepages feeding Fossil Creek in Yavapai and Gila counties. Springsnails of the genus *Pyrgulopsis* typically occur in moderate currents on rock or aquatic macrophytes. They occurs in rheocrene springs (water forced directly out of the ground under pressure and forming a stream) on firm sediment (from pebble up to cobble sized substrate). They prefer shallower areas of spring and usually occur closer to the spring source where their requirements for stable water chemistry and flow is provided. Springsnails occur under water and adhere to submerged substrate,

aquatic and emergent vegetation and organic litter (leaves, woody material) upon which they graze and lay eggs. Because springsnails have only a partial operculum, they cannot withstand any desiccation, and occur only in water that is perennially flowing. Other characteristics of suitable habitat include unpolluted water, spring orifices and channels free of embedded substrate, the presence of aquatic vegetation, algae and leaf litter from overstory tree canopy, and sufficient sunlight.

Threats include: activities that result in the loss or degradation of habitat from activities such as wildfires and suppression activities, livestock grazing, recreation, manipulation of springheads; predation from non-native predators such as crayfish and bullfrogs; loss of water or increased water temperatures due to climate change, drought, and/or groundwater depletion; and contamination from soap, sunblock, and herbicides. In addition to crushing individual snails, these activities alter or destroy the structural and biological needs for this species in ways that: reduce water quality (from sediment, ash, and contaminants); increase sedimentation and embeddedness of substrate which reduces places for adhering and egg laying; disturb vegetation and substrate; introduce chemicals such as retardant, soap, bug spray and sunblock; and reduce flows.

Habitat and Populations in the Analysis Area
Some surveys for springsnails have occurred in the Fossil Creek watershed, however numerous seeps and springs have not yet been inventoried. Many seeps and springs are inaccessible due to extremely steep terrain or the spring orifices being tucked back in narrow spaces in travertine formations (such as at the hanging gardens). In a mapping effort to highlight potential springsnail habitat, the light filters in aerial photographs were adjusted to accentuate deciduous vegetation. This resulted in the identification of potential seeps that may have enough above-ground water to support springsnails. Of those mapped, 11 have not yet been visited due to inaccessible terrain. These maps have not been updated to reflect recent survey results, so are not included in this report.

Between the 1970s and 1990, Landye and Hershler conducted various surveys and documented seven populations of springsnails in the Fossil corridor; in two springs above the historic Fossil Springs dam, one spring uphill of the Flume trail, and four springs on the southern side of Fossil Creek along FR 708.

Northern Arizona University conducted surveys in 2005 and 2009 around Fossil Springs, Irving power plant, and Below Sally May Wash. They documented springsnails in six out of nine surveyed sites in the Fossil corridor (Marks et al 2009). However, two of these sites were listed as non-reproducing sites.

Surveys by FWS in 2012 and 2013 monitored five known sites (Fossil Springs and four along FR 708). They documented that springsnails continue to exist in four springs (they were unable to relocate the occupied Fossil Springs site) and that population counts at one site had declined.

In 2005 and 2013, AZ Game and Fish (AZGFD) monitored existing populations. In 2017, the AZGFD with the Forest Service monitored existing populations (noting an increase at two sites where counts in previous years were low and of concern) and documented an additional population of springsnails near the Waterfall trail.

In the fall of 2017, Forest Service biologists conducted surveys for springsnails in five locations in the Fossil Springs area; none were detected, including at a spring that previously was known to support springsnails.

During various efforts, there has been difficulty in relocating occupied sites from surveys by previous surveyors. This was likely due to differences in GPS datums or error of GPS waypoints or even possibly that springsnail populations may have disappeared from some sites. As a result, it is difficult to make an actual crosswalk count of occupied and unoccupied sites amongst the various efforts.

In total, there are as many as 11 known occupied sites, at least 8 unoccupied sites, and at least 11 unsurveyed sites that have potential to support springsnails.

During CRMP interim management years from 2011 on, the Forest Service closed camping and decommissioned a user-created trail that crossed an occupied seep just downhill from the FR 708 and Waterfall Trail, however, it took several years of effort for the closure to be effective. Also during that time, footbridges were installed over

several channels leading from springs along the Waterfall trail. Those springs, in 2017, were inventoried and discovered to be occupied by springsnails. The following figures document the recovery in habitat after the footbridges were in place for several years.



Figure 3-43. Denuded springsnail habitat at time footbridges were installed in 2011



Figure 3-44. Springsnail habitat recovery after several years of having footbridges

Other springsnail sites, such as in the Fossil Springs area, are accessible to visitors. One of these springs has had a user-created trail leading to it from the Fossil Springs trail. There has been some concern over the years that visitors can crush snails as they walk in occupied habitat to get up to the spring orifice to filter drinking water. At this and other spring orifices in the area, it was noticed recently that the presence of non-native Himalayan

blackberry (*Rubus procerus*) has compromised springsnail habitat in the Fossil Springs area through shading and reduction of vegetative diversity. The blackberry have covered the ground as well as climbed existing trees and even hang from overstory trees, totally obscuring the spring orifice. This has resulted in an increase in the amount of shading and has reduced the diversity of plant species in the immediate area around the springsnail site. Additionally, according to Jeff Sorensen, invertebrate biologists with AZGFD, "the blackberry may degrade the springsnail habitat by overgrowing open water sections and shading the habitat, which will likely affect algal growth, and periphyton and diatom abundance which the snails rely on as forage."

Plants

There have been numerous surveys over the years and several plant lists are available for the greater Fossil Creek planning area. Species of plants from older lists (Baker, Phillips, Lutz, Sear, Menasco, Collins, Sayers, Goodwin, Wong), were entered into an Access Database (Appendix C of the *Wildlife and Vegetation Specialist Report*). Approximately 350 species for the greater Fossil Creek area and 187 species from the Fossil Botanical Area were recorded. More recently Desert Botanical Garden botanists provided a list of additional documented species that were missing from the Access dbase (Appendix C of the *Wildlife and Vegetation Specialist Report*). In total there are approximately 537 plant species known from Fossil Creek.

The sensitive species in table 3-41 below are included in this analysis because either they are known to occur in the FC WSR corridor or the corridor occurs within their range and contains suitable habitat. Sensitive plant species known to occur in the Fossil planning area include Cochise sedge and Mt. Dellenbaugh sandwort. There have been no collections, records or observations of the remaining sensitive species.

Table 3-41: Sensitive Plant Species in Fossil Creek Project Area

Species	Status	Habitat in Project Area	Habitat and Known Occurrence in Project Area
Arizona phlox (*Phlox amabilis*)	Forest sensitive	This plant is a central Arizona endemic. It occurs in open, exposed, limestone or basalt rocky slopes within pinyon-juniper and ponderosa pine-Gambel oak communities. Plants have been observed in Coconino, Mohave, Navajo, and Yavapai counties in elevations from 3500-7500 feet. Has also been found in Graham and Gila counties.	Verified collection from a canyon 2 mi southwest of project area.
Cochise sedge (*Carex ultra*)	Forest sensitive	This herbaceous perennial grows at about 2,000 to 5,000 feet in elevation on southeast-facing, often shaded exposures in moist soil near perennially wet springs and streams. It is typically found in wet alluvial soil, sand and gravels, associated with aquatic/riparian woodlands or oak-pinyon woodlands.	One record exists for within the project area. See Figure X for locality information from SEINet.
Metcalfe's tick trefoil (*Desmodium metcalfei*)	Forest sensitive	This plant is broadly distributed but has a limited occurrence. It is found on rocky slopes and in canyons within grasslands, pinyon-juniper and oak woodlands, and riparian forests between 4,000 and 6,000 feet in elevation. This perennial plant is deciduous. It produces purple pea-shaped flowers from August to October.	There are few recent collections of this rare plant. The nearest is 45 miles southwest and a lower elevation than the project habitat. Possibly collected in the project area, but is yet to be positively identified.
Mt. Dellenbaugh Sandwort (*Eremogone aberrans formerly Arenaria aberrans)*	Forest sensitive	This species is known only from northern and north-central Arizona usually between 5,500 and 9,000 ft elevation. Occurs mainly in oak and pine forests but is also found in open pine and pinyon pine woodlands, and among junipers.	Collected in project area.
Eastwood Alumroot (*Heuchera eastwoodii*)	Forest Sensitive	Only known from central Arizona and is found on moist slopes in ponderosa pine forests and canyons at elevations between 5,000 and 6,000 feet in elevation	Occurs outside of but near the project area.

Botanists and volunteers with the Arizona Rare Plant Task Force and Desert Botanical Garden (DBG) have been conducting plant inventories within the FC WSR corridor over the last several years. Recent plant collecting trips by Desert Botanical Garden botanists and volunteers have resulted in the collection of numerous endemic species: *Agave chrysantha, Perityle ciliate, Mentzelia longiloba* var. *yavapaiensis, and Echinocereus yavapaiensis, and Galiuim collomiae.* Another endemic*, Dudleya saxosa* ssp. *collomiae,* has not yet been located but is expected to occur in the Fossil area. DBG botanists provided a list of other plant species of interest that have been collected in Fossil Creek; *Desmodium metcalfei** (not yet confirmed), *Eriogonum microthecum* (need to key to subspecies)*, Phlox tenuifolia, Salix bonplandiana, Epilobium canum* var. *latifolium,* and *Epipactis gigantea.* It is important to note that despite major inventory and collecting efforts by DBG botanists in recent years, plant surveys are still limited spatially (there are many areas with difficult access) and temporally (repeat entries across growing seasons are necessary for complete plant inventory) and there are likely numerous other species of interest that have yet to be documented in FC WSR corridor as well as additional locations of special status plant species already documented.

Professional input from DBG botanists (Ward and Hodgson, 2016) include the following points:

- Riparian areas in Arizona and the Southwest are rare.
- Fossil Creek sits between two predicted Arizona endemic hot spots, namely Verde Valley and base of Mogollon Rim.
- The riparian area associated with Fossil Creek is arguably unique.
- The Botanical Area has a high richness of species diversity.
- Even though no listed plant species and only a few sensitive species occur in the FC WSR corridor, the riparian plant community should be viewed in a more inclusive and holistic manner.
- Despite recent surveys, there is a lack of knowledge and understanding of the complexity of plant species and role they play in ecosystems.
- There is concern that lack of such knowledge may result in insufficient management proposals.
- Future needs include:
    - Increased collaboration, with potential for funding, between agency staff and botanists much experienced in Arizona/Southwest floristics, rare and invasive plants (including the Arizona Rare Plant Task Force) and plant systematics is encouraged.
    - Continued collaboration will result in a better understanding of plants and their role in the ecology of Fossil Creek.
    - Desert Botanical Garden staff, working with citizen scientists, continue to better document the flora of this region; population status of the more rare species, including possible new, previously unknown cryptic species may emerge.

In summary, there is a high diversity of plant species in the project area. This is supported by the known presence of four Forest Service Sensitive species, five endemic species, six other species of interest, and potential presence of a handful of other species. Since surveys are still limited spatially and temporally limited, there are likely additional locations of special status plant species already documented. Of what is known, only one sensitive species, Mt. Dellenbaugh Sandwort, occurs in close proximity to where moderate to high levels of human use occur.

Other Special Status Species

Golden and bald eagles are protected under the Bald and Golden Eagle Protection Act (Eagle Act). Existing condition for the golden eagle follows. Refer to the Sensitive Species section above, for existing condition for bald eagle.

Golden Eagle

Habitat requirements

Golden eagles are found nesting in a wide variety of habitats from arid desert scrub to open conifer forests. No matter what habitat they choose in the state, topography features include tall cliffs or canyon in which to construct a nest and nearby large open areas to forage for prey (AGFD 2005). Most golden eagles nesting in Arizona are primarily residents, remaining within or near their home range throughout the year. In Arizona, cliff ledges are the most common nesting substrate used by golden eagles, but they will also use tall trees (esp. ponderosa pine), junipers, rock outcrops, and in rare cases, transmission towers (Glinski et.al. 1998 in AGDF 2005). Golden eagles often nest in areas of high rabbit populations. Golden eagles are well known for subduing large prey; however most of their diet consists of ground squirrels, rabbits, and prairie dogs. Abundant prey in the form of rabbits and ground squirrels occur throughout most of the Fossil CRMP corridor.

Habitat in the Analysis Area

Golden eagles may occur in all biotic communities as long as tall cliffs or canyons are present, prey (primarily rabbits) is abundant and there are relatively low levels of human activity. Habitat meeting these requirements occurs in the project area, particularly the upper portion just below Sandrock and Calf Pen Canyons and the lower portion of Fossil by the “Narrows”.

Surveys in the Analysis Area

Prior to 2011, information on golden eagles was limited in Arizona (McCarty et. al 2015). AGFD has been conducting surveys annually since 2011. Based on the AGFD monitoring effort, there are currently no known, active breeding areas in the project area. However, there are two areas where golden eagles were observed and or nesting suspected and one active nest outside of the project area, but within the cumulative effects analysis area (personal communication, Tuk Jacobson - email 7/28/17):

- A 1999 report of a pair of golden eagles near Irving powerplant was reported to AZGFD. The pair was seen perched and flying together. Although AZGFD searched the area in 2014, no nests were found. AZGFD considers this sighting a species observation. There is high recreational use in this area.
- The second area is called Fossil Pocket (Boulder Canyon), where a large-sized nest was discovered in 2012. However, since no eagles were observed, AZGFD considers this to be a possible nesting location, but unconfirmed. This site is located in Boulder Canyon over 2 miles north of the project area and far from any recreational activities.
- The last site, Deadman Mesa is a single cliff nest that was discovered during the 2005 bald eagle surveys. The first time the nest was observed to be active (eggs laid) was in 2012. However the nest failed in 2012 and again in 2015. The nest is ~0.4 miles south of the Fossil Creek project area on the Fossil-facing cliffs associated with Deadman Mesa and far from recreational activities. Refer to figure 3-45 for these three locations.

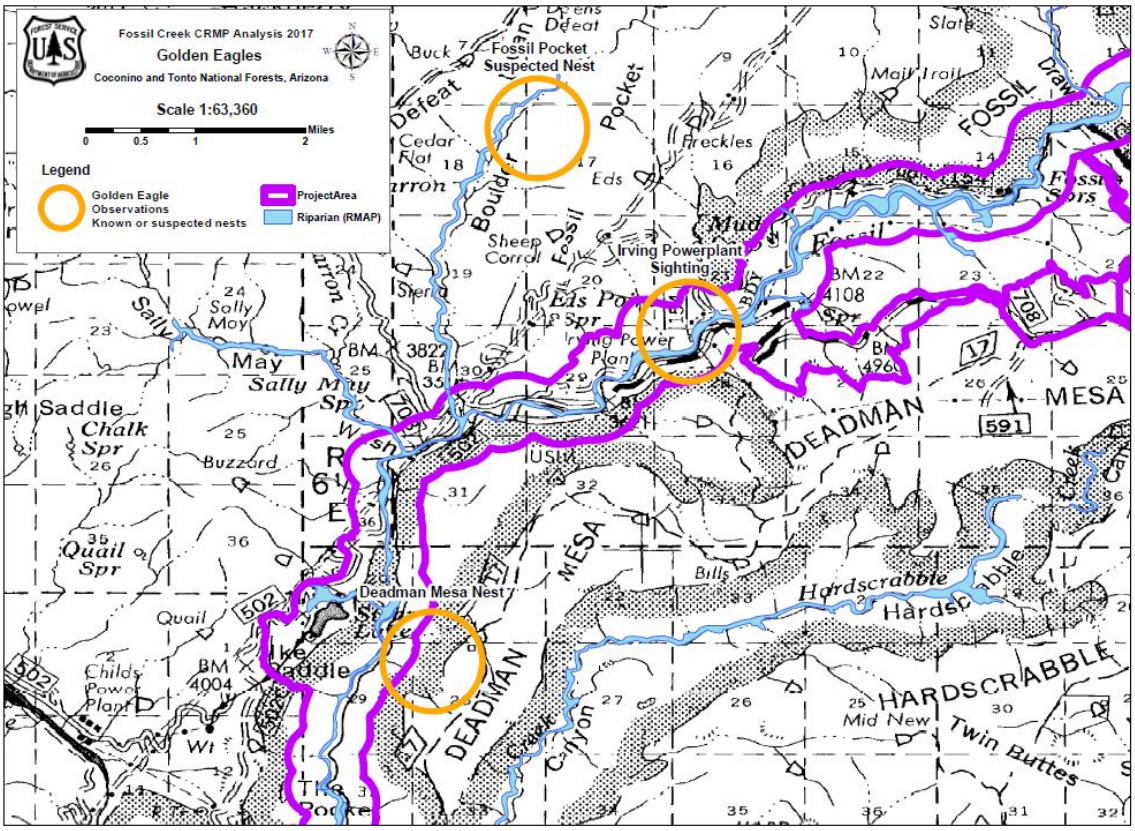


Figure 3-45: Golden eagle observations in the Fossil Creek area

Management Indicator Species

There are numerous MIS identified as indicators for habitats on the Coconino and Tonto National Forest. Macroinvertebrates are being addressed in the Fisheries Specialist's Report and will not be addressed further in this report. This report tiers to and summarizes forestwide habitat and population trends from each Forest's MIS status reports. The MIS analysis, as required, is broken out by forest.

Coconino National Forest MIS

Three MIS are designated on the Coconino National Forest: pronghorn, Mexican spotted owl, and pygmy nuthatch (table 3-42).

Table 3-42: Coconino National Forest Management Indicator Species (MIS) and the habitat they were chosen to represent

Species	Indicator Habitat
Pronghorn Antelope	• Great Basin Grassland • Montane/Subalpine Grassland • Semi-desert Grassland
Mexican Spotted Owl	• Ponderosa Pine – Gambel Oak • Mixed Conifer with Infrequent Fire • Mixed Conifer Frequent Fire
Pygmy Nuthatch	• Ponderosa Pine – Old Growth • Ponderosa Pine - Snags

Mexican spotted owl and Pygmy nuthatch are management indicators for vegetation types that do not occur in more than two percent of the project area (mixed conifer and ponderosa pine,) and therefore are excluded from this analysis.

Habitat features for pronghorn antelope occur within the Fossil CRMP corridor, so this species will be analyzed in this document. The habitat trend for pronghorn on the Coconino NF is considered to be stable to declining, and the population trend is considered to be stable. Approximately 497 acres of pronghorn habitat is present in the project area and approximately 206,199 acres of pronghorn habitat is present on the Coconino NF. Refer to Table X for both habitat and population trends as well as acres of indicator habitat within the project area.

Tonto National Forest MIS

The full list of MIS on the Tonto National Forest can be found in the Wildlife and Vegetation specialist report. Pygmy nuthatch, violet-green swallow, western bluebird, hairy woodpecker, northern goshawk, and Abert squirrel are management indicators for vegetation types that do not occur in more than two percent of the project area (mixed conifer and ponderosa pine forests) and therefore are excluded from this analysis when those two habitats are the only habitats for which they are indicators.

The main habitat types observed in the Fossil Creek corridor include pinyon-juniper woodlands, grasslands, chaparral, desert scrub, and low elevation riparian. The corresponding ERU codes include: MSDS-SOS, SDG, PJO, JUG, MEW, PJC, and JJG. While a few acres of mixed conifer and ponderosa pine forest occur within the project area, the area where these two habitat types are found occur in the uplands, well away from any existing or proposed infrastructure and away from areas where recreation occurs.

Habitat features for Tonto National Forest MIS species in Table 3-43 occur within the Fossil CRMP corridor on the Tonto National Forest, so those species will be analyzed in this document. Refer to Table 3-43 for habitat trends for The Tonto National Forest as well as acres of indicator habitat within the project area.

Table 3-43: Tonto MIS Analyzed Within Fossil Project Area

Species	Indicator Habitat	Departure from Reference Condition	Acres of MIS Habitat in Project Area	Acres of MIS Habitat on Forest
Elk	• PJO • JUG • MEW • PJC* • PJ Grass • PPE • PPF • MCD	• Low • Moderate • Moderate • High • Moderate • High • High • Moderate	• 2086 • 610 • 0 • 0 • 0 • 0 • 0 • 0	• 54,352 • 415,546 • 93,157 • 398,154 • 74,240 • 205,729 • 37,878 • 58,829
Turkey	• PJO • JUG • MEW • PJC* • PT GRASS • PPE • PPF • MCD	• Low • Moderate • Moderate • High • Moderate • High • High • Moderate	• 2086 • 610 • 0 • 0 • 0 • 0 • 0 • 0	• 54,352 • 415,546 • 93,157 • 398,154 • 74,240 • 205,729 • 37,878 • 58,829
Ash-throated Flycatcher	• SDG • PJO • JUG • PJC* • PJG	• High • Low • Moderate • Moderate • Moderate	• 142 • 2086 • 610 • 0 • 0	• 340,983 • 54,352 • 415,546 • 398,154 • 74,240
Gray Vireo	• IC • PJO • MEW • PJC	• Low • Low • Moderate • Moderate	• 0 • 2086 • 0 • 0	• 340,983 • 54,352 • 415,546 • 398,154
Townsend's Solitaire	• PJO • PJC*	• Low • Moderate	• 2086 • 0	• 54,352 • 398,154
Juniper Titmouse	• PJO • MEW • PJC*	• Low • Moderate • Moderate	• 2086 • 0 • 0	• 54,352 • 93,157 • 398,154

Species	Indicator Habitat	Departure from Reference Condition	Acres of MIS Habitat in Project Area	Acres of MIS Habitat on Forest
	• PPE	• High	• 0	• 205,729
Northern Flicker	• PJO • MEW • PJC* • PPE	• Low • Moderate • Moderate • High	• 2086 • 0 • 0 • 0	• 54,352 • 93,157 • 398,154 • 205,729
Spotted Towhee	• MSDS (SOS) • IC • PJO • MEW • PJC	• Moderate • Low • Low • Moderate • Moderate	• 0 • 0 • 2086 • 0 • 0	• 113,557 • 290,771 • 54,352 • 93,157 • 398,154
Black-chinned Sparrow	• IC • PJC*	• Low • Moderate	• 0 • 0*	• 290,771 • 398,154
Savannah Sparrow	• SDG • JUG • PJG	• High • Moderate • Moderate	• 142 • 610 • 0	• 340,983 • 415,546 • 74,240
Horned Lark	• SDG • JUG • PJG	• High • Moderate • Moderate	• 142 • 610 • 0	• 340,983 • 415,546 • 74,240
Black-throated Sparrow	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • JUG • PJG	• Low • Low • Moderate • Low • Low • High • Moderate • Moderate	• 0 • 0 • 0 • 0 • 0 • 0 • 610 • 0	• 21,095 • 54,423 • 113,557 • 602,209 • 290,771 • 340,983 • 415,546 • 74,240
Canyon Towhee	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • PJO • JUG • PJG	• Low • Low • Moderate • Low • Low • High • Moderate • Moderate • Moderate	• 0 • 0 • 0 • 0 • 0 • 142 • 2086 • 610 • 0	• 21,095 • 54,423 • 113,557 • 602,209 • 290,771 • 340,983 • 54,352 • 415,546 • 74,240
Bald Eagle	• Riparian	• Data not available	• 175	• 35,022
Bell's Vireo	• Low elevation Riparian	• Data not available	• 175	• 35,022
Summer Tanager	• Low elevation Riparian	• Data not available	• 175	• 35,022
Hooded Oriole	• Low elevation Riparian	• Data not available	• 175	• 35,022
Hairy Woodpecker	• High elevation riparian	• Data not available	• 175	• 35,022
Arizona Gray Squirrel	• High elevation riparian	• Data not available	• 175	• 35,022
Warbling Vireo	• High elevation riparian	• Data not available	• 175	• 35,022
Western Wood Pewee	• High elevation riparian	• Data not available	• 175	• 35,022
Common Black-hawk	• Riparian streamside	• Data not available	• 175	• 35,022

*Even though the query for vegetation types shows no acres for PJC in the project area or analysis area, this habitat type is present but it is included in other P/J veg types. So, black-chinned sparrow is included in this analysis and the acres for other P/J types are used as a proxy for PJC.

Legend to ERU Codes:
SDS = Sonora-Mojave Creosote-Bursage Desert Scrub
MSDS = Mohave Sonoran Desert Scrub
MSDS(CB) = Sonora-Mohave Mixed Salt Desert Scrub
MSDS(SOS) – Sonoran Mid-Elevation Desert Scrub
MSDS(SP) = Sonoran Paloverde-Mixed Cactus Desert Scrub
IC = Interior Chaparral
SDG = Semi-Desert Grassland
PJC = Pinyon-juniper Evergreen Shrub
PJO = Pinyon-juniper Woodland
JUG = Juniper Grass
MEW = Madrean Encinal Woodland
PJC = Pinyon-juniper Evergreen Shrub
PJG = Pinyon-juniper Grass
PPE = Ponderosa Pine – Evergreen Oak
PPF = Ponderosa Pine Forest
MCD = Mixed Conifer – Frequent Fire.

Migratory Birds

Three sources were used to identify priority species: (1) Partners in Flight Landbird Conservation Plan (Rosenberg et al. 2016), (2) Birds of Conservation Concern 2008 (U.S. Fish and Wildlife Service 2008), and (3) Arizona's State Wildlife Action Plan: 2012-2022 (Arizona Game and Fish Department 2012). Using these sources, a list of migratory birds that occur on the Forests was developed. In the Partners in Flight plan (PIF Plan), birds listed for the Intermountain West and Sonoran Joint Ventures were evaluated. Birds listed in Bird Conservation Regions (BCR) 16 and 34 were evaluated from the Birds of Conservation Concern (BCC 2008) plan, as were Tier 1a and 1b Species of Greatest Conservation Need (SGCN) from the Arizona State Wildlife Action Plan (SWAP).

From those lists, 31 priority bird species were identified. Of those, 25 breed on the Forests and the other six species (Cassin's finch, chestnut-collared longspur, grasshopper sparrow, savannah sparrow, ferruginous hawk, and lark bunting) are present in the winter. Federally-listed and Forest Service Sensitive species were not included, as projects evaluate effects under the ESA and as Sensitive species. Eagles are addressed in the Bald and Golden Eagle Act section.

A total of 13 species are excluded from further analysis because their preferred habitat type is either high elevation riparian which does not occur in the project area or is ponderosa pine and/or mixed conifer which only occurs within less than two percent of the project area and in relatively inaccessible areas where no infrastructure is proposed and recreation activities will be very infrequent. These birds include band-tailed pigeon, Brewer's blackbird, Cassin's finch, evening grosbeak, flammulated owl, Grace's warbler, Lewis's woodpecker, McGillivray's warbler, Mexican whip-poor-will, olive warbler, olive-sided flycatcher, and red-faced warbler. Within the project area, only 19 of the 31 priority bird species occur or have potential to occur (table 3-44).

Table 3-44. Neotropical Migratory Birds Known to or May Occur within the Project Area

Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Bell's Vireo	Known to breed in FWSRC	shrub, tree	Cottonwood Willow Riparian Forest	Nests in shrubs and trees at 1.5-10.8 ft.
Bendire's Thrasher	Possible breeding	shrub, tree	Semi-desert Grassland	Local nester N. of Mogollon Rim; some potential on Forest. ABBA, ebird. Nests in shrubs and trees at 1.9-9.8 ft.
Black-chinned Sparrow	Known to breed in FWSRC	shrub	Interior Chaparral	Probable breeder on the Forest below Mogollon Rim (ABBA). Nest height 1.2-6.8 ft.
Black-throated Gray Warbler	Known to breed in FWSRC	tree	Pinyon Juniper Woodland, Pinyon Juniper Evergreen Shrub	In P-J on the Forest (ABBA). Nests in oaks and junipers 1.6-16.1 ft, which is lower than reported elsewhere in AZ

Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Chestnut-collared Longspur	Possible wintering	n/a	Semidesert Grassland	Occasional; more often adjacent (e.g. Babbit Tank Buffalo Ranch road). Ebird winter detections at Mormon Lake and Doney Park.
Common Black-Hawk	Known to breed in FWSRC	tree	Montane Willow Riparian Forest, Mixed Broadleaf Riparian Forest, Cottonwood Willow Riparian Forest	
Common Nighthawk	Likely breeding, but no night surveys	ground	Ponderosa Pine (including P-O)Pinyon Juniper Woodland, Great Basin Grassland	
Elf Owl	Possible migration and breeding	tree	Cottonwood Willow Riparian Forest	Historical from Oak Creek and BBA atlas detection there. Several eBird detections in April and May. Nest cavities in saguaro, mesquite, cottonwood, willow, sycamore 10-59 ft
Ferruginous Hawk	Possible migration	n/a	Grasslands (all 3?)	In migration and breed off the Forest, but nearby. Spends at least early part of the winter on the Forest (Bald Eagle Midwinter Survey results).
Flammulated Owl	Possible breeding	cavities in Gambel's oak, ponderosa pine, aspen, AZ cypress, AZ sycamore, usually 10-40 ft	Ponderosa Pine	Probable breeder (ABBA); confirmed breeder Forest survey records.
Grace's Warbler	Possible breeding	usually in ponderosa pine 25-40 ft	Ponderosa Pine	
Gray Vireo	Known to breed in FWSRC	usually junipers from 3-17 ft	Pinyon Juniper Woodland, Pinyon Juniper Evergreen Shrub	
Lark Bunting	Possible migration and wintering	n/a	Semidesert Grassland, Desert Communities	Many eBird sightings; mostly scattered throughout Verde Valley.
Lucy's Warbler	Known to breed in FWSRC	tree	Cottonwood Willow Riparian Forest	Nest cavities from 2-36 ft.
Phainopepla	Known to breed in FWSRC	tree	Desert Communities	ABBA - desert washes, desertscrub. Nests in desert trees such as paloverde, mesquite, acacia, oaks from 3-33 ft.
Savannah Sparrow	Possible wintering	n/a	open habitats	Winter and migration detections scattered throughout forest
Virginia's Warbler	Known to breed in FWSRC	ground, shrub	many	Many habitat types; shrub or oak understory is key. Nests on the ground under grass clumps or in woody shrubs, often on slopes.
Wood Duck	Observed in Fossil Creek	tree	Cottonwood Willow Riparian Forest	cavity nester

Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Yellow Warbler (*sonorana* ssp.)	Known to breed in FWSRC	tree	Cottonwood Willow Riparian Forest; Mixed Deciduous Riparian Forest	Nest heights 13-42 ft.

General Wildlife (Non-Special Status Species)

The Fossil Creek area provides a variety of habitat types that support an abundance of wildlife. The habitat types found in the area include ponderosa pine, pinyon/juniper, chaparral, desert scrub, desert grasslands, and riparian. This diversity supports hundreds of species of reptiles, amphibians, fish, birds, and mammals. Some SGCN species were not analyzed in the sections above where all SGCN Tier 1A and most SGCN Tier 1B species were included, so they are included in this section.

Mammals

Game species in the Fossil Creek area include elk, mule deer, white-tailed deer, bear, mountain lion, bobcat, gray fox, coyote, javelina, beaver, otter, cottontail and jackrabbits, squirrels, and raccoons. Elk are primarily found in mixed conifer and ponderosa pine woodlands during the spring, summer and fall months but move into pinyon-juniper woodlands during the winter, especially when deep snows preclude access to forage in the higher country. Deer, mountain lion, bobcat, coyote, fox, cottontails and jackrabbits occur throughout all biotic communities within the Fossil planning area. Javelina occur in desert scrub, grassland, riparian, and chaparral and pinyon/juniper slopes with abundant prickly pear cacti. Raccoons occur primarily within riparian and other vegetative zones within close proximity to riparian areas. Refer to Appendix C of the *Wildlife and Vegetation Specialist Report* for a list of actual mammal observation in Fossil Creek as well as a list of species for which suitable habitat occurs.

Non-game mammal species include chipmunks, mice, rats, woodrats, skunks, ring-tailed cats, and numerous species of bats (some of which are analyzed in the sensitive species section. Spotted and striped skunks occur primarily within riparian and other vegetative zones within close proximity to riparian areas. Hog-nosed skunks may occur more in upland habitats. Cliff chipmunks, white-footed mouse, and white-throated woodrat are a few small mammal species that occur within the chaparral and pinyon-juniper habitats. Rock squirrel, Harris' antelope ground squirrel, harvest mouse, and brush mouse are other small mammals that likely occur in the planning area. Sinagua High School teachers have been conducting annual surveys for small mammals and macroinvertebrates in Fossil for well over a decade. Small mammals trapped included: a ring-tail cat, southern grasshopper mice, and pinyon mice.

Following is a summary of all known bat survey efforts in Fossil Creek. Bat species codes are the first two letters of the genus and species – refer to scientific names in table 3-45. Detailed descriptions of the population status of and survey efforts for the western red bat, Allen's lappet-browed bat, plate Townsend's big-eared bat, and spotted bat are provided in an earlier section of this report.

Bat surveys on the Tonto National Forest in 1993 and 1994 detected Myau (1), Nyfe (1) , Epfu (5) in Fossil near Flume Trailhead (now called the Lewis trailhead), and Epfu (1) at a tank on Hardscrabble Mesa in pinyon-juniper woodland. Refer to table 3-45 for a crosswalk of bat names and species codes.

Table 3-45: Crosswalk of bat scientific name, common name, and species code

Common Name	Scientific Name	Species Code
Yuma Myotis	*Myotis yumanensis*	Myym
Cave Myotis	*Myotis velifer*	Myve
Arizona Myotis	*Myotis occultus*	Myoc
Long-eared Myotis	*Myotis evotis*	Myev
Southwestern Myotis	*Myotis auriculus*	Myau

Common Name	Scientific Name	Species Code
Fringed Myotis	*Myotis thysanodes*	Myth
Long-legged Myotis	*Myotis volans*	Myvo
California Myotis	*Myotis californicus*	Myca
Small-footed Myotis	*Myotis ciliolabrum*	Myci
Silver-haired Bat	*Lasionycteris noctivagans*	Lano
Canyon Bat	*Parastrellus hesperus*	Pahe
Big Brown Bat	*Eptesicus fuscus*	Epfu
Allen's Lappet-browed Bat	*Idionycteris phyllotis*	Idph
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Coto
Pallid Bat	*Antrozous pallidus*	Anpa
Red Bat	*Lasiurus borealis*	Labo
Hoary Bat	*Lasiurus cinereus*	Laci
Spotted Bat	*Euderma maculatum*	Euma
American Free-tailed Bat	*Tadarida brasiliensis*	Tabr
Big Free-tailed Bat	*Nyctinomops macrotis*	Nyma
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	Nyfe
Mastiff Bat	*Eumops perotis*	Eupe
California leaf-nosed Bat	*Macrotus californicus*	Maca

In 2010, mist netting in May and June at three locations around Fossil Springs resulted in the detection of Myve (1), Epfu (5), Laci (4), Myca (1), and Myyu (1).

Also, in 2010, caves and a fissure near Fossil Springs were inspected during the day for roosting bats. While bats were not observed, one cave had staining and guano, two caves did not have bat sign but in one, that could have been due to the presence of an active bee hive. One set of caves were not seen until after hiking down; roost inspections there are needed. In addition a fissure (a wide near vertical crack) was inspected at the entrance; no bat sign was detected.

In June 2011, a multi-agency effort organized by NAU through a Forest Service contract resulted in hundreds of mist net hours. Over 35 biologists from various agencies across the state turned out for both nights. Janie led a crew each night and assisted Carol with logistics. As a result of this massive effort, agency and volunteer biologists mist netted six sites in Fossil the first night (including 3 crews hiking down the springs trail 4 miles, mist netting three sites until one, then hiking out 5 miles). The next night biologists mist netted three tanks in the uplands within 1/4 mile of Fossil Creek (so still within the CRMP boundary). Overall, 13 species of bat were mist netted. A few unusual species netted included one cave myotis, two red bats, two Townsend's big-eared bats, one Allen's lappet-browed bat, and the Coconino National Forest's first record of a big free-tail. Table 3-46 shows the species, number, and sex netted during efforts in 2011.

Table 3-46: 2011 Bat Mist Netting Results

		Female				Male		
	Total	Pregnant	Lactating	Nonreproductive	Postlactating	Nonreproductive	Scrotal	percent
TABR	**50**	**17**	**1**	**4**	**4**	**24**	**0**	**31.8**
ANPA	**36**	**1**	**23**	**1**	**2**	**3**	**6**	**22.9**
MYCA	**23**	**0**	**15**	**3**	**3**	**2**	**0**	**14.6**
EPFU	12	3	2	0	2	5	0	7.6
PAHE	12	2	6	0	3	1	0	7.6
MYCI	8	1	3	0	2	2	0	5.1
MYAU	3	0	0	0	0	3	0	1.9
MYYU	3	0	0	0	0	2	1	1.9
LABL	2	0	2	0	0	0	0	1.3
MYVE	2	0	0	0	2	0	0	1.3
COTO	1	0	1	0	0	0	0	0.6
IDPH	1	0	0	0	0	1	0	0.6
LANO	1	0	0	0	0	1	0	0.6
MYVO	1	0	0	0	0	0	1	0.6
NYMA	1	0	0	1	0	0	0	0.6
UNKN	1	0	0	1	0	0	0	0.6

Additional surveys were conducted in 2013 by NAU through a contract with the Forest Service. Surveys at Purple Mountain, Fossil Creek bridge, and Boulder bridge resulted in the capture of 24 individuals (including a red bat that escaped) representing eight species: Anpa, Labl (1), Epfu, Coto (1), Myve, Myca, Pahe, and Epfu. In addition, one big brown bat was hand captured during an inspection of the Boulder Creek bridge and staining and guano indicated use by *Myotis* species.

When combining 2011 and 2013 data, 15 species of bats were captured. Mexican free tails, pallid bats, and California myotis were the most common species, comprising 68% of the 180 bats captured. Sixty-two percent were pregnant, lactating, or post lactating females (as compared to 90% in 2011). Twenty-seven percent of the captures were non-reproductive males.

On June 29, 2016, Forest Service inspected bridges along FR 708 and FR 502 within the Fossil corridor. While no bats were observed and use was not significant, there was evidence that the Boulder and Sally May bridges are being used at least as night roosts. Sally May bridge had a tiny amount of staining indicating light night use.

In 2017, volunteers mapped and scouted out the seven flume tunnels that were closed during the decommissioning phase. Nine of the tunnel entrances/exits were gated before closing the tunnels to the public. Five tunnels entrances/exits were buried and/or sealed and there was no obvious entrance or exit to these tunnels. Exit counts were conducted at a total of seven gated sites in 2017. While none of the tunnels supported large roosts, bats were using four of the seven gated sites; bats were not detected at three sites. Exit counts are still needed at Tunnel 3 entrance and exit. Table 3-47 displays the survey efforts in 2017 and future survey needs. Refer to map X for all the known and potential bat roosts in the Fossil corridor.

In the late summer of 2017, the district archeologist reported bats in a cave north of Fossil Springs. On September 27, a cave above Fossil Springs dam was checked for signs of bat use; none was detected.

Table 3-47 Fossil Flume Tunnels and 2017 Exit Count Survey Results

Location	Description
Tunnel 1 Entrance	Tunnel is 36" wide and 66" high. Used by bats as a night roost.
Tunnel 1 Exit	Tunnel is 38" wide by 47" high. Used by bats as a night roost.
Tunnel 2 Entrance	No bats were detecting during an exit count.
Tunnel 2 Exit	Tunnel appears to be buried.

Location	Description
Tunnel 3 Entrance	Tunnel is about 40" wide by 60" high, but part of that is below ground level, so only 28" of the gate is exposed above ground. There is a hole in the roof just behind the gate, about 16" in diameter. An exit count is needed.
Tunnel 3 Exit	The roof has collapsed on the tunnel exit, leaving a large opening for bats and/or people to enter. Tunnel is about 40" wide x 60" high. An exit count is needed.
Tunnel 4 Entrance	Only 45" wide by 46" high. Used by bats both as a day and a night roost.
Tunnel 4 Exit	Only 60" wide by 38" high. Used by bats as a day roost.
Tunnel 5 Entrance	Tunnel is 60" wide by 37" high. No bats were detected during an exit count.
Tunnel 5 Exit	Sealed; not suitable for bats.
Tunnel 6 Entrance	Tunnel is 36" wide by 60" high, but part of that is below ground. Only 18" of the gate is exposed above ground. No bats were detected during exit count.
Tunnel 6 Exit	Tunnel appears to be buried.
Tunnel 7 Entrance	Sealed; not suitable for bats.
Tunnel 7 Exit	Tunnel appears to be buried.

Approximately 22 species of bats may occur in the Fossil Creek area based on species' ranges and habitat preferences (table 3-48). When looking at survey data across all years and efforts, 17 bat species have been detected in the greater Fossil Creek area, making this area unique for its high diversity of bat species. The high numbers captured in 2011 and 2013 likely indicate sizeable roosts within the local area. The lower portion of Fossil Creek has been unsurveyed (due to inaccessibility) but has Sonoran desert species such as blue palo verde, indicating the possibility that some low elevation species such as California leaf-nosed bat may occur in the lower portion of Fossil Creek corridor. Roost inspections and exit counts have resulted in the detection of bats or signs of use at sites in the corridor (figure 3-46).

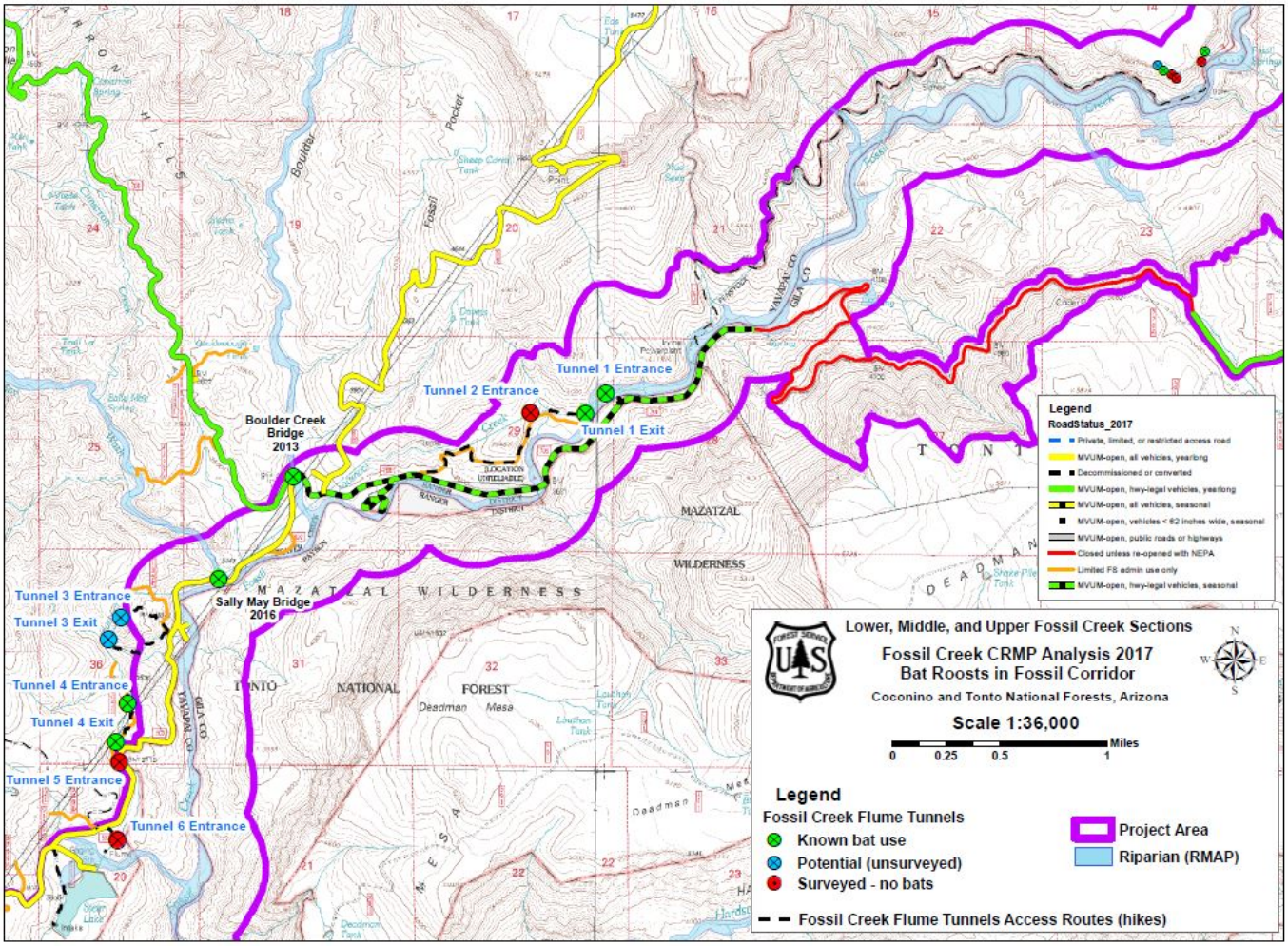


Figure 3-46: Known and Potential Roost Sites in Fossil WSR Corridor

Table 3-48: Bat Species and their Habitat Requirements

		Roost Requirements					Habitat						
Common Name	Scientific Name	S	R	C	T	F	MC	PP	PJ	C	DS	G	R
California leaf-nosed bat	*Macrotus californicus*			X					X		X		
Yuma myotis*	*Myotis yumanensis*	X	X	X				X	X		X	X	X
Cave myotis*	*Myotis velifer*	X		X							X		
Occult little brown bat	*Myotis lucifugus occultus*	X		X	X			X					
Long-eared myotis	*Myotis evotis*	X	X	X	X		X	X	X	X			
Southwestern myotis*	*Myotis auriculus*							X	X	X	X		
Fringed myotis	*Myotis thysanodes*	X		X	X		X	X	X	X	X	X	
Long legged myotis*	*Myotis volans*	X	X	X				X	X		X		
California myotis*	*Myotis californicus*			X				X			X		
Western small-footed myotis*	*Myotis ciliolabrum*		X	X				X	X	X			X
Pallid bat*	*Antrozous pallidus*							X	X				
Allen's big-eared bat*	*Idionycteris phyllotis*		X	X	X		X	X	X				X
Townsend's big-eared bat*	*Corynorhynus townsendii*	X		X			X	X	X		X		
Spotted bat	*Euderma maculatum*		X					X	X	X	X		X
Silver-haired bat*	*Lasionycteris noctivagans*						X	X	X				
Canyon pipistrelle*	*Parastrellus Hesperus*		X	X			X	X	X		X		X
Big brown bat*	*Eptesicus fuscus*			X			X	X	X	X	X	X	X
Red bat*	*Lasiurus blossevillii*					X							X

Common Name	Scientific Name	Roost Requirements					Habitat						
		S	R	C	T	F	MC	PP	PJ	C	DS	G	R
Hoary Bat*	*Lasiurus cinereus*					X	X	X	X				
Mexican free-tailed bat*	*Tadarida brasiliensis*			X				X	X	X	X	X	
Pocketed free-tailed bat*	*Nyctinomops fermorosaccus*		X								X		
Big free-tailed bat*	*Nyctinomops macrotis*			X							X		X

Legend
S = Structures such as buildings, barns, bridges
R = Cracks and crevices in cliffs, and under rocks
C = Caves, cliff dwellings, mines, tunnels
T = Hollow trees, snags, underneath loose tree bark
F = Among foliage of trees and leafy shrubs
MC = Mixed Conifer
PP = Ponderosa Pine
PJ = Pinyon Juniper
C = Chaparral
DS = Desert Scrub
G = Grassland
R = Riparian
* Denotes species that have been detected in Fossil Creek during survey efforts.

Few roost inspections have been conducted for bats in the planning area but several occupied bat roosts are known to occur in cliff dwellings and sealed and gated flume tunnels along Fossil Creek. Other roosts likely occur in natural structures such as underneath loose bark on snags, in tree and snag cavities, under rocks, in the cracks and crevices of cliffs, and in man-made structures such as bridges, buildings, and gated flume tunnels. All of the bat species occurring or potentially occurring in the area are insectivorous. Water sources such as earthen stock tanks, springs, seeps, and streams are important for bat foraging due to the abundance of insects found flying above the water. Refer to table 3-48 for Bat Species potentially occurring in Fossil corridor and their habitat types.

Birds

There are many species of birds that occur in the Fossil CRMP corridor. A query of the Fossil Creek database (Appendix C of the *Wildlife and Vegetation Specialist Report*) for actual bird observations reveals that numerous species have been documented as occurring in the Fossil Creek area. The majority of these birds are passerines but other groups of birds include waterfowl, wading birds, fowl-like birds, raptors, and various non-passerine birds such as kingfishers, doves, hummingbirds, and woodpeckers. Of particular note (and that haven't already been analyzed) are zone-tail hawks, American dipper, brown-crested flycatcher, bridled titmouse, yellow warbler, Bullock's oriole and Abert's towhees, Gila woodpeckers, pinyon jay, gray flycatcher, and Lazuli bunting. Other SGCN bird species not recorded but that could occur based on their range and habitat requirements include black-tailed gnatcatcher and common poorwill.

Reptiles & Amphibians

Amphibian and reptiles in the Fossil Creek corridor include several species of toads, frogs, lizards, snakes, and turtle. Amphibians include canyon treefrogs and red spotted toads. Further up in the watershed, striped chorus frogs and tiger salamanders occur. Mountain tree-frogs may occur at the very head of the corridor and likely in the wooded portions of the upper watershed. Numerous species of lizards occur throughout the uplands (non-riparian areas); Gila monster, collared, fence, earless, side-blotched, tree, Gila spotted whiptail, and Madrean alligator. Snake species that occur in the area include: black-necked gartersnake; Sonoran whip snake; Sonoran mountain king snake; gopher (bull) snake; and Arizona black, black-tailed and Western diamondback rattlesnakes. The Sonora mud turtle is also observed all along Fossil Creek. Refer to Appendix C of the *Wildlife and Vegetation Specialist Report* for a list of actual reptile and amphibian observations in Fossil Creek as well as a list of species for which suitable habitat occurs.

Terrestrial Invertebrates

Invertebrate surveys in Fossil Creek have been numerous but have almost exclusively focused on aquatic macro invertebrates (see Fisheries specialist report). Some terrestrial invertebrates that have been observed and documented in the Fossil corridor include tarantula, wolf spider, various beetles (alder leaf flea beetle, tiger, two dot click, green florescent, glorious scarab, ten-lined June bug,), cicadas, tarantula hawk, moths (tiger, Virginia and yellow sphinxs, glover silkmoth, Io, Polyphemous), butterflies (Southern dogface, pipevine swallowtail, mourning cloak, painted lady, Arizona sister, Queen, common buckeye, yellow sulphur, Sarah's orangetip, cabbage white, skipper), antlion, katydid, and centipede. Semi terrestrial invertebrates include six-spotted fishing spider, and numerous species of damselflies, skimmers, dragonflies, dobsonflies.

Environmental Consequences for Wildlife and Vegetation

The entire environmental consequences section starts with a general discussion on how proposed activities can result in direct and indirect effects to special status species and their habitat. More in-depth analysis of effects for individual special status species occur later in this section.

General Effects Common to All Action Alternatives

All action alternatives have both programmatic and site-specific components.

Programmatic actions *common to all action alternatives* include comprehensive river management plan (CRMP) management direction and adjustment of the Fossil Springs botanical area. The CRMP lays out desired conditions, standards, guidelines, objectives, and management approaches for Fossil Creek WSR river values and other resources and uses occurring in the area. This management direction is to ensure that the river's outstandingly remarkable values, including biological habitat and populations are protected or enhanced.

Wildlife and vegetation-specific desired conditions outlined in the CRMP strive towards protecting and maintaining a diversity of wildlife and plant species, improving the status of special status species and contributing to recovery of these species, providing abundant and accessible refugia where species are largely un-impacted from recreation activities, educating visitors about the consequences of introducing and/or spreading non-native species (plants, fish, crayfish, mussels, and diseases). Wildlife and vegetation-specific standards outline in the CRMP ensure: the control and spread of invasive plants, removal of non-native fish should they be introduced in the native fishery. Guidelines provide protection to special status birds during their breeding season, restoration of springs interrupted by manmade features, discouraging visitation to bat roosts, continuing treatment of invasive species, ensuring the permanent fish barrier is functioning properly, limiting mesquite bosque fragmentation and minimizing human use in refugia areas. An objective of obtaining baseline inventory for the major taxa groups will give a clear picture of diversity and will highlight species that may need special management actions. Management approaches mainly involve close coordination with other agencies and species specialists but also allows for the construction of temporary fish barriers and calls for restoring impacted habitat outside of recreation sites. Enlarging the botanical area, ensuring the integrity of native species and natural ecological processes are maintained, ensuring vegetation communities and soil productivity are largely free of impact from human activities, staggering invasive plant treatments to avoid erosion, and prohibiting horse camping in the botanical area, will all protect the botanical area and this will benefit vegetation as well as riparian and terrestrial wildlife. In summary, the guidance specific to wildlife and vegetation will provide a long-term benefit to regionally important populations and special status species, as well as the unique and exceptionally high quality habitat. As a result, CRMP guidance will result in the protection and enhancement of the diversity of species as well and ensure diverse and contiguous habitat; all of which are criteria for the Biological ORV.

Following is a summary of the effects of programmatic guidance for other program areas on vegetation, wildlife and special status species.

Table 3-49: Summary of program level effects of the CRMP on vegetation, wildlife, special status species, and their habitat

Program Area	Anticipated Effects to Riparian Species and Habitat
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, rehabilitate and recover bare soil areas outside of recreation sites, all contribute to long term benefits to species and their habitat.
Riparian Function	Benefits to riparian obligate and aquatic species and their habitat from implementing management direction for proper function riparian areas, ensuring stream channel and banks are stable, and maintaining aquatic management zones.
Vegetation	See discussion above.
Soil Condition	Minimizing human-created bare areas particularly outside of recreation sites and within AMZ and implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation into Fossil Creek will result in long-term benefits to wildlife and their habitat.
Geology	Protection of travertine formations and the unique structural and vegetative habitat they create will protect species particularly in the high-formation reach.
Wildlife, Fish and Aquatic Species	See discussion above.
Traditional Cultural Practices	Discouraging visitation to cliff dwellings, caves, and cliffs and limiting use of banks in Fossil Springs to day use will benefit riparian and aquatic wildlife species and their habitat. Access for traditional practitioners for ceremonies could result in short term noise disturbance to wildlife.
Heritage Resources	The protection and preservation of prehistoric, historic, and traditional/sacred places will also benefit wildlife species and their habitat.
Recreation	When appropriate infrastructure is in place, capacities are appropriately set, entry is managed, developed camping is limited to outside the 100 year floodplain and AMZ, and dispersed camping in limited, impacts to species and their habitat will be reduced. In addition, there will be no: new trails across springs or paralleling Fossil Creek to connect recreation sites; no roadside parking; no motorized watercraft; no campfires; no glass containers, and no rope swings. Trails should be located on soils with low erosion hazard, outside of the AMZ, and away from areas with special-status species concerns. Helicopter landings are restricted to emergency and limited administrative purposes. Recreation fees and partnerships will ensure resources to implement the CRMP, monitoring, and adaptive management. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience. As a result their behavior supports protection of river values, most visitors will recreate responsibly, and the majority of visitors will stay within the designated areas. As a result, the refugia in between recreation sites will be largely free of human disturbance and this will benefit riparian vegetation, riparian and aquatic species, and species' habitat. The developed recreation sites where infrastructure will be constructed, will result in the long-term loss of a small area of wildlife habitat. The recreation use areas will have less effect, but there will be some bare soil areas through the uplands and along the creek banks as a result of recreational activities.
Recreation/Lands Special Uses	The continued use and maintenance of existing utility infrastructure results in a long term loss of wildlife habitat and disturbance to wildlife during maintenance activities. Vegetation under powerlines is kept mainly free of tree canopy and this result in a long-term loss of specific structure required by tree-dependent species. Lands special use guidance that benefits wildlife and their habitat include requiring powerlines comply with avian protection guidelines, not allowing new aerial utilities to be constructed in the Fossil corridor, and not widening existing utility corridors. There will be no commercial filming using helicopters or unmanned aerial vehicles. Commercial filming/photography and commercial special-use recreation events will be prohibited during the high-use season; these activities will have minimal impact to species outside of the high use season. Permit holders should provide an education component to their programs and filming should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values. While outfitter/guided activities can result in visual and aural disturbance to wildlife and impacts to their habitat, impacts will be less than unguided recreation because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities, likewise are screened, tailored to reduce impacts to wildlife and habitat, and contribute data needed to make informed management changes.
Roads and Facilities	The existence of roads and infrastructure equates to the loss of wildlife habitat. Maintenance of roads will include adequate drainage and will implement BMPs, design features; all of which will minimize resource impacts. Unauthorized roads will be decommissioned, obliterated or closed, with priority to roads that intersect stream courses or springs or those that result indirect delivery of sediment to Fossil creek. This will benefit wildlife species and their habitat. In addition, guidance calls for locating recreation infrastructure outside of areas with special status species concerns.
Scenery Resources	There are no negative effects from scenery guidance on wildlife and habitat. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare soil areas outside of recreation sites, trails and roads will benefit wildlife and their habitat.

Program Area	Anticipated Effects to Riparian Species and Habitat
Special Areas	Act-driven restrictions in special areas indirectly benefit wildlife species and their habitat through minimizing the use of motorized equipment and mechanized travel as well as maintaining free flow and protecting and enhancing river values. Expanding the Fossil Springs Botanical Area would increase the area in which the protection and maintenance of physical and biological processes unique to the Fossil Springs area is emphasized. This would benefit wildlife and vegetation by supporting protection of the vegetation and habitat in the vicinity of Fossil Springs.
Interpretation and Education	Interpretation and education will mainly result in indirect benefits to wildlife species and their habitat. In addition interpretation infrastructure and organized activities in the uplands will aid in reducing the amount of people recreating along the creek and in the water. I&E events in the corridor, however, can result in similar visual and aural disturbance to wildlife and impacts to their habitat as described above for recreation.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Site-specific actions *common to all action alternatives include*: development of recreation sites including construction of infrastructure and delineation of parking; restoration activities; construction and repair of roads and trails; withdrawal of the recreation segment from locatable mineral entry; obtaining federally reserved water rights for streamflows; maintaining access to Stehr Lake, Childs, and Deadman Mesa Road; infrastructure at east and west welcome stations; repair and extension of existing gabion; construction of a new vehicle bridge adjacent to existing Fossil Creek bridge; day use opportunities; access for dispersed backcountry camping; camping for administrative activities and special events; camping at Stehr Lake; possibility of outfitter/guiding activities after a separate needs assessment and prospectus is completed; Mail trail (length and location), maintenance of roads (grading, new drainage improvements, vegetation maintenance and utility maintenance); road hazard mitigation activities (including rock scaling); facilities maintenance; restoration of closed roads, unauthorized roads and trails, and bare soil areas (but amount differ by alternatives); armoring recreation sites and trails; and installation of barriers to delineate sites and installation of runoff retention basins, and other drainage features. Refer to the alternative descriptions for details on these actions that are common to all action alternatives.

Important assumptions, adaptive management measures, and implementation strategies common to all action alternatives include:

- If future changes to CRMP management direction are needed to ensure protection or enhancement of river values, the management direction would be updated and, if necessary, would include the current forest plan amendment process.
- Elements of the monitoring plan may be modified to improve assessment and protection of river values or incorporate new methodologies and the best available science.
- Upon completion of the CRMP, existing infrastructure that supports education and interpretation would be utilized, with materials updated as needed to support CRMP implementation. Over time, additional infrastructure such as kiosks, displays, welcome centers, and group facilities would be built if resources to do so are available and river values are protected.
- Areas outside of recreation sites, construction footprints, and designated roads and trails would serve as relatively undisturbed habitat (refugia) for wildlife, fish, and plants. In refugia areas, the effects from visitor use are anticipated to be so minor as to be negligible and there would be no use of heavy machinery or development of infrastructure.
- If human disturbance that may adversely impact the structure or function of refugia areas is detected, educational messaging could be focused on the importance of refugia, or restoration activities or temporary closures may be used to aid recovery of these areas. Physical barriers such as rocks, vegetative material, or fencing may be used to prevent access to these areas.

- A permit system may be used if needed to accommodate increasing use, administrative considerations or to protect river values, the length of the permit season could be expanded up to the point that it includes the entire year. Likewise, the area for which permits are required for parking or camping may be expanded to include additional locations such as Stehr Lake. The number of daily permits available on a weekly or seasonal basis could be adjusted if needed to provide temporal refugia for fish or wildlife. The permit system could also be adjusted to redistribute the timing, location, and/or type of use as need to protect river values.
- Actual visitor use is anticipated to continue to differ on a seasonal basis. From April through September, recreational uses is highest. From October through March, recreational use is substantially lower and focused more around activities such as hiking, fishing, and hunting. During this low use period, visitor access would not be subject to the permit system unless use increases to the point that it risks exceeding established capacities or adversely affecting river values.
- The precise location and arrangement of amenities within recreation sites would be determined after approval of the CRMP through a separate site design process. However, this analysis assumes that within any portion of developed recreation footprints, disturbance could occur from machinery, the building of infrastructure, the presence of vehicles, and use by visitors. Within the recreation dispersal footprint, the effects of visitors (ground disturbance, noise disturbance, trash, et.) will be analyzed but the assumption is that no major machinery or infrastructure will be used or built in these areas. Minor infrastructure or actions in the recreation dispersal area could include signage, hardened trails, armored creek access, fencing, and restoration activities.
- If monitoring indicates recreation activities or conditions at recreation sites may be adversely impacting river values, a variety of actions may be taken including implementing resource protection measures, modifying the type or arrangement of facilities provided within recreation sites, targeted restoration activities, increased management presence, education efforts targeted at addressing observed impacts, permit system changes to adjust use patterns, or temporary or long-term closures or prohibitions of specific recreation activities.
- Motor vehicle access into the corridor may be temporarily restricted to protect public safety or to protect resources.
- Restoration activities would be prioritized in areas where there is direct connectivity with Fossil creek or where sensitive cultural or natural resources occur.

Administrative activities include area and permit operations, routine maintenance and servicing of facilities, construction activities, survey efforts by other agencies and researchers, and occasional tribal ceremonies. The majority of activity in Fossil Creek is from recreation. Recreational activities occurring within the Fossil Creek planning area under all alternatives include: swimming, non-motorized boating, snorkeling, picnicking, hiking, biking and equestrian use on certain trails, wilderness exploration, learning about history and contemporary uses associated with the corridor, off-road vehicle use, camping, hunting, fishing, and viewing scenery, wildlife, fish, and plants/wildflowers.

Direct and Indirect Effects to Wildlife

The presence of people (visitors, agency personnel, tribes, researches, volunteers, law enforcement, emergency responders, and special use permit holders) and pets, and the use of vehicles (personal and administrative, including equipment needed for servicing, maintenance and construction) can result in direct and indirect effects to wildlife and their habitat. Because people would be more concentrated at recreation sites in Fossil Creek, these effects are expected to occur at developed recreation sites which mostly occur in Middle Fossil Creek as well as the Fossil Springs area. However, these impacts would not be expected in the refugia areas (riparian and uplands outside of developed recreation sites, recreation dispersal areas, and roads and trails).

Humans can directly affect wildlife by intentional activities such as handling or collecting, especially reptiles and amphibians and to a lesser extent, invertebrates (Maxell and Hokit, 1999). However, most of direct effects are

unintentional consequences including: trampling smaller animals (e.g. invertebrates or tadpoles); physically disturbing frog and toad eggs masses; trampling larvae attached to substrate and/or vegetation; stepping on or knocking over nests; and spilling contents of nests (Hamann et al. 1999). Handling, harassing, or translocating reptiles or amphibians can result in increased risk of mortality, especially certain species more susceptible to stress from human handling (Maxell and Hokit 1999). It is anticipated that most of these types of disturbances will occur from visitors and their pets as they recreate along Fossil Creek in the developed recreation sites. Vehicular activities, including construction and restoration activities can result in collisions that injure or killed individuals, particularly reptiles, small mammals, passerine birds, and invertebrates.

Activities in Fossil Creek under all alternatives can directly affect wildlife species when people, pets, vehicles and equipment cause aural and visual disturbance to wildlife present in the planning area. Aural disturbance occurs when noises (such as that from people, pets, vehicles, equipment, and music) occurs within close enough proximity to wildlife. Visual and aural disturbance results in reduced health and fitness, reduced reproduction rates, and increased mortality/decreased reproductive success (Leung and Marion, 2000). Proposed activities that can result in direct disturbance to wildlife include: day use at developed recreation sites, camping in designated campsites and in wilderness, and dispersed back country recreation such as canyoneering in Fossil Springs and Mazatzal wildernesses; repair and extension of the gabion along FR502; construction of a new vehicle bridge on FR 708; road hazard mitigation activities; and construction of infrastructure when it results in new ground disturbance. Other proposed activities that have a short term impact but long term benefit to wildlife include maintenance of roads and trails, maintenance of facilities, construction of infrastructure that contains recreation impacts (parking area delineation) and mitigates effects (runoff retention basins that reduce contaminants from reaching Fossil creek), and restoration activities.

Most bird, mammal, reptile, and aerial invertebrate species are mobile and are capable of dispersing from disturbance. However disturbance that is frequent, or of long duration, or during critical periods (such as visitor use of designated recreation sites in Middle Fossil and up at Fossil Springs) can result in: disrupted wildlife movement; abandonment of nests, dens or roosts; nest failure; and even abandonment of young (Knight and Cole 1991). Individuals incapable of dispersal (eggs, larvae, non-aerial individuals such as invertebrates or tadpoles, dependent young, and egg masses attached to aquatic vegetation or substrate) or individuals unwilling to disperse (adults with immobile young) can experience negative effects including: death or injury from trampling, crushing, and collection; increased physiological stress; flushing of birds from incubating eggs thus increasing potential for eggs to become unviable; premature fledging of young from nests; and exposing nests resulting in an increased potential for predation, nest parasitism, and exposure to elements. Response to humans include altered behavior, changes in spatial distribution, and changes in the use of habitats (Hamann et al. 1999). Monitoring data shows that when recreation numbers drastically increased at both the waterfall and the historic Fossil Springs dam, black-hawks nesting at those sites disappeared after 2007 and before 2009; as of 2011 neither of those two territories have been reoccupied. Proposed activities that may result in disturbance to wildlife over the long term include; day use, camping, and dispersed back country recreation; use along roads and trails; and construction of infrastructure when it results in new ground disturbance. Again, these impacts to wildlife would not be expected in the refugia areas (riparian and uplands outside of developed recreation sites, recreation dispersal areas, and roads and trails).

Disturbance to bats may occur when activities in the corridor result in noise within close enough proximity to bat roost (particularly maternity roosts) and hibernacula locations. Noise disturbance at certain intensities can disturb bats in their roosts and result in premature exiting or unnecessary arousal from hibernation. Since hibernating bats often have only enough fat reserve to bring them out of hibernation once, disturbance during the winter can trigger bats to arouse from hibernation, only to go resume hibernation without enough fat reserves to come back out in the spring. Noise disturbance of long duration can cause temporary or permanent roost abandonment. Recreation-caused changes to vegetation can result in reduced plants that are hosts to insects that insectivorous bats eat. Only a handful of bat roosts are known and except for the bridges, the flume tunnels and most cliff dwelling roosts occur mainly in areas away from or relatively inaccessible to visitors. However there are many unknown roost locations including, trees, snags, crevices in cliffs, caves, rocks on talus slopes, etc. Bats that roost among foliage of deciduous trees are also likely to be disturbed in recreation sites. As for hibernating bats,

activities in Fossil are fairly limited during that season and is mainly from hunting and fishing and then administrative activities such as maintenance, construction, and restoration. Construction, maintenance, and restoration activities would have the most potential for disturbing hibernating bats, especially since hibernacula locations are unknown.

More specifically, proposed administrative activities that may affect species and their habitat, either temporarily or long-term, include construction (new infrastructure such as the 708 bridge) and certain maintenance activities (such as the failing gabions). Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat.

Forest Service employees have observed over the years of interim management, an increase in the number of ants and skunks in high-recreation-use areas of the Fossil corridor. Wild predators (ravens, skunks, raccoons, coyotes, and foxes) are supported at artificially higher numbers where high human activity generates more trash and displace native species, and can have higher predation rates on reptiles and amphibians (Maxell and Hokit 1999).

There is always potential that visitors to Fossil Creek illegally or unintentionally introduce non-native species (such as non-native sport fish; invasive plants) or move non-natives around within the corridor (such as crayfish). Nonnative species directly affect wildlife through competition, predation, reduced diversity of prey, and increased risk of introducing or spreading disease or pathogens (Maxell and Hokit 1999). Non-native fish introduced into Fossil would not only put native fish at risk, but also native amphibians (such as lowland leopard frogs) which would in turn affect predators such as gartersnakes and black-hawks.

Administrative (area management, construction, and restoration activities) and recreation activities can directly affect wildlife habitat when activities in the corridor disturb, alter, or destroy their habitat. Activities and infrastructure that support these activities can act as barriers to, and displace wildlife from, food, water and shelter (Leung and Marion 2000). Recreational use at designated sites and along roads and trails also contribute to introduction and spread of invasive species, both plant and animal (Leung and Marion 2000).

Pronounced ground-disturbing activities alter the characteristics of soil, vegetation, and water which affect the quality and amount of food, water, cover, and nest substrate and concealment, for wildlife resulting in a decline in the diversity and species richness of wildlife species (Cole and Landres, 1995 and Leung and Marion, 2000). Impacts from visitation on vegetation include a reduction in the amount and types of herbaceous ground cover; decline in plant vigor, reduction and even elimination of tree seedlings and saplings, mechanical injury to mature trees which encourages diseases and parasites, shift in species diversity to those more tolerant of impacts, and establishment and spread of invasive species (Johnson and Carothers, 1982 and Cole and Landres, 1995). Impacts from proposed activities on soils can include: compaction, reduction in plant ground cover, reduced infiltration, and reduced organic debris (Johnson and Carothers, 1982 and Cole and Landres, 1995). Compacted soil hinders burrow excavation and affects fossorial wildlife species (such as ground squirrels) and species that prey on them (such as Gila monsters).

Activities within the riparian zone result in: loss of soil-stabilizing ground cover; exposed and eroding stream banks, soil compaction; direct damage to riparian plants from trampling of riparian vegetation; exposure of the root system of woody riparian plants; decreased amount of grasses, forbs, shrubs, and recruitment trees; increased potential for establishment and spread of invasive weeds; decreased infiltration of water during rain events; decreased soil moisture availability to plants; increase rates of run off; increased sedimentation into streams; increase of trash and contaminants (human waste, vehicle fluids) into streams; decreased water quality (higher levels of turbidity and *E.coli*, altered pH levels), and exacerbated flooding.

Unauthorized trails from day use and camp sites lead directly down to Fossil Creek and act as conduits facilitating sediment input into Fossil Creek. When these activities occur in the uplands, they cause degraded upland conditions which subsequently cause increased water runoff, increased soil deposition, decreased water quality;

further contributing to decreased quality of riparian habitat. Excessive sedimentation into Fossil Creek can result in the stream substrate becoming embedded with soil. This reduces the surface area for macroinvertebrates to attach. Macroinvertebrates are the food source for many aquatic and riparian obligate species; when macroinvertebrate populations decline, the effects carries over to predator species as well. These impacts are mostly likely to occur at Fossil Springs and the Middle Fossil area (Waterfall downstream to Mazatzal), but are not expected to occur above the springs nor below the Mazatzal recreation site. Figures 3-47 through 3-50 are pictures demonstrating denuded and compacted soil at high use recreation sites in Fossil in the years following restoration of full flows.



Figure 3-47. Denuded area at Fossil Creek Bridge (left) and Purple Mountain (right), 2006



Figure 3-48. Denuded area at unknown Fossil Creek location, 2013



Figure 3-49. Denuded area at Sally May (left) and the waterfall (right), 2016



Figure 3-50. Denuded area along the Watefall Trail, 2017

Poor road and trail drainage causes erosion and sediment delivery which can result in: altered channel morphology, loss of fish spawning and rearing habitat, and changes in the macroinvertebrate assemblage (Lisle 1989; Miller and Benda 2000; Wood and Armitage 1997). When sediment from unmaintained roads indirectly affect fish and macroinvertebrates, there is a subsequent affect to those species that forage on fish and macroinvertebrates. Frogs, toads, and some birds (such as the American dipper) depend on aquatic invertebrates for food. Garter snakes depend at least partly on fish, frogs, toads, tadpoles, and salamanders for food. Insectivorous birds (flycatchers, warblers, and others) and bats depend at least partly on the aerial life forms of aquatic macroinvertebrates for food. Birds such as black-hawks, herons and kingfishers depend on fish and other aquatic organisms for their food. Mammals such as raccoons and river otters depend at least partly on fish and aquatic invertebrates for their food.

Proposed activities such as improved drainage along designated roads and trails, withdrawal from mineral entry, repair of the gabion, restoration of closed roads and unauthorized roads and trails, delineation of creek access trails that lead to armored areas, barriers to delineate sites, installation of runoff retention basins all contribute to reducing the amount of sediment that gets into Fossil Creek. Monitoring bare area will ensure timely closure and restoration of unauthorized trails. All these activities will minimize effects to aquatic species and those species they depend on aquatic species for food.

Trails, roads, and recreation sites, especially within the riparian corridor, fragment habitat and reduce the amount of unaltered habitat. Fragmentation of limited and linear habitats, such as riparian areas, causes greater effects to songbirds when compared to fragmentation of uplands adjacent to riparian (Hamann et al. 1999). Trails, roads, and recreation sites fragment habitat, reduce hiding cover, and disrupt wildlife movement, all of which increase the potential for predation and loss of nesting, roosting, and hiding areas. The cumulative decrease in the quality and quantity of suitable nesting, roosting, and foraging habitat from all activities in the project area can cause site abandonment ultimately reducing the composition and diversity of wildlife species over the next several decades.

The concept of refugia – protecting the areas outside of roads, trails and the recreation sites, along with mostly day use, will reduce the potential for fragmentation.

Vehicle use on roads and parking at recreation sites may contribute to pollutants (oils, fuels, radiator fluids) that can affect macroinvertebrates, amphibians, and aquatic reptiles as well as their habitat when these vehicle-related pollutants enter streams (Maxell and Hokit 1999). The proposed sediment retention basins to be constructed in the parking lots will reduce this potential.

Use of helicopters for search and rescue may occur anywhere within the Fossil corridor and could result in short term disturbance to wildlife resulting in individuals fleeing from the vicinity of a land zone. However, this disturbance will be very infrequent and of short duration and is not expected to cause abandonment for a long enough duration to result in mortality.

Indirect Effects to Habitat

Ground disturbing activities, such that occur in areas where people concentrate at recreation sites in Middle Fossil Creek and the Fossil Springs area, result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff (U.S. Fish and Wildlife Service 1993b). Increased runoff in turn then results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. At the lowest level sedimentation increases embeddedness which decreased habitat availability for macroinvertebrates which are the base of the food chain.

While monitoring will show where impacts are occurring and adaptive management will result in the on-the-ground action to reduce those impacts, there may be a temporal delay in implementation. For example, unauthorized trails are more likely to become established in the summer months during the high use period. Monitoring in the off season would not detect the impact of unauthorized trails until fall/winter. Closure of unauthorized trails should occur before the next high use season. This temporal delay will result in short-term impacts such as trampled vegetation, bare soil soils, potential sediment source for Fossil, and visual/aural disturbance to special status wildlife species.

Invasive plant species affect wildlife and wildlife habitat in numerous ways. Vehicles, people and pets can bring in seed as well as spread it throughout the corridor. Infestations of invasive non-native plant species: reduce the diversity of plants in an area, even resulting in monostands; reduce ground cover; reduce forage for wildlife; deteriorate wildlife habitat; out-compete native vegetation, and in some cases can be toxic to wildlife. In Fossil Creek, non-native plants such as Himalayan blackberry, giant reed, and tall fescue are well established in some areas. Where these invasive species occur, they result in dense stands where no native vegetation can persist. Moreover, endophytes in fescue causes the plants to produce an alkaloid toxin that makes the plant unsuitable for animals and allows fescue to outcompete other plant species. Birds that eat large portions of infected seed are subject to substantial weight loss (Madej 1991). Fungal endophyte-infected fescue is toxic when consumed by mammalian herbivores (Clay et al 1984). Not all fescue is infected with endophytes, however, and it is unknown whether tall fescue in Fossil contains endophytes. Even without endophytes, this non-native grass overtakes the wetted soil within riparian areas, forms a dense stand that out-competes native herbaceous vegetation, reduces vegetative diversity, and is considered an inferior source of food for animals when compared to a native assemblage of plants.

Beneficial Effects

Many of the measures common to all action alternatives will have a positive effect in moving current vegetation and wildlife resource towards the desired future conditions. In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: bare soil areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors. Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused

education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that harden sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

The healthier and more diverse a habitat, the less likely it is to have invasive species establish and flourish, partly due to a reduced chance of introducing new species as well as a reduced chance of establishment. All of the management actions listed above that benefit general vegetation composition, structure and resiliency will lead to these areas being less susceptible to invasion by weeds as well as minimizing spread of current populations. Invasive species are introduced to an area by humans and their equipment.

Effects Unique to Each Action Alternative

The best way to demonstrate the differences in amount of habitat altered/destroyed by alternative is through a table. The following table summarizes various categories of disturbance and restoration miles and acres by alternative by vegetative community.

Table 3-50: Summary of Disturbed Acres in the Project Area by Veg Type and Alternative

Vegetation Type	No Action	Alt B	Alt C	Alt D	Alt E	Alt F
Alligator/Utah juniper Savanna	4.6	4.6	4.6	4.6	5.3	4.6
Juniper Woodland – Semi Desert Grassland Transition	15.6	13.8	16.6	12.9	17.4	21.4
Lake (No longer lake – now PJ/Semi Desert Grassland	0.1	0.03	0.03	0	0.03	0.03
Pinyon-juniper Woodland	57.3	47.0	48.2	45.6	50.7	48.8
Ponderosa Pine Forest	1.9	1.9	1.9	1.9	1.9	0.8
Riparian Streamside Vegetation + RMAP = Total Riparian Veg	0.2+26.4 = 26.5	0.2+9.1 = 9.3	0.2+8.4 = 8.6	0.2 + 13.4= 13.6	0.2+21.4 = 21.6	12.6 + 7.8= 20.4
Semi-desert Grassland	20.3	17.3	17.3	17.3	17.5	17.0
Total Veg Acres disturbed[1]	126.3	94.0	97.1	95.9	114.7	114.3
Total Veg Acres Restored	0	41.2	43.7	46.4	40.6	41.6

[1]Total Veg Acres Disturbed for the No Action alternative includes disturbed areas that would be restored in the action alternatives.

The no action has the most acres of disturbed habitat (upland and riparian) of all alternatives, followed by Alt E, Alt F, and Alt C. Alt B has the least followed by Alt D. For restoration, Alternative D calls for the most at 46.4 acres, followed by alternative C (43.7), then F (41.6), then B (41.2), then E (40.6) and least, Alt A (0).

In addition, the differences between alternatives in regard to the various riparian habitat categories is displayed in Table 3-51. Since most special status species in the corridor are riparian obligates, this data was important to consider in the effects analysis.

Table 3-51: Summary of Riparian Acres by Category and Alternative

	No Action	Alt B	Alt C	Alt D	Alt E	Alt F
Total Riparian Acres	652.2	652.2	652.2	652.2	652.2	652.2
Riparian Acres Disturbed	26.5	9.3	8.6	13.6	21.6	14.6
Undisturbed Riparian Refugia (rip tot – rip disturbed)	625.6	642.9	643.6	638.6	630.4	637.7
Riparian Acres Restored	0	20.5	21.8	22.3	20.5	20.4
Full Potential for Riparian Refugia (undisturbed rip refugia + riparian acres restored)	625.6	663.4	665.4	661.0	651.0	657.9

	No Action	Alt B	Alt C	Alt D	Alt E	Alt F
Total Number of Recreation Sites with Access to Fossil Creek	9	10	8	4	11	11
Total PAOTs	810	640	720	905	1510	2580

Most of the special status species in the Fossil Creek corridor are either riparian obligates or depend on water and riparian areas for a portion of the life history requirements. In one publication, the authors recommend that no new roads, trails, or campgrounds be established within 600 meters of a stream or riparian forest (Hamann et al. 1999). All action alternatives have recreation sites, roads, and trails within 600 meters of riparian, however the amount of disturbance in riparian habitat differs among alternatives. Acres of riparian habitat disturbed is highest in the no action (26.5 ac), followed by Alt E (21.6 ac), Alt F (14.6), Alt D (13.6 ac) and Alt B (9.3 ac). Alt C has the least impact to riparian veg at 8.6 acres. Riparian acres to be restored is most in alternative D (22.3), followed by C (21.8). Alternatives B and E both call for the restoration of 20.5 acres of riparian areas. Alternative F would restore 20.4 acres. No restoration would be able to occur under the no action alternative until further NEPA was completed. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.9) then E (651.0) and last, the no action (625.6).

Alternative F eventually would allow the most PAOTs (2,580), followed by E (1,510), D (905), the no action (810), C (720) and then B (640). If Alternatives B or C were selected, PAOTs would be decreased. If alternatives D, E, or F were selected, PAOTs would not be incrementally increased until infrastructure is in place and monitoring shows there are no effects from current capacities.

Under alternatives A, B, E, and F, roughly 1.65 miles of perennial Fossil Creek would be within recreation sites. This constitutes about 11.3% of the total perennial stream length within the WSR corridor. This means that around 12% of the stream length within the WSR corridor would be within existing or proposed recreation sites. The number and length of recreation sites vary by alternative; consequently the stream length immediately adjacent to recreation sites varies from about 2826 feet (Alt D) to over 8700 feet (Alts E and F) (table 3-52). Alternative D is likely to be most protective of stream bank stability since the linear distance of recreation sites immediately adjacent to Fossil Creek is less than that for all the other alternatives whereas alternatives E and F have the most linear distance of recreation sites adjacent to Fossil Creek.

Because most special status species depend on Fossil Creek for all or a part of their needs, another important consideration was to look at PAOTs, linear stream miles within recreation sites, and the potential for crowding resulting in impacts to refugia. The higher the number of visitors, the more crowded visitors may feel within recreation sites. The higher potential for crowding results in an increased potential for impacts to refugia (i.e. creation of social trails and bare area). See Fisheries Specialist Report for full description of table including assumptions and caveats). To facilitate comparison between alternatives of potential recreation impacts and the likelihood of intact refugia, we calculate the potential visitor density. The potential for crowding is most in alt F and D, followed by E and C. The potential for crowding is least under action alternative B. These values are useful in comparing the potential for impacts between alternatives. For example, visitors using recreation sites in Alternative F are estimated at a density of just over 3 feet/person (3 feet between visitors), whereas visitors in the same area in Alternative B are nearly 12 feet/person. Based on the relative crowding of people in each alternative, it is reasonable to predict that in order to escape the high density of recreation some visitors in Alternative F will be more likely to move away from the dispersed recreation site than in Alternative B (Hall and Shelby 2000; Manning and Valliere 2001).

Table 3-52: Stream lengths designated for impact from recreation.

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Number of Dispersed Recreation Sites with Creek Access	10	10	7	4	10	10

Stream length with recreation access (ft)	7,511	7511	4642	2826	8195	8021
People at one time (PAOT)	810	640	720	905 total 475 at rec sites	1,510	2,580
Feet of stream per person if every visitor stays within Recreation Sites	10.2	13.4	7.0	4.4	6.1	3.2

While monitoring and adaptive management will prevent long-term effects, such as crowding and impacts to refugia, from occurring, there is potential that these effects occur for a season (or a year) before monitoring is conducted and adaptive management is implemented, or even for several seasons (or years) if adaptive management techniques are not effective the first year.

Alternative B

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 94 acres; of which, 9.3 acres occur in riparian and 84.7 acres occurs in the uplands.

In general, construction activities will result in direct removal of vegetation (habitat) and disturbance to wildlife. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative B, new construction would occur at Heinrich and could include a welcome center with 15 parking spaces, indoor/outdoor interpretive displays, short interpretive trail and/or canopy walk, toilet, trash receptacles, one-way loop road, host/administrative site with toilet. Habitat at this site is completely upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Habitat loss for upland species will occur. In addition, toilets may be installed at the end of the Lewis trail and in the Fossil Springs area. While there could be some minor loss of habitat from toilet placement, there would be an overall benefit to improved water quality.

Camping, especially in or near riparian habitat, can result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. Allowing 3 dispersed campsites near Fossil Springs year round and up to 10 campsites at developed rec sites outside of the high use season can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat.

The corridor-wide capacity of 640 PAOT is lowest PAOT of all action alts and 170 PAOT less than current management. Monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is least likely to occur in action alternative B.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there’s no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 41.2 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 1.9 acres of unauthorized trails would be restored using above methods. 3.7 acres of unauthorized roads restored and system roads decommissioned. A total of 35.6 acres of bare area not associated with roads and trails would be restored as well. The total acres restored in riparian is 20.5 and uplands is 20.7. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 663.4 acres of riparian refugia could be realized.

A total of 57 parking spaces at recreation sites would be reduced from the permit season following finalization of the CRMP to bring recreation sites capacities to prescribed levels. This is a reduction of 5 spots at Homestead, 17 spots at Tonto Bench, 3 spots at Irving, 16 spots at Lewis, and 15 spots at Bear Trailhead.

Roads and vehicle access – The currently closed 4.1 mile section of FR 708 would remain closed to motor vehicles (but available for non-motorized travel). Road maintenance would occur to improve drainage and reduce sediment runoff.

If human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented.

Alternative C

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 97.2 acres, of which, 8.6 acres occurs in riparian and 88.6 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative C, new construction would include the Cactus Flat parking area and visitor center, the Creek View trailhead and trail along with two connectors, a host/admin facility at Heinrich, the Rim trail and connector, and the new Bear Trailhead. Habitat at these sites is completely upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Habitat loss for upland species will occur. The west and east welcome centers could involve new facilities and additional ground disturbance; this would be of upland vegetation and would not affect riparian obligate species.

Allowing three designated campsites at Cactus Flat and four at Rim Trailhead can affect upland species. Camping in the uplands would result in trampling and denuding vegetation, compacting vegetation, increased bare area, and a higher potential for trash and human waste issues. Camping would also cause visual and aural disturbance to wildlife, especially birds during their nesting period and roosting bats. This alternative calls for not allowing any camping in riparian habitat; therefore there will be no direct effects to riparian obligate species and their habitat.

The corridor-wide capacity of 720 PAOT is second lowest PAOT of all action alts and 90 PAOT less than current management. Monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative C compared to action alternatives B and less likely to occur when compared to action alternatives D, E, and F.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there's no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas. Additional benefits unique to this alternative follow. A total of 43.7 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 2.7 acres of unauthorized trails would be restored using above methods. 3.8 acres of unauthorized roads restored and system roads decommissioned. A total of 37.2 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 21.8 and uplands is 21.9. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 665.4 acres of riparian refugia could be realized.

A total of 86 existing parking spaces at recreation sites would be reduced. This is a reduction of 6 spots at Purple Mountain and 10 spots at Sally May with the closure and restoration of those two sites. Because there would be no motorized access beyond Homestead other parking spots to be closed include 10 spots at Fossil Creek bridge, 21 spots at Tonto Bench, and 18 spots at Irving, and 21 spots at Lewis Trailhead.

A 6.1 mile portion of FR 708 would remain closed to motor vehicles (but available for non-motorized travel). Road maintenance would occur to improve drainage and reduce sediment runoff.

In alternative C there would be no access to the Fossil Springs, botanical area, and historic Fossil Springs dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Even though Cactus Flat parking area is new construction, parking here and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback.

Alternative D

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 95.9 acres, of which, 13.6 acres occurs in riparian and 82.3 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. In alternative D, new construction includes additional parking spaces at Irving with a new bridge over Fossil to access new shade ramadas and group use sites. There would also be a boardwalk on the south side of the creek and trail to wildlife blind at Irving. There would be a new one mile Rim Trail loop constructed in the vicinity of the existing Bear Trailhead. New construction at Heinrich includes a small welcome center with 10 parking spaces, short interpretive trail and/or canopy walk, toilet, trash receptacles, as well as host/administrative site with toilet. A 4.1 mile section of 708 would be opened after major repairs (including rock scaling) are completed. Habitat at these site is primarily upland vegetation with no mesquite

bosque and therefore will not affect riparian obligate species. Some habitat loss for upland species will occur. The board walk may occur in the riparian corridor, but its intent is to provide armored access. ‘

Motorized use will occur under this alternative. As a result, there would be a slight increase in sedimentation from motorized use along roads. Proper engineering of roads, along with routine road maintenance would make delivery of sediment into Fossil Creek minimal. In addition, increased motorized use would increase noise disturbance to wildlife.

The corridor-wide capacity of 905 PAOT is 95 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in degradation of river values, including the habitat and population portion of the Biological ORV.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there’s no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative D compared to action alternatives B, C, and E and less likely to occur when compared to action alternative F.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 46.4 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 4.5 miles of unauthorized trails would be restored using above methods. 3.8 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 22.3 and uplands is 24.1. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 661 acres of riparian refugia could be realized. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas. Scenic driving also diverts some use from riparian.

A total of 73 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Purple Mountain, 10 spots at Sally May, 5 spots at Homestead, 5 spots at Homestead, 21 spots at Tonto Bench, and 21 spots at Lewis.

The Purple Mountain, Sally May, Tonto Bench, and Lewis sites would be closed and rehabilitated. The Lewis and Bear trails would be closed and rehabilitated. A 1.25 mile portion of the Flume trail would be closed and there would be no access to the historic Fossil Springs dam, Fossil Springs, or the botanical area. There would be no camping in Middle Fossil, the east side trailheads, nor the Fossil Springs and botanical area, and this would eliminate the direct and indirect effects associated with camping to wildlife and their habitat.

In alternative D there would be no access to the Fossil Springs, botanical area, and historic Fossil Springs dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Alternative E

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 114.4 acres, of which, 21.6 acres occurs in riparian and 92.8 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season.

In alternative E, new construction would include: a new welcome center, parking area, and trailhead at Cactus Flat with trails leading from the trailhead; new facilities at Heinrich; additional build-out at Irving including a new bridge across the creek, boardwalk and wildlife blind; a new toilet at the end of the Lewis trail; a new Bear trailhead with a new trail; alternative toilet at Fossil Springs; and a new Rim Trail loop and connector trail. A 4.1 mile section of FR 708 would be opened after major repairs (including rock scaling) are completed. As a result of motorized use on the 4.1 mile section of FR 708, there would be a slight increase in sedimentation from motorized use along the road. Proper engineering of the road, along with routine road maintenance would make delivery of sediment from FR708 into Fossil Creek minimal. In addition, there would be increased noise from motorized use along the 4.1 miles that could result in aural disturbance to wildlife.

Habitat at these site is primarily upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Some habitat loss for upland species will occur. The board walk may occur in the riparian corridor, but its intent is to provide armored access and reduce compaction of soil, erosion, and sedimentation into the stream.

Camping, especially in or near riparian habitat, can increase the effects to water quality, soil, vegetation, and increase the amount of visual and aural disturbance to wildlife, designating camping. Allowing 3 dispersed campsites near Fossil Springs year round and up to 10 campsites year round at developed rec sites can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat. Camping in the uplands at Cactus Flat and Rim Trailhead can result in direct disturbance to upland wildlife and their habitat.

The corridor-wide capacity of 1,510 PAOT is 700 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative E compared to action alternatives B and C, and less likely to occur when compared to action alternatives D and F.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there’s no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 40.6 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard

closures involving ripping, seeding, and temporary barriers. 2.1 miles of unauthorized trails would be restored using above methods. 3.7 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.5 and uplands is 20.11. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 651 acres of riparian refugia could be realized.

A total of 6 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Tonto Bench.

If human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented.

Alternative F

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 113.0 acres, of which, 20.4 acres occurs in riparian and 92.6 acres occurs in the uplands.

Upon implementation, 400 parking spaces would be constructed at Cactus Flat with potential for another 100 spaces in the future. This would be an increase of 352 from the current situation. The construction of this parking lot is included in the acres of disturbed area, above. Loss of upland habitat would occur at this location.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative F, new construction would include the Cactus Flat parking area and visitor center, additional parking and infrastructure at Homestead, a host/admin site and facilities at Heinrich, the Creek View trailhead and trail along with two connectors, the Rim trail and connector and new bridges installed on the Flume trail across two side canyons (to provide for limited administrative OHV access to the historic dam). Habitat at these construction sites is mostly upland vegetation. Habitat loss for upland species will occur. The only affect to riparian obligate species would be 1) those that also use mesquite bosque (such as yellow-billed cuckoos, Lucy’s warbler, and Bell’s vireo) and 2) possibly springsnails where they may occur in seeps that flow across the Flume trail. At Homestead, a small amount of mesquite trees may be removed slightly reducing the overall mesquite bosque habitat important to cuckoos for foraging and to other passerine birds for nesting. In order to reduce effects of OHV crossing riparian habitat where seeps cross the Flume trail, structures will be installed to avoid OHVs from touching wetted soil. Should these seeps be occupied by Fossil springsnails, these structures will ensure that snails are not crushed by OHV vehicles.

Camping, especially in or near riparian habitat, can result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. Allowing dispersed camping at up to 10 designated walk-in campsites at Homestead year round can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat.

The corridor-wide capacity of 2,580 PAOT is 1,700 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in

degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative F compared to all other action alternatives.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Closing the Bear trail may result in reduced pressure on riparian habitat, species habitat and to wildlife at Fossil Springs, even though the Fossil Springs area would be accessible via the Flume trail. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas reducing disturbance to wildlife and habitat. Additional benefits unique to this alternative follow. A total of 40.1 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Two acres of unauthorized trails would be restored using above methods. A total of 3.9 acres of unauthorized roads restored and system roads would be decommissioned. A total of 34.7 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.4 and uplands is 20.9. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 657.9 acres of riparian refugia could be realized.

A 4.1 mile portion of FR 708 would remain closed to motor vehicles year round between the Waterfall trailhead and gate on the Strawberry side. This would result in less noise to disturbance to wildlife near that section of road and would reduce the amount of sediment that would make its way to Fossil Creek.

Even though Cactus Flat parking area is new construction, parking there and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead, reducing noise disturbance, collisions, and sedimentation. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback.

Effects of Not Implementing the Project Actions (No Action)

Programmatic Actions:

Under the no action alternative, there would be no formal monitoring plan and therefore no consistent or effective way to determine when changes in management (adaptive management) are needed in order to minimize adverse effects to species and their habitat. Education and interpretive materials would be provided to support current management system but would not be a focus like they are in the action alternatives. As a result, visitors would have less understanding and be less supportive of river values resulting in more adverse effects to species and their habitat. The no action alternative does not articulate the concept of refugia and therefore, unauthorized trailing and compacted dispersed recreation sites in between the designated recreation sites would not be targeted for closure and rehabilitation. Locatable mineral entry would be possible in the recreation segment and this may result in more direct and indirect effects to species and their habitat.

Without a comprehensive river management plan the river's outstandingly remarkable values, including habitat and population components of the biological ORV, may not be protected or enhanced, even with continued implementation of interim management measures. Since NEPA will not have been completed for on-the-ground actions, implementation of needed actions would be delayed during the time NEPA is completed. In addition, neither forest plan currently has sufficient guidance that would protect the biological ORV, and there would be no forest plan amendments that would incorporate management direction that would protect the biological ORV under the no action alternative. Another programmatic component is the botanical area. The Fossil Springs botanical area would continue to be inconsistent between the two forest plans. Uncertainty about the size and location of the botanical area would contribute to inconsistent management. The botanical area would be smaller (anywhere from 12 to 26 acres) compared to the action alternatives (33 acres) so fewer plants (species and individuals) would be protected. The effects of the plan amendment are the same as the programmatic direction discussed above.

Site Specific Actions:

Under the no action alternative, no permit would be required for camping use so unlimited camping outside of the permit season would be allowed downstream of Fossil Creek bridge and upstream of the historic Fossil Springs dam. Unlimited dispersed camping would be allowed year-round outside of permit area in wild segments. Camping at Stehr Lake area would be allowed year-round. Camping allowed under the no action alternative would result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. In the wild segments, where camping would be allowed during the summer months, impacts to soil and vegetation would likely be minimal but there would be visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats.

The no action alternative calls for more total parking spots than alts D and E and more rec sites with parking than alts B and D. In addition, the no action alternative does not call for better delineation, surfacing, and installing water retention basins at any of the parking areas. This can result in creep and enlarging of the parking areas, as well as more run off contributing more sediment and vehicle fluids into Fossil Creek. While some of the action alternatives call for more parking spots than the no action, the action alternatives also provide for more infrastructure and site hardening to accommodate those higher numbers.

Overall capacity in the corridor would be 810 persons at one time (PAOT), including administrative use. While this is less than Alternative D, E, and F, the no action alternative would allow more PAOT than Alternatives B and C and wouldn't have NEPA completed on any new infrastructure that would accommodate and absorb the impact of 810 PAOT. Because there would be no refugia concept, repeat visitor use and resulting impacts to streamside vegetation would occur along a much greater length of Fossil Creek than with the action alternatives.

There would be no specific scenic driving permits. This likely results in more visitors spending time along the creek, contributing more impacts to riparian and aquatic species and their habitat. There would be no motorized trail use permits which means that the 708 road would remain closed. But since this section of road would be closed but not rehabbed, erosion and sedimentation coming off the road would be worse in this alternative than any of the action alternatives. Sedimentation into Fossil Creek will contribute to negative impacts to aquatic systems, riparian habitat, and their associated biota.

Under the no action alternative, outfitter/guide use in WSR corridor is minimal. Fewer visitors would be guided and more likely to act irresponsibly, resulting in more resource degradation than guided visitors.

The Creek View Trail, Rim trail, Bear trailhead, and various interpretive trails would not exist. Without these upland trails, dispersal of visitors in the corridor is reduced and more visitors recreated in fewer and more concentrated areas along the creek. This would result in more direct and indirect effects to riparian and aquatic species and habitat.

Any new infrastructure construction would be subject to separate analysis resulting in slower response time in implementing measures to better manage recreation activities in Fossil Creek. Without infrastructure, direct and indirect impacts to aquatic and riparian habitat will be higher than the action alternatives.

Bare areas, unauthorized trails, and unauthorized roads would be restored on an as-needed basis. There would be less restoration of bare areas and unauthorized roads and trails without the management direction provided in a CRMP. Changing the status of system roads would be subject to separate analysis delaying the implementation of restoration activities.

Cumulative Effects Analysis

The spatial boundaries for analyzing the cumulative effects to wildlife and plants is comprised of four sixth code watersheds: Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek, and Gap Creek-Verde River, but the portion of Gap Creek is so little that activities in that watershed are negligible in the

cumulative effects. These watersheds were selected because there may be downstream indirect effects such as sedimentation and movement of non-native species that result in direct and indirect effects to vegetation, wildlife, and their habitat. In addition, canyoneering, cross country travel, and use of the Mail Trail connect activities in the uplands outside of the corridor to the Fossil Creek corridor. The temporal boundaries for analyzing the cumulative effects are 10 years because we anticipate we will have implemented the majority of the proposed action elements with resulting direct effects from these actions within 10 years.

A list of past, present, and reasonably foreseeable future actions within the analysis area can be found in Appendix B of the EIS.

Cumulative Effects to Riparian Habitat and Species

In general, past, present, and reasonably foreseeable activities may affect wildlife and plant habitat through the loss, destruction, or modification of riparian vegetation. More specifically, activities within the riparian area result in: loss of soil-stabilizing ground cover; soil compaction; decreased amount of grasses, forbs, shrubs, and recruitment trees; increased potential for invasion of exotic weeds; decreased infiltration of water during rain events; increase rates of run off; increased sedimentation into streams; increase of contaminants into streams; and decreased water quality (Cole and Landres, 1995; Johnson and Carothers, 1982; and Leung and Marion, 2000). All of these activities impact riparian conditions, which consequently degrade wildlife and plant habitat. Some actions can provide benefits to habitat by increasing water flow, reducing impacts from human activities, etc.

Activities within the riparian zone may result in direct aural and visual disturbance to wildlife species, particularly during critical periods such as breeding, roosting, and feeding. Disturbance can result in increased physiological stress, nest, roost, or site abandonment, flushing of birds from eggs, premature fledging of young from nests, and reduction in the amount of suitable nesting and foraging areas.

Past Activities with No or Beneficial Effect

Past activities occurring in riparian areas within the Fossil Creek Watershed include: recreation, hydropower decommissioning, the Heinrich land acquisition, the native fish restoration effort, invasive plant treatments, Fossil interim management activities, maintenance of utility lines, road and trail maintenance, and research and education permits. All activities except for recreation, maintenance of utilities, and research and education permits have benefited wildlife habitat in various ways. The restoration of 43 cfs of spring flows back into Fossil Creek greatly improved aquatic habitat, allowed for native frog colonization downstream of Fossil Springs, and increased the amount and diversity of riparian and aquatic habitat. The decommissioning also restored habitat when infrastructure and man-made structures were deconstructed. The Heinrich acquisition increased the amount of riparian and aquatic habitat within the NFS system and since this site will not allow creek access, there will be an increase in riparian that is off-limits to recreation. The restoration of the native fisheries removed non-native fish species, increased native aquatic species that were previously declining, and provide native prey sources for other riparian obligate species such as the common black-hawk. Treatment of invasive plant species has eliminated some species from the project area and reduced the spread of other species in the corridor. Interim management activities, especially capacity control, since 2005 have incrementally reduced the effects of recreation on natural resources, including fish, wildlife and rare plants. For example interim management resulted in the rerouting of a trail and construction of footbridges to protect the endemic Fossil springsnail at three springs along the waterfall trail. Proper maintenance of roads and trails has contributed to reduced erosion and sedimentation into Fossil Creek and improved water quality and habitat condition for aquatic species, especially macroinvertebrates. Research proposals are carefully screened to avoid adverse effects and typically result in useful information that support and drive future land management decisions resulting in better resource protection. The Fossil stream gage has minimal impact to the stream since operation of the stream gauge is wireless and does not involve any access to the creek beyond the existing pipe and transducer which is fixed to the bedrock channel bottom. The benefits from having stream flow data for research, management, and effects analyses outweighs the short-term effects during the initial installation period.

Past Activities with Adverse Effects

Past activities that may have adversely affected wildlife and their habitat along Fossil Creek include recreation; maintenance of utilities (such as APS and WAPA power lines, fiber/optic line, 5 mile communication site, USGS stream gage, water pipelines and local communication lines in Strawberry); road and trail maintenance; research and education permits; short-term effects from maintenance of the native fisheries; hydropower decommissioning activities; development on private land; and water withdrawal.

Recreation occurring along Fossil Creek increased dramatically after restoration of full flows in 2005. Visitation during the high use season in 2006 was around 20,000 people but by 2011 had increased to 95,000 people. Recreational activities in Fossil Creek, particularly before camping was restricted and capacity controls were implemented starting in 2011, resulted in resource damage including bare soil and compacted soils both adjacent to the creek as well as in the uplands, an increase in trash and human waste, damage to trees, small wildfires, etc. (Adams et al. 2015). In addition, the large number of recreationists in a relatively unmanaged recreation setting resulted in direct disturbance to wildlife in Fossil Creek. For example two black-hawk nests were abandoned by the historic Fossil Springs dam and by the waterfall when recreation numbers increased from 37,000 people/high use season to 81,000 people per high use season. Beginning in 2012 capacities were controlled by closing entrances when parking areas filled up. When the permit system was implemented in 2014, recreation use and the resulting impacts were decreased to a greater extent considered so that recreational effects were limited to the most sustainable areas in the project area. Fishing in the uplands is known to occur at stock tanks because non-native fish have been detected in various locations. These non-native fish are a source, that when floods carry them downstream, can become established in Fossil Creek, compromising the entire native fisheries there.

Maintenance of permitted utility sites and lines causes visual, aural, and physical disturbance when done during critical periods for various species (bird nesting, bat roosting, etc.). In addition, maintenance of power lines allows for some removal of riparian trees which reduces habitat. Road and trail maintenance likewise can cause visual and aural disturbance if conducted during critical periods. The Forest Service had to close the section of FR 708 road between the Waterfall and Fossil Springs Trailheads due to the deteriorating condition of the 708 road, the extreme cost to properly repair to the road to safety standards, and then to maintain it frequently. As a result, rock falls, rilling, undermining has occurred and has contributed soil and sediment runoff; some of which has likely ended up in Fossil Creek contributing to water quality issues.

Without proper screening or detailed permits, research and educational activities can disturb species as well as impact habitat.

Maintenance of the native fishery, required when non-native fish appeared in the native section, required building a temporary fish barrier, treating 3 miles of stream with a piscicide, repair of the native fish barrier, and having many people in the riparian corridor and along the stream for weeks in 2012. Non-native fish made it over the compromised fish barrier requiring the construction of a temporary fish barrier at Sally May and a piscicide retreatment along 3 miles of Fossil Creek. These short-term adverse effects were outweighed by the long-term effects of a non-native free portion of Fossil Creek. Short-term impacts to aquatic species occurred when the historic Fossil Creek Dam was lowered 14 feet in 2009. A subsequent winter storm resulted in severe shearing of banks in the unstable sections above the dam, resulting in scoured habitat above and downstream for several miles. In addition the unstable nature of the channel and the high velocity flows from the winter flood damaged the fish barrier about 10 miles downstream. Fortunately, with phased decommissioning (where frog populations were given four years to colonize in restored flows downstream of the historic Fossil Springs dam), frog populations survived the flood and have rebounded.

Existing wells drilled in the Strawberry have resulted in an increase in groundwater withdrawal. In general throughout the southwest, there is concern with reduced instream flows as a result of groundwater withdrawal.

Ongoing and Future Activities

Ongoing and future activities in the riparian corridor include maintaining the native fisheries which may require similar actions as in the past, invasive plant treatments, repair and maintenance of utilities, and research and

educational events. The ongoing and future effects would be the same as described above. In addition, should future drilling of wells on private land result in decreased instream flow in Fossil Creek, further well drilling can have direct effects to aquatic species in Fossil Creek even though private land is miles away from Fossil Creek.

Cumulative Effects to Upland Species and Habitat

The presence of people, vehicles, and equipment in the cumulative effects area can result in aural and visual disturbance to wildlife species, particularly during critical periods such as breeding, roosting, and feeding. Disturbance that occurs frequently and over a period of time can result in increased physiological stress, nest, roost, or site abandonment, flushing of birds from eggs, premature fledging of young from nests, and reduction in the amount of suitable nesting and foraging areas. In addition to direct disturbance to wildlife species, adverse effects to wildlife habitat can occur when activities reduce the amount of soil-stabilizing ground cover, compact soil, reduce the amount of grasses, forbs, shrubs, and recruitment trees; increase the potential for invasion of exotic weeds; all of which contributes to decreased infiltration of water during rain events and increase rates of water and soil run off. The additive decrease in the quality and quantity of wildlife habitat from all activities in the Fossil Creek cumulative effects area can cause site abandonment ultimately reducing the distribution of wildlife species.

Other past, present, and reasonably foreseeable activities that occur in the uplands of Fossil Creek and contribute to cumulative effects to species and their habitat include: recreation; addition of the Davey's Recommended Wilderness Area, hydropower decommissioning; Heinrich land acquisition; vegetation management; wildlife habitat improvement efforts; prescribed burning; fuels reduction and managed wildfires; invasive plant treatments; quarrying and mineral storage activities; interim management activities; livestock grazing; repair and maintenance of utilities; motor vehicle use; temporary permits for hikers/trail riders; research; personal uses; urban development and interface growth; and increased groundwater withdrawal.

As described above, recreation in Fossil Creek increased from 20,000 to 95,000 people during the high use season before capacity control measures were taken during interim management. While most of the recreational use occurred in the riparian areas, dispersed camping occurred in the uplands until camping restrictions were implemented. Dispersed camping resulted in resource damage including bare soil and compacted soils, an increase in trash and human waste, and increase in nuisance wildlife such as skunks and ants, damage to trees, small wildfires, etc. Other recreation in the cumulative effects area includes hunting and fishing. Hunting, a necessary tool for managing game populations, occurs mostly outside of the critical season for most wildlife species. Fishing in the uplands is known to occur at stock tanks because non-native fish have been detected in various locations. These non-native fish are a source, that when floods carry them downstream, can become established in Fossil Creek, compromising the entire native fisheries there.

Hydropower decommissioning may have had short-term adverse effects to wildlife and habitat in the area through visual and aural disturbance and ground disturbing activities. Stehr Lake was a wetland surrounded by mature deciduous trees. But with decommissioning and restoration of full flows, Stehr Lake dried up and was returned to natural contour. Ultimately, decommissioning benefited species by removing man-made structures and restoring previous developed lands back to natural habitat. During decommissioning, flume tunnels were closed to the public but were fitted with bat gates that have allowed use by bats for roosting structure.

The Heinrich acquisition increased the amount of upland habitat within the NFS system and allows for improved consistency of management of the acquired acres, possibly decreasing fragmentation.

Past, present and continuation of vegetation management involves removing encroached junipers in areas with a natural low (<10%) canopy cover. These types of activities have occurred in Sycamore Basin, and 1,800 acres are planned for treatment on the Fossil Creek Allotment in the upper Fossil Creek watershed. Removal of encroached junipers allows for increased herbaceous cover, reduced erosion and sedimentation into stream channels and stock tanks, and overall improves watershed condition.

Other vegetation management activities include prescribed burning, fuels reduction and managed wildfires. These activities are aimed at moving vegetative condition closer to historic conditions, to reduce overstocked fuels that contribute to catastrophic wildfires, and improving watershed condition. Besides short term disturbance to special status wildlife and plants, as well as their habitat, the overall benefit of restored ecosystem function outweighs the short-term effects from on-the-ground implementation.

Invasive plant treatments have been conducted and will continue to be conducted. There are possible short term disturbances to wildlife, but overall, the control of spreading weeds protects habitat in that vegetative diversity and abundance is preserved. Treatments for woody invasive species occur in the fall and winter months, out of the most critical periods for most wildlife species.

The addition of 1,739 acres in Davey's Recommended Wilderness Area should have slight beneficial effects. This area is already remote and few activities besides livestock grazing and hunting occur in this area. The designation would provide protection from future proposals such as the designation of new roads for motor vehicle use or proposals that might require installation of range infrastructure that may cause disturbance to wildlife or fragmentation of their habitat.

Chiricahua leopard frog habitat improvement efforts such as the repair and maintenance of stock tanks which are used by this species, habitat fencing, erosion control sock installation, and juniper thinning treatments, have occurred in-portions of the watershed above the rim. These activities have been focused around occupied sites and were deemed necessary by multiple agencies to reduce sedimentation into stock tanks which causes the stock tanks to become shallower, putting frogs at risk of desiccation during drought years. Habitat fencing was constructed around portions of five occupied stock tanks to exclude livestock from a portion of each tanks' perimeter in order to protect vegetation needed by frogs for hiding cover, basking platforms, tadpole food, and egg mass structure. Habitat fencing was later retrofitted to an improved standard (from sucker rod to pipe toprail and cable railings) to reduce the potential for fence failure, access by unauthorized livestock, and reduced maintenance. These activities will continue into the future.

The Ike's Backbone Allotment has recently been closed within the Fossil Creek analysis area resulting in beneficial effects to wildlife and their habitat over the coming decades. In addition, the Deadman Mesa Allotment on the Tonto National Forest, which occurs along the majority of the perennial section of Fossil Creek on the Tonto side, has been vacant for 19 years and there are no foreseeable plans to reauthorize livestock grazing at this time. Five other allotments occur in the cumulative effects boundary. Standard structural range maintenance has occurred within the past, present and will continue into the future, including cleaning tanks to their original depth, cleaning out sediment traps, repairing berms, fixing fences, and converting electric fences to more reliable wire fences. Livestock grazing is managed and monitored to ensure livestock use levels stay within allowable intensities and utilizations so there are no adverse effects to vegetative communities and the wildlife species that depend on them. Livestock may have access to habitat occupied by the sensitive Arizona phlox (*Phlox amabilis)* and Mt. Dellenbaugh sandwort (*Arenaria aberrans),* which only occur within Arizona, resulting in possible grazing and trampling. Because there are no riparian pastures along Fossil Creek, grazing will not have direct effects to riparian and aquatic plants and animals. Great effort has been made to ensure riparian areas are protected, for example livestock on the Fossil Creek allotment are trailed through the Stehr Lake pasture because livestock fencing, to keep livestock out of the riparian, would hinder recreational access.

Repair and maintenance of utilities can have direct visual and aural effects as well as direct effects to habitat (such as when vegetation under powerlines is cleared to prevent arcing and wildfires).

Motor vehicle use can have direct visual and aural effects to wildlife and occasionally vehicles run over or hit individuals causing injury or death. The prohibition of cross-country travel and the closure of roads through the Travel Management Rule have reduced effects to wildlife and habitat. Maintenance of highways, roads, and trails general protect habitat by properly designed water drainage features.

Use by individuals such as recreationists, hunters, temporary permitted hikers/trail riders and those collecting forest products, can result in short-term effects to wildlife and their habitat. Use occurring in a concentrated area over a long period of time can result in alteration of wildlife movement and even site abandonment.

Research activities sometime occur in the uplands but proposals are carefully screened to avoid adverse effects and typically result in useful information that support and drive future land management decisions resulting in better resource protection.

Activities on private lands, including urban development and interface growth, can not only affect wildlife habitat, but can affect wildlife movement through large tracts of private land.

Cumulative Effects Related to Climate Change in the Southwest

Current climate change in the southwest has been already been observed and documented. The southwest's recent warming is among the most rapid in the nation and in some areas, significantly greater than the global average (Karl et al, 2009). There has been a near 2°F increase in temperatures in the last century, with 110 years of records showing the 2001-2010 decade being the warmest (EPA website, accessed 2016). August in 2015 was the hottest August ever for Phoenix. The length of the frost-free season has increased by 19 days in recent decades (EPA website, accessed 2016). Declines in spring snowpack have been observed in recent decades (Garfin et al 2013 and EPA website, accessed 2016). The highest streamflows occur earlier in the year and there's been a decrease in the total yearly streamflow over the last decade (EPA website, accessed 2016). Changes in phenology (the timing of biological events) has also been observed. Spring is progressively earlier since the 60's.

Observed changes to flora in the Southwest include changes in phenology such earlier shooting of plants, earlier first flowering, earlier tree budburst, and plants growing in a longer season (Garfin et al 2013). With increasing temps, habitat for many North American species are moving north and to higher elevations. Alligator juniper occur 1000' higher in elevation since the 1960s and may eventually no longer occur in the Fossil Corridor (Brusca et al, 2013). In recent decades plants and animals have moved to higher latitudes at a rate of 10.5 miles per decade and to higher elevations at a rate of 36 feet per decade and (EPA website, accessed 2016). In the Fossil corridor, this could mean a range expansion for some species but for others a move into less hospitable habitat. In addition, drought has led to a substantial die off of pinon trees (90%) across 4,600 square miles of the Four Corners region (EPA website, accessed 2016; Defenders of Wildlife, accessed 2018; and Karl et al, 2009). The loss of pinyon removes an important food source for bears, birds, small mammals, and humans (especially tribes) and applies to the Fossil Corridor. Other examples of observed effects include: changes in the distribution of evergreen increases in forest pest populations and increases in the size and severity of wildfires.

Predicted changes in Southwest weather include increase temperatures. Temperatures in the southwest are projected to rise 4-6 degrees Fahrenheit under the lowest emission scenarios (by up to 10F under highest emission scenarios) by the end of the century (Defenders of Wildlife website, accessed 2018). Average annual temperatures are projected to rise an additional 3.5°F to 9.5°F by the end of this century, with the greatest temperature increases expected in the summer and fall. The southwest will experience hotter heat waves (Garfin et al 2013). Winters in the southwest will also be altered by having fewer frost days, shortened snow season, less snowpack, more frequently extremely dry and extremely wet winters, increase precipitation outside of summer seasons (Garfin et al 2013; Karl et al, 2009).

The Southwest will experiences in changes in water availability with more frequent, intense and longer droughts, reduced river flow and soil moisture, increasingly scarce water supplies, increased frequency of floods, and altered timing of floods. Drought conditions are already common in the Southwest and drought periods are expected to become more frequent, intense, and longer. Drought will affect important water sources. Combined with expected population growth, climate change will exacerbate existing stresses.

Finch (2012) sites numerous predictions for changes in Southwest landscapes due to climate change and those pertinent to the Fossil Corridor follow. By 2099, 55% of western landscapes will have climates incompatible with current vegetation types. Pinyon juniper woodlands move northward and upslope. Semi desert grassland expands

northward and occupies an area four times that of the present. Great basin shrub/grassland decreases by 40% and becomes fragmented. Great Basin montane scrub declines (69%) and displacement through time. There will be a northward shift of key plant species including saguaro, and creosote bush. Species with small distributions (AZ cypress) experience complete climate disequilibrium early in the century. There will be an increase in and expansion of invasive plant species and invasive cheatgrass shifts northward. It is likely that grass species such as lovegrass, yellow bluestem and cheatgrass increase in the Fossil Corridor.

Phenology—the timing of seasonal activities of animals and plants—is perhaps the simplest process in which to track changes in the ecology of species in response to climate change. Birds, butterflies and wild plants, in particular, include popular and easily identifiable species and thus have received considerable attention from the public. As a result many long-term phenological data sets have been collected. Common changes in phenology include: earlier bird nesting, earlier arrival of migrant birds, earlier choruses and spawning of amphibians, earlier appearance of butterflies, and earlier insect hatching (EPA website, accessed 2016). These may not always match with all of species' life history requirements. Some species may not have advanced their timing of breeding sufficiently to continue reproducing optimally relative to the occurrence of peak food availability, thus becoming mismatched compared with their food sources (EPA website, accessed 2016).

12% of local populations of 48 lizard species in Mexico have already disappeared because of warmer temperatures.

Climate change will present both challenges and opportunities for adaptations for amphibians. Highly aquatic frog species will be challenged as they lose habitat from diminished flows and toad size has been observed to be smaller in temporary pools versus perennial waters (Regan et al 2014). Frogs and toads occupying temporary pools in the intermittent portion of Fossil Creek, along with other Fossil tributaries such as Boulder Creek may experience similar challenges. Tadpoles (great basin spadefoot tadpoles and other species) in warmed pools opportunistically reached metamorphosis 15-17 days earlier with little cost to size (Regan et al 2014) and so amphibians in Fossil Corridor may be able to similarly adapt. A New Mexico study did not find evidence that shrub encroachment has had negative impacts on the toad community and may even have had positive effects on anurans, especially Great Plains toad and Plain's spadefoot toad, both of which are more common in mesquite habitat (Boeing et al. 2014). This is because: mesquite's ability to provide shelter (small mammal burrows found under mesquite – roots prevent burrow collapse), increase surface moisture and humidity, and lowering temperature from shading, and increased abundance of food resources within this habitat (Boeing et al. 2014). There are upland mesquite (versus bosque mesquite) in the Fossil Corridor that may provide shelter for upland toad species in the Fossil corridor.

Audubon's Breeding Bird Survey and Christmas Bird Count's huge and longest-running data sets were used to model climate change effects on North American bird species. An Audubon website (accessed 2015) reveals the following. In the last 50 years, greater than 60% of 305 bird species shift their winter ranges northward by an average of 35 miles (American robin is an example and occurs in the Fossil Corridor)(Audubon website accessed 2015). Of 588 species modeled, 314 bird species will lose more than 50 percent of current range by 2080. Some will adapt, others will have nowhere to go. One species modeled that occurs in the Fossil Corridor is the green-tailed towhee. Audubon modeling predicts an 82% decrease in its summer range by 2080 (Audubon website accessed 2015).

Aquatic habitats in the Southwest will also experience changes due to climate change. A 17% increase in the frequency of stream drying events is expected. Spring and early summer flows in rivers will diminish between 8 and 20% (Jaeger et al. 2014). More frequent and severe droughts will result in altered flows and connectivity in SW streams (Jaeger et al, 2014). Water will become more isolated due to longer stretches of dry channel (Jaeger et al. 2014). Altered flows and reduced connectivity will make aquatic species especially vulnerable. This may be the case in the future for Fossil Corridor's intermitted tributaries.

Water tables are lowering as a result of ground water pumping and rising temperatures are causing lower flows in major rivers (Karl et al, 2009). At this time, groundwater use from the portion of the regional limestone aquifer that supports perennial flow in Fossil Creek is extremely limited or absent. However, development of a production

well in the vicinity of a deep exploratory borehole that was drilled would likely impact discharge at Fossil Springs since groundwater would be withdrawn from the same regional limestone aquifer that supports springs discharge and groundwater extraction would be in close proximity to Fossil Springs.

Overall, the anticipated effects of climate change to species habitat (e.g. diminished spring flows in intermittent reaches, fewer and shorter-term pools for amphibians, northward shift in species habitat and die off of pinyon trees and possibly oak trees, declines in summer ranges for migrants) combined with the direct and indirect effects of implementing the CRMP alternatives, would result in additional effects to certain groups of wildlife (toads, non-ranid frogs, some migrant birds) and some species of vegetation (such as Alligator juniper, pinyons, and possibly evergreen oaks).

Summary

Cumulatively, the implementation of the different action alternatives when combined with past, present and future actions in the adjacent watershed, will not result in adverse effects to the outstandingly remarkable values associated with Fossil Wild and Scenic River. Overall, various management actions (removal of non-native fish in upland tanks, maintenance of the native fisheries in Fossil, vegetation management and watershed improvement projects, Chiricahua leopard frog habitat protection measures, Fossil interim management including capacity management, implementation of Travel Management Rule, closure of Ike's Backbone allotment) have contributed to improving vegetative conditions, wildlife habitat, and watershed function in the cumulative effects analysis area. These efforts are expected to counteract the cumulative stressors and disturbance caused by climate change, rec use, invasive species establishment and spread, and recurring drought and wildfire risk.

Additional Analysis for Federally-listed and ORV-specific species

The purpose of this section is to evaluate the potential effects of this action on listed and ORV-specific species. This assessment is based on the current geographic range of species on the Coconino and Tonto National Forests and the area affected by the project. This assessment considers, as appropriate for the species and area, factors that may affect the current trend for the species population. Additionally, this assessment will display findings under the various management alternatives considered for the project (FSM 2621.2).

Birds

Mexican Spotted Owl

Effects from Programmatic Components of All Action Alternatives

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian recovery habitat for the Mexican spotted owl. An increase in the size of the botanical area will provide protection to more recovery habitat for the Mexican Spotted owl.

In the no action alternative and in regards to riparian recovery habitat, there would be no management guidance from a comprehensive management plan, limited monitoring, and no adaptive management. Restoration activities would be subject to further NEPA and therefore implementation would be delayed for one to three years once impacts are identified. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Action Alternatives

There are no protected activity centers in the CRMP project area, only within the broader analysis area. A small amount of critical habitat occurs at the very northern end of the corridor. The only activities in that may occur in protected or critical habitat would be backpacking and/or canyoneering activities, but due to the location, access is very challenging. From the Fossil Springs Trailhead, this habitat is located nearly four miles upstream of Fossil Springs (which is a four mile hike from the trailhead) along an intermittent section of Fossil Creek that doesn't appeal to most visitors due to the lack of water and riparian vegetation. Access into MSO protected and critical habitat is equally difficult from Hwy 260, requiring canyoneering skills including rappelling. However, some

determined and skilled backpackers and canyoneers may occur within MSO protected habitat during the breeding season and this may result in direct aural and visual disturbance to owls. Since backpackers and canyoneers tend to travel in small groups and are more likely to practice leave no trace principles when compared to the average visitor to Fossil, visual and aural disturbance is expected to be of low intensity. Due to the remoteness, disturbance is expected to be limited. Due to the nature of backpackers and canyoneers, they tend to stay one or just a few nights in one location, so the impacts are expected to be of short duration.

The majority of recreation occurs in Fossil riparian habitat from just above Fossil Springs down through the middle section to below Mazatzal. The riparian habitat in this area is considered recovery habitat for the Mexican spotted owl. Owl use of the perennial portion of Fossil Creek is expected to be limited (due to the distance from occupied habitat) and likely only used by wintering and and/or dispersing owls. In all alternatives, the presence of people and their vehicles (visitors as well as administrative personnel), the operation of machinery for new construction (such as the new FR 708 bridge), maintenance/repair existing infrastructure (e.g. gabion baskets) and restoration activities, could cause visual and/or aural disturbance to individuals, should they occur in this portion of Fossil Creek.

Proposed actions common to all action alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainages, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek over the next decade.

Overall and across all action alternatives, activities that will improve riparian recovery habitat include better management through a comprehensive river management plan, monitoring, and adaptive management. The project area is expected to see a long-term reduction in bare soil area, better delineated creek access via hardened areas and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences Among All Alternatives
Alternative A results in the most riparian habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian recovery habitat disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored are added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

The no action alternative results in the most alternation to owl riparian recovery habitat. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Southwestern Willow Flycatcher

Effects from Programmatic Components of All Action Alternatives
Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed for one to three years after impacts are identified.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the southwestern willow flycatcher. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Action Alternatives
There have been no detections of flycatchers where surveys were conducted in marginal habitat occurring in wider pockets of riparian along Middle Fossil Creek. However, not all pockets of marginal habitat have been surveyed including between the waterfall and the dam, at Purple Mountain recreation site, and various pockets between the permanent fish barrier and the confluence. Activities in the CRMP corridor that may occur in marginal habitat would include recreation, restoration, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance. Recreation activities in the riparian area could directly affect willow flycatchers through visual and/or aural disturbance, should they be present in the Fossil corridor. Recreation activities can result in indirect effects to flycatchers when activities degrade habitat conditions and increase the amount of trash that attracts parasitic brown-headed cowbirds (Airola, D.A., 1986). Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance are unlikely to disturb flycatchers, should they be present, because these activities would occur during the low use season which is outside of the flycatcher's breeding season. Restoration activities will benefit willow flycatchers by increasing the amount of riparian habitat over the next decade

Because even the best habitat within Fossil Creek is marginal and surveys have been negative, it is the determination that there is a very low possibility that southwestern willow flycatchers nest in the FC WSR boundary. Even though marginal habitat is present, it is rationalized that the chance of southwestern willow flycatchers occurring in middle Fossil are slim for several reasons.

One, the best habitat in Fossil Creek is marginal. Two, all surveys to date have been negative. Three, the overall population is greatly diminished, known nesting areas are limited, and the nearest nesting occurs in the broad valley floodplain of the Verde Valley. Four, this species has high site fidelity and therefore returning birds generally come back to the area they were fledged; not new areas miles from where they fledged. Five, the colonial nature of this species reduces the chance that a male finds a female this far from known nesting sites. Given all these factors, there is very little likelihood that there will be southwestern willow flycatchers present in the project area over the next ten year.

Proposed actions common to all action alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainages), closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus possibly benefit the southwestern willow flycatcher, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives
Alternative A results in the most willow flycatcher habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative

C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term (1-2 years) because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to willow flycatcher habitat with no decision to allow for habitat restoration. In considering both the amount of willow flycatcher habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to willow flycatcher habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Western Yellow-billed Cuckoo

Effects from Programmatic Components of All Alternatives
Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the southwestern willow flycatcher. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives
There have been no detections of yellow-billed cuckoos in Fossil Creek, however, suitable habitat occurs in wider pockets of riparian, especially where there are mesquite bosque vegetation adjacent to the riparian that provide foraging habitat. Even though the Fossil riparian area contains all the components of cuckoo habitat, repeat surveys have been negative. While it is unknown why Fossil doesn't support nesting cuckoos, it is the determination that there is a slim possibility that cuckoos nest in the FC WSR boundary. This is because, with low populations there are not enough yellow-billed cuckoos to disperse into all the suitable habitat (Johnson et al. 2011). However, protection of all suitable habitat is important, because improved management across the species range will allow for an increase in the cuckoo population leaving future potential for cuckoos to resettle into suitable habitat such as that along Fossil Creek (Johnson et al. 2011).

Activities in the CRMP corridor that may occur in suitable habitat would include recreation, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance. Recreation effects to yellow-billed cuckoo are best described in the report 2009 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ (Johnson et al. 2009):

> "Some experts believe the primary natural resource management issue for this century will revolve around conflicts between recreation and wildlife (Gutzwiller 1995). Recreation use of river corridors (e.g., boating, hiking, biking and camping) in Arizona alone is projected to double over the next 15 years. This increase has the potential of impacting Common Black-Hawk, yellow-billed cuckoo, and other riparian bird species, by degrading riparian habitat. Taylor (1986) found a possible correlation between recreational activities and decreased riparian bird abundance. Blakesley and Reese (1988) reported seven species negatively associated with campgrounds in riparian areas in northern Utah. Therefore, there is evidence that recreational activities can impact riparian species, especially if black-hawks and cuckoos select breeding sites in riparian areas near popular camping sites in Fossil Creek.

Recreation can impact wildlife through: 1) direct mortality, 2) indirect mortality, 3) lowered productivity, 4) reduced use of habitat, 5) reduced use of preferred habitat, and 6) aberrant behavior or stress that results in reduced productivity or survival rates (Gutzwiller 1995). These impacts are not easily measured and different species may not react to them in the same way. The following are brief summaries of potential recreation risks and impacts on Common Black-Hawk and Yellow-billed Cuckoo habitat:

1. Fire Risk – As the number of recreation users increases, so does the probability of an accidental fire. If recreation use is to persist and fire continues to be a risk on black-hawk and cuckoo habitat, fire can be reduced by confining campfires to certain locations, using fire boxes, restricting campfires during high fire danger conditions and/or prohibiting campfires.

2. Habitat Impacts – Direct impacts on soils and vegetation from recreational use are easier to measure and are well documented unlike direct recreation impacts on wildlife. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion (Webb 1983, Briggs 1996, Monz 1998). Activities contributing to these changes include hiking, horseback riding, camping and day use (Briggs 1996, Cole and Spildie 1998). Trails, campgrounds and facilities can fragment habitat to the point where it cannot develop into suitable breeding habitat. Where vegetation is sparse, even light use can prevent further development of dense lower strata, an important component to black-hawks and cuckoos. Increased water turbidity, bank erosion, water pollution, noise disturbance and over-water movement resulting from waters sports like swimming, fishing, and boating can also reduce suitability of habitat (Tellman et al. 1997).

Ultimately recreation can reduce habitat structure and complexity, causing declines in species diversity and richness (Hammitt and Cole 1987). Vegetation changes in and near camping areas can cause bird species diversity to shift to more common and generalist species, while rarer and specialist species such as Common Black-Hawks and Yellow-billed Cuckoos decline (Aitchison 1977). Reduced shrub and tree densities, woody debris and litter depth in campgrounds cause ground, shrub and small tree nesters to also decline (Blakesley and Reese 1988).

3. Predators, Scavengers and Nest Parasites - Where human activities occur, animal disturbance will soon follow. Food and garbage left behind by recreation users attracts predators and nest parasites, including jays, Common Ravens (*Corvus corax*), Great-tailed Grackles (*Quiscalus mexicanus*), Brown-headed Cowbirds, skunks, ringtails (*Bassariscus astutus*), lizards, rodents and squirrels (Aitchison 1977, Carothers et al. 1979). An increase in predators can significantly reduce black-hawk and cuckoo nest success directly (i.e. Common Ravens) and indirectly (food base such as lizards)."

Recreation activities in the riparian area could directly affect yellow-billed cuckoos through visual and/or aural disturbance, should they occur in the area in the future. Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance are unlikely to disturb cuckoos, should they be present, because these activities would occur during the low use season which is outside of the cuckoo's breeding season. Restoration activities will benefit yellow-billed cuckoos by increasing the amount of riparian habitat.

Poor watershed conditions in the uplands can have adverse indirect effects on cuckoo nesting and foraging habitat. Disturbance associated with recreational activities can contribute to poor watershed conditions and can occur directly in foraging habitat. Activities in the uplands can result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff (U.S. Fish and Wildlife Service 1993b). Increased runoff in turn then results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. All of these impacts can have an indirect impacts to riparian areas, including cuckoo habitat. While some of these actions (parking areas) will result in long-term disturbances to upland vegetation including some cuckoo foraging habitat, BMPs, road and trail improvements, and restoration areas will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in cuckoo habitat.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots,

prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term loss of vegetation, BMPs and improvements (in drainages), closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the yellow-billed cuckoo, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives
Alternative A results in the most suitable cuckoo nesting habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term (1-2 years) because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to cuckoo habitat with no decision to allow for habitat restoration. In considering both the amount of cuckoo habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Common Black-hawk

Direct and Indirect Effects
Recreation effects to black-hawks are best described in the report 2009 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ (Johnson et al. 2009), and are quoted in the Western yellow-billed cuckoo section, above. There is a strong correlation between the location of black-hawk nests in Fossil Creek and areas with high recreational use. Once restoration of full flows occurred and recreation increased, black-hawks abandoned their nest near the waterfall. In addition, increased recreation levels at the Springs, combined with decommissioning activity in 2008, resulted in abandonment of the nest just downstream of the historic Fossil Springs dam. This is a shift from three nests to just one nest from the Springs down to Irving. Results from visitor and bare area monitoring document increases between 2009 and 2011 at both the waterfall and Fossil Springs:

- A 31% increase in the number of vehicles parked at the Fossil Springs Trailhead occurred between 2009 and 2011.
- Areas denuded from camping in the Fossil Springs area more than doubled between 2005 and 2011 (0.41 acres to 0.88 acres).
- Areas denuded from camping at the waterfall increased by 406% (0.17 to 0.86) from 2005 to 2011.

To further strengthen the correlation between nesting and recreation, in areas where recreation use is fairly low black-hawk nest much closer together; from just upstream of the Mazatzal site, there were 3 active nests in 2011 within a little over a mile reach. Compare this to only one black-hawk nest in 2011 between Fossil Springs and Irving and this is an approximate 3.5 mile reach.

Another concerning factor is that the reach with the highest nesting densities (from below Purple Mountain downstream of the Mazatzal site) also has the highest abundance of crayfish. So, although black-hawks may choose to nest there in higher densities based on lower recreation levels, prey composition there is not the most optimal. Crayfish are non-native and take more energy for birds (adults and nestlings) to consume due to the hard exoskeleton. Unfortunately the portion of Fossil Creek where most black-hawk nest displacement has occurred (from the historic Fossil Springs dam downstream to the waterfall) is largely crayfish-free. If it were not for the abundant native fish in Fossil (above the fish barrier), black-hawk nesting success would likely be lower in this reach with abundant crayfish. Should the native fishery ever be compromised and not maintained, nesting black-hawks would eventually have to switch to feeding their young crayfish and therefore nesting success would very likely decline (as indicated by nest success rates in other Verde Valley streams dominated by crayfish).

As indicated by past levels of recreation, recreation activities in the riparian area could directly affect common black-hawk through visual and/or aural disturbance (see full discussion under the baseline and existing condition sections of the black-hawk in the affected environment section). A serious indirect effect to black-hawks could occur if non-native fish were introduced into Fossil Creek. Currently, above the permanent fish barrier, there are over ten miles of exceptional foraging conditions due to the lack of non-native fish and a minimal number of crayfish. Introduction of non-native species could reverse this condition and consequently affect black-hawk health and reproductive success. Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance could affect black-hawks because even if these activities occur during the low use season, black-hawks begin courtship in March and often stay on-site even into December. In the long-term, restoration activities will benefit common black-hawks by increasing the amount of riparian habitat and the prey base on which this species depends.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives (especially B-E), activities that will improve riparian habitat and thus benefit the black-hawk, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives

Alternative A results in the most alteration black-hawk nesting habitat at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of black-hawk nesting habitat disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

During the seven years of black-hawk monitoring in Fossil Creek a decline in nesting activity and detections has been observed in the upper reach of Fossil Creek. Between 2007 and 2009, black-hawks breeding areas between the Springs and just downstream of Irving decreased by 50% with black-hawks no longer nesting at the dam or the waterfall site. A likely explanation is the increase in recreational activity in Fossil Creek from the Springs downstream through middle Fossil Creek. Since restoration of full flows in 2005, the median number of people per weekend day increased from 180 in 2006, 233 in 2007, 327 in 2008, 551 in 2009, 537 in 2010, and 630 in 2011 (Rotert 2012). Holiday weekends experienced peaks in visitation as demonstrated by 2011 capacity data: 1900 people/day during Memorial Day weekend, 2400 people/day during 4th of July weekend, and 1700 people/day during Labor Day weekend (Rotert, 2012). There is concern that increased levels of recreation may further affect black-nesting in areas where recreation activity is high, especially since all alternatives have higher PAOTs than the median number of visitors per weekend day in the years 2006-2011 (table 3-53).

Table 3-53: Comparison of Median # Visitors per Weekend Day per Year and PAOTs by Each Alternative

2006	2007	2008	2009	2010	2011	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
180	233	327	551	537	630	810	640	720	905	1510	2580

In alternative C and F, visitors would have to park at Cactus Flat and walk to recreation sites. There is concern that instead of visitors walking along the road or a new trail paralleling the road (such as from Cactus Flat across Boulder Canyon), visitors will instead want to walk directly to the closest riparian. That shortest route would place visitors right where black-hawks nest downstream of Homestead. Through adaptive management and education these impacts could be mitigated once they are detected.

Camping in or near riparian habitat can increase the effects to water quality, soil, vegetation, and impacts to black-hawk habitat. Camping increases the duration of disturbance to nesting black-hawks, increasing the amount of visual and aural disturbance to black-hawks. Alternatives that allow for camping in/near riparian during the nesting season (B,E, F) would have more affect to black-hawks than alternatives that don't allow for riparian camping during the breeding season (A) or at all (C and D).

A consideration of crowding is an important social effect that may affect nesting black-hawks. Under alternatives A, B, E, and F, roughly 1.65 miles of perennial Fossil Creek would be within recreation sites. This constitutes about 11.3% of the total perennial stream length within the WSR corridor. This means that around 12% of the stream length within the WSR corridor would be within existing or proposed recreation sites. The number and length of recreation sites vary by alternative; consequently the stream length immediately adjacent to recreation sites varies from about 2826 feet (Alt D) to over 8700 feet (Alts E and F). Alternative D is likely to be most protective of stream bank stability since the linear distance of recreation sites immediately adjacent to Fossil Creek is less than that for all the other alternatives whereas alternatives E and F have the most linear distance of recreation sites adjacent to Fossil Creek.

The higher the number of visitors, the more crowded visitors may feel within recreation sites. The higher potential for crowding results in an increased potential for impacts to refugia (i.e. creation of social trails and bare area) and to places black-hawks may select for netting. The potential for crowding is most in alt F and D, followed by E and C. The potential for crowding is least under action alternative B. These values are useful in comparing the potential for impacts between alternatives. For example, visitors using recreation sites in Alternative F are estimated at a density of just over 3 feet/person (3 feet between visitors), whereas visitors in the same area in Alternative B are nearly 12 feet/person. Based on the relative crowding of people in each alternative, it is reasonable to predict that in order to escape the high density of recreation some visitors in Alternative F will be more likely to move away from the dispersed recreation site and into areas black-hawks choose for nesting than in Alternative B (Hall and Shelby 2000; Manning and Valliere 2001).

There is potential for short-term effects to species and habitat before monitoring occurs (bare area monitoring occurs in the fall at the end of the high use season) and before adaptive management is implemented. In some cases, adaptive management measure may not be enough to ensure those effects aren't carried over into the next high use recreation season. Repeat visual and aural disturbance to nesting black-hawks could result in increased

physiological stress and reduced reproductive success (e.g. by causing adults to flush off of eggs for too long, young to pre-fledge, abandonment of nest sites). Re-occupancy can take more than one year to occur, based on past monitoring results.

To summarize the combined effect to nesting black-hawks, the alternatives are ranked for each of the factors discussed above. Based on that ranking (see table 3-54) the alternatives that have most impact to nesting black-hawks, are E, F, and A. The alternatives that have the least impact to nesting black-hawks are C, followed by B and then D.

Table 3-54: Ranked Comparison of Factors Affecting Nesting Black-hawks by Alternatives

	No Action	B	C	D	E	F
Impact to Habitat	1	5	6	4	2	3
Acres of Riparian Restoration	1	5	6	4	2	3
Full Potential for Riparian Restoration	1	5	6	4	2	3
# PAOTS	6	5	4	3	2	1
Camping Impacts	2	4	5	6	2	2
Weighted Score	11	24	27	21	10	12

Best = 6, worst = 1

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Amphibians

Chiricahua Leopard Frog

Effects of Not Implementing the Project Actions (No Action)
There are no effects of implementing the no action alternative since the Chiricahua leopard frog does not occur in wild and scenic river corridor but rather further in the uplands of the Fossil watershed west of the Mail Trail and trailhead.

Effects from Programmatic Components of All Alternatives
Not applicable since the CRMP and forest plan amendment covers only the wild and scenic corridor where Chiricahua leopard frogs and critical habitat do not occur.

Direct and Indirect Site-Specific Effects of All Alternatives
There will be no direct or indirect effects to the Chiricahua leopard frog because they do not occur in the Wild and Scenic Corridor. Indirect impacts to the Chiricahua leopard frog from the use of the Mail Trail may occur if trail users detour off the trail and travel to area tanks. There is a potential for visitors who visit tanks, especially equestrians, to inadvertently dislodge egg masses or crush tadpoles. In addition, when people or stock carry wet mud from one tank to another, there is potential to spread diseases and pathogens such as the chytrid fungus, which has been detected on Chiricahua leopard frogs in the Buckskin Hills population. Additionally, an increase in visitation at area tanks increases the threat of introduction/relocation of exotic fish and crayfish; all of which prey on the Chiricahua leopard frog. These effects were disclosed in a separate ESA section 7 consultation for the Mail Trail.

Differences Among the Action Alternatives
There is no difference among alternatives.

Cumulative Effects
Cumulative effects to Chiricahua leopard frog include livestock grazing, past and present watershed treatments (juniper cutting, filtersoxx installation), fire management, and personal use fuelwood gathering. Livestock grazing from the Hackberry/Pivot Rock and Fossil Creek allotments occur in occupied, suitable, dispersal, and critical habitat. Livestock grazing on other allotments occur in historical habitat. Various watershed treatments have occurred including lop and scatter of juniper on small acreages and installation of erosion control filter sox around

erosive soils. There have been various wildfires within the Fossil watershed. In addition to concerns with erosion and sedimentation that occurs after wildfire and planned fires reduces vegetative cover, suppression activities are also of concern. Withdrawing water from occupied sites and flying over suitable sites with contaminated water, are several concerns with suppression activities.

Lowland Leopard Frog

Effects from Programmatic Components of All Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian and aquatic habitat that is occupied by lowland leopard frogs. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives

Recreational activities within the riparian area can directly affect frogs by collecting and handling and trampling of egg masses, tadpoles, and subadult frogs. Recreational activities can cause habitat degradation by: trampling aquatic and streamside vegetation in which this species uses for hiding cover, temperature regulation, and substrate to support eggs masses; spreading predaceous, exotic organisms such as crayfish, bullfrogs, and non-native fish species; and increasing sediments in and turbidity of the water channel thereby decreasing water quality for these species and their prey base. Recreation activities in the riparian area can destroy leopard frog habitat over time by denuding stream banks and point bars, compacting soil thereby eliminating re-growth of riparian vegetation, and affecting water quality directly through human wastes and indirectly by facilitating erosion and sediment runoff. Recreational activities and infrastructure in the uplands near riparian can direct affect leopard frogs as they use the uplands for dispersal. Visitors can potentially (intentionally or accidentally) introduce and/or move nonnative aquatic organisms into occupied habitat; thereby increasing predation upon lowland leopard frogs.

Poor watershed conditions in the uplands can have adverse indirect effects on aquatic systems and frog habitat. Disturbance associated with recreational activities (parking areas, camping areas, unauthorized roads and trails) can contribute to poor watershed conditions. Such activities result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff. Increased runoff in turn results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. Increase sedimentation results in increased embeddedness which affects macroinvertebrates which is the prey base for frogs. All of these impacts can have an indirect adverse effect to aquatic systems, including lowland leopard frog habitat.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to upland vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for these lowland leopard frogs, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from

increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences Among All Alternatives
Alternative A results in the most alteration of suitable occupied and suitable lowland leopard frog habitat at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to suitable and occupied lowland leopard frog habitat with no decision to allow for habitat restoration. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

In the no action and alternatives B-E, capacity at Fossil Springs would be regulated. However, in Alternative F, management of Fossil Springs will be a hands off approach with adaptive management allowing for a change in management if needed. Under Alternative F, there could be undesirable direct effects to lowland leopard frogs and their habitat. It would take time before management changes could be enacted and for the riparian and aquatic habitat to recover. Repeat visual and aural disturbance to lowland leopard frog egg masses, tadpoles and individual frogs.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Because there is habitat occupied by lowland leopard frogs and that recreation and management activities result in direct effects to individuals and indirect effects to habitat, *it is the determination that no action and the action alternatives may impact the lowland leopard frog, but is not likely to result in loss of viability or trend toward federal listing.*

Reptiles

Northern Mexican and Narrow-headed Gartersnakes

Effects from Programmatic Components of All Alternatives
Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed for 1 to 3 years.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the both the northern Mexican and narrow-headed gartersnakes. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives
There have been no detections of either species of gartersnakes in Fossil Creek, however, suitable habitat occurs along all of Fossil Creek. In addition, an optimal prey base exists in about 10 miles of restored fisheries. Activities in the CRMP corridor that may occur in suitable habitat would include recreation, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance.

Recreation activities can result in indirect to effects to gartersnakes, should they occur in the future, when activities degrade habitat conditions either through loss of habitat or by introducing/spreading non-native aquatic organisms. Recreation activities in the riparian area can destroy gartersnake habitat over time by denuding stream banks and point bars (ridges of fine sediments inside the banks of the creek) point bars, compacting soil thereby eliminating re-growth of riparian vegetation, removing vegetation for firewood, and affecting water quality directly through human wastes and indirectly by facilitating erosion and sediment runoff. Visitors can potentially (intentionally or accidentally) introduce and nonnative aquatic organisms to suitable habitat; thereby increasing predation upon gartersnakes as well as decreasing their suitable forage base.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineating and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance could result in short-term disturbance to these gartersnake species, should they be present, because these activities could occur in the riparian area when gartersnakes are active, or in the uplands during shedding or brumation. In the long term, restoration activities will benefit these two species of gartersnakes by increasing the amount of riparian habitat.

Because neither species of gartersnakes have been detected from the Fossil Springs area downstream to the fish barrier where many aquatic surveys have been conducted over the years, it is very unlikely these species currently occur in Fossil Creek. However, should either species occur in the corridor in the future, the potential effects are disclosed in this analysis.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for these two gartersnake species, include better management through a comprehensive river management plan, monitoring, restoration of riparian habitat, and adaptive management. The project area is expected to have a long-term reduction in bare soil area, better delineated creek access to hardened areas, and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Proposed critical habitat occurs along the Verde River, including up the Fossil confluence 600 feet from the Verde River. Activities associated with Fossil within proposed critical habitat would be limited to canyoneering and backpacking. These activities are very limited in the lower end of Fossil Creek; use of the Deadman Mesa trail is minimal. Also, management of the ¼ mile of overlap of the Fossil and Verde wild and scenic corridors defers to the Verde CRMP.

Differences in Effects Among All Alternatives
Alternative A results in the most alteration of riparian habitat potentially used by gartersnakes at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative.

When the riparian acres to be restored are added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change.

The no action alternative results in the most alteration to riparian habitat potentially used by gartersnakes with no decision to allow for habitat restoration. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Snails

Fossil Springsnail

Effects from Programmatic Components of All Alternatives
Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian and aquatic habitat that is occupied by Fossil springsnails. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives
Fossil springsnails are only known to occur in the Fossil Creek corridor and there are only a few small populations making them vulnerable to population die-offs and risk of extinction. Therefore proposed activities that could affect occupied springsnail sites are given careful consideration. Some springsnail sites (3 sites along 708 road and above Flume trail) are not in areas visited by visitors either because they are in areas that are not developed or are inaccessible. Visitors may access areas where springsnails exist within or near recreation sites (especially in the Fossil Springs area and possibly along the waterfall trail). This may result in: direct trampling of individual springsnails; disruption of substrate to which they adhere and lay eggs; and reduced water quality from contaminants such as soap, insect repellent, and sunblock.

Continued existence and further invasion of Himalayan blackberry will continue to degrade springsnail habitat, especially in the Fossil Springs areas where this has been observed. While the action alternatives allow for treatment of invasive plants, use of herbicide on plant populations located near springsnail sites could result in contamination.

Poor watershed conditions in the uplands can have adverse indirect effects on springs and springsnail habitat. Disturbance associated with recreational activities can contribute to poor watershed conditions. Such activities result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff. Increased runoff in turn results in increased silt loads, increased turbidity, decreased water quality, and altered pH levels. Increase sedimentation results in increased embeddedness which smothers the substrate to which springsnails adhere and upon which they lay their eggs. Embedded sediment can also smother algae and other forage needed by springsnails.

Proposed actions common to all alternatives that occur near springsnail sites include road and trail maintenance, obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation,

weed treatments, designating creek access trails, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). BMPs and improvements (drainage, closures and rehabilitation) will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation at occupied springsnail sites.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for the springsnail, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites. Additionally, the modification to the corridor boundary by including a spring with springsnails near the FR 708 will benefit springsnails by providing all the above benefits from being covered by the CRMP.

Differences Among All Alternatives
Camping near springs occupied by springsnails can increase the effects to water quality, soil, vegetation, and impacts to individual snails. Camping increases the duration of a visit, increasing the need to pump water from Fossil Creek or springs inhabited by the springsnail. One springsnail site in Fossil Springs has had a social trail from the main trail down to the spring. During a springsnail survey in 2017, no springsnails were detected and one factor may be repeat disturbance and habitat degradation by recreators. Alternatives that allow for camping in/near Fossil Springs (A, B, E, and F) would have more affect to springsnails than alternatives that don't allow for camping at Fossil Springs (C and D). Also, alternatives that allow for access to Fossil Springs (A,B,E, and F) would have more affect to springsnails than alternatives that do not allow access to Fossil Springs (C and D). Overall, alternative C and D provide for the most protection for springsnails and habitat in the Fossil Springs area.

Monitoring would be conducted before capacity changes in Alts B-F and capacity changes would only be implemented if monitoring show the riparian condition could support the change.

Use of motorized off-road vehicles along the Flume trail for emergency purposes could crush springsnails occurring in seeps that cross the Flume trail. In order to reduce these effects, structures will be installed to avoid OHVs from touching wetted soil. Should these seeps be occupied by Fossil springsnails, these structures will ensure that snails are not crushed by OHV vehicles.

Cumulative Effects for Action Alternatives
Refer to the general cumulative effects analysis for all species, above.

Effects and Determination for Remaining Sensitive and Locally Important Species

The effects and determinations for sensitive and locally important species that were not covered in detail above (because there is either not enough information on their occurrence or that they have not been detected within the corridor), are summarized in the table below. For full disclosure of how proposed activities may affect species and their habitat, refer to the General Effects Common to all Alternatives section, above.

Table 3-55. Effects determination for Sensitive and locally important species the Fossil Creek Wild and Scenic River Corridor

Common Name	Summary of Effects	Determination of Effects
Bald Eagle	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to bald eagles that may occur in the area, especially during the high use months. Infrastructure (existing and new) results in habitat loss for nesting and wintering bald eagles.	May impact.
American Peregrine Falcon	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to peregrine falcons that occur in the area, especially during the high use months.	May impact.

Common Name	Summary of Effects	Determination of Effects
Northern Goshawk	Since operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities occur along Fossil Creek which is well away from goshawk habitat, there will be no effect to nesting habitat. However, the above activities that occur in pinyon juniper woodlands may result in disturbance to wintering goshawks, should they occur in the project area.	May impact.
Western Red Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting and foraging red bats along Fossil Creek, especially during the high use months. Since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	May impact.
Allen's Lappet-browed Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting bats but since these bats roost in juniper or pine trees, disturbance to roosting bats is anticipated to be low. And, since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	May impact.
Pale Townsend's Big-eared Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting bats that occur in the area, especially during the high use months. Since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	May impact.
Spotted Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities are unlikely to result in disturbance to roosting bats since these bats roost high up in cracks and crevices in cliffs and canyon. The only activities associated with cliffs would be rock scaling above FR 708 in alternatives D and E. Therefore, disturbance to roosting bats is anticipated to be low. There would be no effect to roosting spotted bats in alternatives A, B, C, and F. And, since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	May impact.
Arizona Toad	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to habitat and possibly to individuals, should they be present.	May impact.
Arizona Phlox	Activities in canyons where this plant may occur are limited, however, use and maintenance of existing roads (708) and trails (Flume, Fossil Springs and Mail trails) could result in disturbance to individuals.	May impact.
Cochise Sedge	Although the only known occurrence for this plant is in lower Fossil Creek where use is very limited, suitable habitat occurs along the entire perennial stretch of Fossil Creek. Therefore, recreational activities could result in trampling of plants along the entire perennial portion of the creek. Construction of bridges and repair of gabion may result in removal of individuals.	May impact.
Metcalfe's Tick-trefoil	Activities on rocky slopes and in canyons where this plant may occur are limited, however, use and maintenance of existing roads (708 switchbacks) and trails (Fossil Springs and Mail trail) could result in disturbance to individuals.	May impact.

Common Name	Summary of Effects	Determination of Effects
Mt. Dellenbaugh Sandwort	This species is known to occur in the corridor. Activities in uplands with oak, pine, and pinyon/juniper woodlands could result in disturbance and even removal of individual plants. The use and maintenance of existing roads (708 switchbacks) and trails (Fossil Springs and Mail trail) could result in disturbance to individuals.	May impact.
Eastwood Alumroot	Even though this plant is only known to occur outside of the corridor, there is potential for it to occur in the corridor on moist slopes in ponderosa pine forests and canyons toward the upper end of the corridor. Activities in the corridor where this appropriate vegetation and elevation exist is very unlikely to occur and so potential for disturbance is very low.	No impact.

Bald and Golden Eagle Protection Act

To comply with the Eagle Act, the U.S. Fish and Wildlife Service (FWS) recommends using the *Conservation Assessment and Strategy for Bald Eagles in Arizona* (Driscoll et al. 2006) in conjunction with the *Bald Eagle National Management Guidelines* (USDI Fish and Wildlife Service 2007) to protect bald eagles in Arizona. For golden eagles, the FWS has issued a report titled *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* (Pagel et al. 2010).

Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle. There is no likelihood that there be purposeful take with proposed activities. However, some activities could result in disturbance to eagles that could interfere with breeding, feeding, or sheltering behavior during the breeding season, or in the vicinity of roost sites in the winter. Examples include: fuel reduction activities; road, trail, and facility construction; prescribed burning; dispersed or developed recreation use including uncontrolled-off-highway vehicle use; and special use permits in the vicinity of eagle nests or roost sites. Direct injury to eagles from management activities is not a large threat, although collisions with communication towers, powerlines, and vehicles can occur and result in injury or death of eagles

Bald Eagle

There are no known bald eagle nests or winter roosting areas within the Fossil WSR corridor. However, suitable food as well as roosting and nesting habitat is available in the corridor. Should eagles be discovered nesting or roosting in the WSR corridor, the following mitigations, which come from the National Bald Eagle Management Guidelines (2007), would be taken to avoid disturbance, harm, harassment, and take:

- Employ nest buffers zones 1, 2, or 3 as per the Conservation Assessment and Strategy for the Bald Eagle in Arizona (Driscoll et al. 2006).
- Maintain undisturbed, natural habitats between the activity around the nest tree.
- Avoid activities within buffers during the breeding season (Dec 1 through June 30) and avoid changes to the landscape outside of the breeding season.

Direct and Indirect Effects

Direct effects to the bald eagle would be from activities that cause auditory or visual disturbance to eagles within or adjacent to the project. The Verde River and Fossil Creek are flown by AGFD looking for eagle nests; no bald eagle nests are known within or near the Fossil WSR corridor. The closest eagle nest is Coldwater, which has been unoccupied for the last three years. Because there are no bald eagles known to nest in the project area, there will be no direct effects to nesting eagles. Bald eagles that forage in the corridor, particularly near the riparian area of the recreation segment may be disturbed by people and vehicles, but due to the large amount of suitable foraging habitat this disturbance would be incidental and infrequent.

Indirect effects to the bald eagle include effects to eagle habitat, eagle prey species, or prey species habitat. Bald eagles prey mainly on waterfowl and large fish. While fishing is allowed in Fossil Creek during the fall, winter,

and spring, it would minimally affect the age class of fish preferred by bald eagles and would be limited to the area between the powerline crossing and the large falls. There are no anticipated measurable adverse effects to prey species or their habitats.

Despite direct and indirect effects that may occur to bald eagles, should they occur in the corridor, most Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle.

Cumulative Effects
There are no effects to bald eagles anticipated from project activities therefore there are no cumulative effects.

Golden Eagle

Direct and Indirect Effects
Direct effects to the golden eagle would be from activities that cause auditory or visual disturbance to eagles within or adjacent to the project. Since the nearest known golden eagle sites are out of the corridor and in remote uplands, there will be no direct effects to nesting eagles. Eagles that forage in the corridor, particularly near the riparian area of the recreation segment may be disturbed by people and vehicles, but due to the large amount of suitable foraging habitat (uplands) this disturbance would be incidental and infrequent.

Indirect effects to the golden eagle include effects to eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects to prey species or their habitats. There are no treatments proposed in potential nest habitat as rock outcrops and cliff ledges are not accessible.

Despite direct and indirect effects that may occur to golden eagles, should they occur in the corridor, most Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle.

Cumulative Effects
There are no effects to golden eagles anticipated from project activities therefore there are no cumulative effects.

Determination of Effect for Bald and Golden Eagles
The proposed treatments and activities will not result in take as defined by the Bald and Golden Eagle Protection Act. Neither species of eagle nests or roosts within the WSR corridor. Although there could be some level of disturbance to eagles foraging or passing through the corridor, they are not expected to cause 1) injury to an eagle, 2) a decrease in productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior.

Management Indicator Species – All Alternatives

The amount of MIS habitat disturbed by each alternative is listed in Tables X and X for the Coconino and Tonto National Forests, respectively.

The amount of pronghorn habitat disturbed in alternatives A, B, C, D, E, and F are 34.5, 29.9, 32.6, 29.0, 33.6 and 38.5 acres, respectively. Because the no action and action alternatives would result in minor loss of habitat (less than a fraction of one percent) for MIS species when compared to available habitat on the Coconino National Forest, the loss is too small to alter forest-wide habitat and population trends for any species. Therefore, it is the determination that the no action, the action alternatives, and the CRMP will have no effect to forest-wide trends for management indicator species on the Coconino National Forest.

Table 3-56: Amount of MIS Habitat Disturbed by Alternative on the Tonto NF

		Acres of Habitat Disturbed						
Species	Indicator Habitat Occurring Within Project Area	No Action	Alt B	Alt C	Alt D	Alt E	Alt F	Forest-wide Acres
Elk	All P/J types	**45.0**	**39.3**	**39.6**	**38.3**	**41.4**	**29.4**	**469,898**

		Acres of Habitat Disturbed						
Species	Indicator Habitat Occurring Within Project Area	No Action	Alt B	Alt C	Alt D	Alt E	Alt F	Forest-wide Acres
Turkey	All P/J types	45.0	39.3	39.6	38.3	41.4	29.4	469,898
Juniper Titmouse	Late seral P/J and snags	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Ash-throated Flycatcher	All P/J types	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Gray Vireo	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Townsend's Solitaire	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Northern Flicker	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Spotted Towhee	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Black-chinned Sparrow	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Savannah Sparrow	Juniper/Semi desert grassland and Alligator/Utah Juniper Savannah	40.4	34.7	35.1	33.7	36.1	34.8	756,529
Black-chinned Sparrow	Pinyon juniper with shrub	39.0	33.4	33.7	32.6	34.8	33.5	688,925
Horned Lark	Juniper/Semi desert grassland and Alligator/Utah Juniper Savannah	40.4	34.7	35.1	33.7	36.1	34.8	756,529
Black-throated Sparrow	Juniper – grassland transition and semi-desert grassland	6.0	5.9	5.9	5.7	6.6	5.9	415,546
Canyon Towhee	Juniper – grassland transition and semi-desert grassland	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Arizona Gray Squirrel	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Common black-hawk	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Bald Eagle	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Bell's Vireo	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Summer Tanager	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Hooded Oriole	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Hairy Woodpecker		9.0	1.4	1.4	1.0	1.6	1.5	35,022
Arizona Gray Squirrel		9.0	1.4	1.4	1.0	1.6	1.5	35,022
Warbling Vireo		9.0	1.4	1.4	1.0	1.6	1.5	35,022
Western Wood Peewee		9.0	1.4	1.4	1.0	1.6	1.5	35,022

*Even though the query for vegetation types shows no acres for PJC in the project area or analysis area, this habitat type is present but it's included in other P/J veg types. So, black-chinned sparrow is included in this analysis and the acres for other P/J types are used as a proxy for PJC.

Because the no action and action alternatives would result in minor loss of habitat (less than a fraction of one percent) for MIS species when compared to available habitat on the Tonto National Forest, the loss is too small to alter forest-wide habitat and population trends for any species. Therefore, it is the determination that the no action,

the action alternatives, and the CRMP will have no effect to forest-wide trends for management indicator species on the Tonto National Forest.

Migratory Birds – All Alternatives

Effects Common to All Alternatives

Most Forest Service management activities would not meet the definition of take under the Migratory Bird Treaty Act, which is "… to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). Activities that result in direct ground disturbance (construction, maintenance, restoration) and unintentional ground disturbance (recreation) can result in the removal or destruction of vegetation. Vegetation removal or destruction is not considered a taking; however, activities occurring during the breeding seasons, could result in unintentional take if active nests with eggs or young are present in trees, shrubs or on the ground. These activities would occur under all alternatives considered in this analysis.

One Important Bird Area (IBA), the Salt and Verde Riparian Ecosystems IBA occurs along the Verde from Childs downstream to the Fossil confluence. This IBA occurs in the area covered and managed under the Verde Comprehensive River Management Plan.

Though overwintering by bird species occurs in the project area, no areas within the Fossil WSR corridor have been designated as important overwintering areas.

Cumulative Effects Common to All Alternatives

Because migratory birds spend a good portion of the year in migration and on their wintering grounds, activities that degrade stopover or wintering habitats can have an effect on the food and cover requirements for these birds. Similarly, on breeding grounds, activities on non-Forest Service lands can also degrade habitats and disturb birds.

Determination of Effects for Action Alternatives

The CRMP guidance under all action alternatives provides for migratory bird habitat through desired conditions and guidelines for the vegetation types, as well as desired conditions and guidelines (restriction on loud activities during breeding season, treatment of invasive plant populations, and limiting new disturbance to mesquite bosques) for wildlife and their habitat. Additional general direction to improve habitats and maintain viable populations in wildlife direction also applies to migratory birds.

Monitoring specifically for migratory birds is not part of the Fossil Creek monitoring plan, however, a plot at Fossil Springs was monitored through a state-wide riparian bird monitoring led by AGFD. This plot will be monitored periodically through that effort. In addition, forest-wide migratory bird monitoring occurs in representative habitats across the forest. While forest-wide monitoring does not occur annually, it does occur on a rotational basis.

Unintentional take could occur when management activities or visitors destroy nests or kill individual birds. This may occur if trees and snags are removed for the construction of infrastructure and when hazard trees are removed. The scope and scale of these losses will be distributed throughout the 10+ years of plan implementation and in the long-term, management activities strive towards habitat improvement, sustaining priority bird habitat into the future.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, all action alternatives are likely to result in some unintentional take of migratory birds, but is not likely to be occurring to such an extent to have a measurable negative effect on migratory bird populations.

Determination of Effects for No Action Alternative

There would be no CRMP guidance to protect migratory birds and their habitat under the no action alternative. As a result, unintentional take could occur when management activities or visitors destroy nests or kill individual

birds. The scope and scale of these losses will be distributed throughout the 10+ years of plan implementation and in the long-term, management activities strive towards habitat improvement, sustaining priority bird habitat into the future.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, the no action alternative would likely result in some unintentional take of migratory birds, but it would not likely occur to such an extent that would have a measurable negative effect on migratory bird populations.

Summary

Degree to Which the Purpose and Need for Action is Met

There is a need to develop a long-term management plan and site-specific actions to provide for the protection or enhancement of the biological ORV. Alternatives B-E will provide the protection and possibly enhancement of the biological ORV. However, alternatives A and F will not provide protection for populations of black-hawks and Fossil springsnails. Rationale is detailed in species effects and determination sections.

Degree to Which the Alternatives Address the Issues

Key issues were raised in regards to: recreation use and visitor capacities; recreation management; infrastructure development; motorized access; and economic and commercial opportunities. Specifically for wildlife the following issues were raised:

1. Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.

2. Allowing camping may increase impacts to natural and cultural resources and result in additional trash in the Fossil Creek corridor.

3. Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.

Based on detailed analysis of effects, it is determined that alternatives B through E, best address the above issues due to the monitoring and adaptive management components.

The no action alternative will not address the above issues. Rationale for this determination is detailed in species effects and determination sections and in summary of environmental effects below.

Summary of Environmental Effects

In an attempt to summarize how the alternatives compare in terms of both impacts and benefits to wildlife habitat, the important factors considered in the effects analysis are ranked by alternative in the tables below. Important factors considered that would negatively impact habitat include total riparian acres disturbed, potential for impact to refugia based on the potential for crowding, and amount of stream accessible in designated recreation sites. See table 3-57. The overall weighted ranking of alternatives in terms of least impact to habitat is as follows: B, A, C, then D, E and F.

Table 3-57: Ranked Comparison of Impacts to General Wildlife Habitat by Alternative

	No Action	B	C	D	E	F
Total Riparian Acres Disturbed	1	5	6	4	2	3
Potential for Impact to Refugia	5	6	3.5	3.5	2	1
Recreation Stream Access (crowding)	6	5	4	2	3	1
Score	12	16	13.5	9.5	8	5

Best = 6, worst = 1

Important factors considered that would benefit wildlife habitat include total acres of vegetation restored, total riparian acres restored, and full potential of refugia acres. See Table 3-58. The overall weighted ranking of alternatives in terms of most benefit to habitat is as follows: D and C, followed by B, then F, E, and last A.

Table 3-58: Ranked Comparison of Benefits to General Wildlife Habitat by Alternative

	No Action	B	C	D	E	F
Total Veg Acres Restored	1	4	5	6	2	3
Total Riparian Acres Restored	1	3.5	5	6	3.5	4
Full Potential Refugia Acres	1	5	6	4	2	3
Score	3	12.5	16	16	7.5	10

Best = 6, worst = 1

Even though there will be direct and indirect effects to special status species and their habitat and the level of these effects differ among alternatives, overall *it is the determination that alternatives B-F would not result in enough segment-wide disturbance to constitute adverse effect or degradation and as a result wildlife populations and wildlife habitat components of the Biological ORV will be protected and/or enhanced under alternatives B-F.* This is because disturbance is minimal when compared to the overall undisturbed area and monitoring will occur before incremental increases in capacity are implemented in alternatives D, E and F. With the no action alternative, effects to species could occur but would be unknown to managers because there would be no formal monitoring plan, no CRMP, nor forest plan amendments *resulting in adverse effect or degradation of wildlife populations and their habitat.*

Key Points:

- The wildlife population and habitat portion of the Biological ORV was designated based on the important populations of a locally important and management indicator species, the common black-hawk, and two Forest Service Sensitive species, the lowland leopard frogs and Fossil Springsnails.
    - The Fossil Creek population of black-hawks is important for numerous reasons (see that section for details). The alternatives that would have the most impact to nesting black-hawks, are E, F, and A. The alternatives that would have the least impact to nesting black-hawks, based on ranking of numerous factors analyzed in the effects section, are C, followed by B and then D. The alternatives that have the least impact to nesting black-hawks are C, followed by B and then D.
    - The lowland leopard frog population in Fossil Creek is the Coconino National Forest's only viable population and is a significant population for the Tonto National Forest. The action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C. In the no action and alternatives B-E, capacity at Fossil Springs would be regulated. However, monitoring data does not show a correlation to changes in lowland leopard frog numbers, rather decreases were correlated to major flooding that scoured habitat and increases were correlated to restoration of full flows and recovery after major flooding.
    - The Fossil springsnail only occurs in springs associated with Fossil Creek and because it's a narrow endemic, this species is susceptible to extinction. When considering day use and camping in the Fossil Springs area, alternatives C and D provide for the most protection for springsnails and habitat in the Fossil Springs area.
- Because habitat for listed species occurs in the corridor, the effects analysis covers potential effects to species' habitat.
- There are no listed wildlife (excluding fish) species that are currently known to occur in the perennial portion of the Fossil corridor (where the majority of infrastructure and recreation occurs).

- There is potential for Mexican spotted owl, western yellow-billed cuckoo, southwestern willow flycatcher, northern Mexican gartersnake, and narrow-headed gartersnake to be present in the corridor. Effects analysis covers potential effects to these species should they occur in the future.
- The only critical habitat within the project area is: 1) for the two gartersnakes and occurs at the last 600 feet of Fossil at its confluence with the Verde and 2) a minor amount of MSO habitat at the very top end of the corridor. Therefore, there would be no effect to any species' designated critical habitat since there is either no critical habitat in the analysis area or it occurs in areas where recreation and management activities will not affect primary constituent elements.
- Short-term effects to species can occur before monitoring occurs (bare area monitoring occurs in the fall at the end of the high use season) and before adaptive management is implemented. In some cases, adaptive management measure may not be enough to ensure those effects aren't carried over into the next high use recreation season.
- In the action alternatives, the concept of refugia, forest plan direction (seasonal closures if needed, etc.), monitoring prior to incremental increases in capacity in D, E and F (capacities decrease for B and C), monitoring for recreational use and impacts outside of recreation sites and adaptive management, all provide for long-term adequate protection for wildlife and habitat. Therefore alternatives B-F would not cause a degradation of the wildlife population and wildlife habitat components of the Biological ORV.
- With the no action alternative, effects to species could occur but effects would be unknown or information about effects to ORVs would be delayed to managers, resulting in adverse effect or degradation of wildlife populations and their habitat.

Short-term Uses and Long-term Productivity

Proposed activities that have a short term impact but long term benefit to wildlife include maintenance of roads and trails, maintenance of facilities, construction of infrastructure that contains recreation impacts (parking area delineation), mitigative actions (runoff retention basins that reduce contaminants from reaching Fossil creek), and restoration activities.

Proposed activities that may result in disturbance to wildlife over the long term include; day use, camping, and dispersed back country recreation; use along roads and trails; and construction of infrastructure when it results in new ground disturbance.

Minimizing human-created bare areas particularly outside of recreation sites and within AMZ and implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation into Fossil Creek will result in long-term benefits to wildlife and their habitat.

In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: bare soil areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors.

Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that hardens sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

Overall, the implementation of action alternatives will not jeopardize the long-term productivity of the National Forest System lands.

Unavoidable Adverse Effects

While there will be new ground disturbance with the action alternatives, the acres are a fraction of a percent when compared to the total acreage in the corridor. Implementation of the CRMP management direction, resource protection measures, required monitoring and resulting adaptive management will minimize effects and in some cases, result in beneficial effects. Overall, there are no significant adverse effects as a result of implementing any of the action alternatives.

Irreversible and Irretrievable Commitments of Resources

While some actions (mainly construction of infrastructure) will result in an irretrievable loss of wildlife habitat, this loss is minimal when compared to the total acres within the corridor. However, none of the proposed infrastructure is irreversible; it would be possible to remove infrastructure and restore to natural conditions.

Aquatic Resources

This report summarizes the affected environment and environmental consequences of the actions described in the Environmental Impact Statement for the Fossil Creek Comprehensive River Management Plan (CRMP) on federally listed (threatened, endangered, candidate and proposed) species and Forest Service sensitive species. This specialist report presents the results of an analysis of the direct, indirect, and cumulative environmental consequences of the proposed action, other alternatives considered, as well as no action. The Biological Outstandingly Remarkable Value (ORV) in Fossil is comprised of both habitat and populations of fish, aquatic invertebrates, and wildlife, including birds, mammals, reptiles, and amphibians. This report includes fish and macroinvertebrates (the Aquatics aspect of the Biological ORV); terrestrial organisms and springsnails are covered in a separate specialist's report.

Aquatic habitat and fauna are an integral component of Fossil Creek's Biological Outstandingly Remarkable Value (ORV). The restoration of Fossil Creek was in large part driven by the potential for it to provide habitat for native fishes and aquatic species. In addition to dam removal and returning water flow to the stream channel, a critical component of the 2004 restoration of Fossil Creek was the chemical removal of non-native fish from 16 km of stream (Weedman et al. 2005). Fossil Creek now supports a diverse native fish community comprised of seven species (table 3-59). High water quality and a wide diversity of habitat types also support a wide diversity of macroinvertebrates species. Macroinvertebrates provide the food base for many native fish, and the wide diversity of these species in the system is unique in its own right. The interdependence among Fossil Creek native fish, invertebrates, and their aquatic and riparian habitat make this resource outstandingly remarkable.

The high quality and diverse habitats in Fossil Creek that provide for a diverse native fish community contribute to the Biological ORV. Environmental traits such as stream length, abundant water flow, elevational gradient, unfragmented nature, and travertine section provide a large diversity of aquatic habitat and combine to make Fossil Creek unique relative to other Arizona streams. High water quality and a wide diversity of habitat types also support a wide diversity of macroinvertebrates species. Stable isotope studies in Fossil Creek demonstrate the importance of riparian vegetation to the food web (Marks et al. 2010, O'Neill 2013) Macroinvertebrates provide the food base for many native fish, and the wide diversity of these species in the system is unique in its own right.

Table 3-59 Special status species included in this analysis.

Common Name	Scientific Name	Status	Species Present in Fossil Creek	Critical Habitat in Fossil Creek	Species/Critical Habitat included in Analysis?
Fish					
Roundtail chub[1]	*Gila robusta*	FS Sensitive	Yes	NA	Yes/NA
Sonora sucker	*Catostomus insignis*	FS Sensitive	Yes	NA	Yes/NA
Desert sucker	*Catostomus clarki*	FS Sensitive	Yes	NA	Yes/NA
Longfin dace	*Agosia chrysogaster*	None	Yes	NA	No/NA
Speckled dace	*Rhinichthys osculus*	None	Yes	NA	No/NA
Spikedace	*Meda fulgida*	Endangered	Yes[2]	Yes	Yes/Yes
Loach minnow	*Tiaroga cobitis*	Endangered	No[3]	Yes	Yes/Yes
Razorback sucker	*Xyrauchen texanus*	Endangered	No[4]	No	No/No
Gila topminnow	*Poeciliopsis occidentalis*	Endangered	Yes[5]	No	Yes/No
Aquatic Macroinvertebrates					
A Caddisfly	*Polycentropus arizonensis*	None	Yes	NA	Yes/NA
A Caddisfly	*Hydropsyche venada*	None	Yes	NA	Yes/NA
A Caddisfly	*Wormaldia arizonensis*	FS Sensitive	Yes	NA	Yes/NA
Page Spring Micro Caddisfly	*Metrichia nigritta*	Species of Concern	Yes	NA	Yes/NA
A Caddisfly	*Mayatrichia acuna*	None	Yes	NA	Yes/NA

Table footnotes:

1. Fossil Creek was previously thought to maintain two species of chub, the roundtail chub (*Gila robusta*) and headwater chub (*Gila nigra*) (Minckley and DeMarais 2000). Taxonomic changes to the genus *Gila* have resulted in the combination of three Gila species (*G. robusta, G. nigra*, and *G. intermedia*) into the species *Gila robusta* (Page et al. 2017). In this analysis we use the most recent available data for chub (a single species in Fossil Creek), but we also recognize that the taxonomic status of the genus *Gila* may not be certain (i.e. Carter et al. 2017, Copus et al. 2018, Marsh et al. 2017, Moran et al. 2017) and future changes to both the taxonomic and legal status are possible.
2. Though reproduction has been confirmed in Fossil Creek, spikedace have not spread throughout the creek and populations remain small and sporadically located (Rinker and Rogers 2018). The ability of spikedace to persist in Fossil Creek is in question (Rinker and Rogers 2018, Robinson and Mosher 2018). High flow events in the winter 2016 and spring 2017 may have displaced spikedace as only one fish was detected during AGFD's 2017 snorkel survey (Rinker and Rogers 2018).
3. Despite repeated stocking efforts, loach minnow do not appear to occur in Fossil Creek and stocking has been halted (Robinson and Mosher 2018).
4. Razorback suckers were stocked into Fossil Creek prior to the 2004 restoration and persisted in the Stehr Lake impoundment prior to that restoration. After restoration, razorbacks were stocked into the creek for research (Avery et al. 2011) and as a grow-out opportunity (Robinson and Mosher 2018). Razorback stockings are considered to have failed and there are no further stocking plans (Robinson and Mosher 2018).
5. Though Gila topminnow were present in Fossil Creek high numbers from 2013 through 2016 (Robinson and Mosher 2018; Rinker and Rogers 2018), winter 2016 and spring 2017 high flow events in the may have displaced much of the population so that only two fish were detected in spring 2017 snorkel surveys (Rinker and Rogers 2018).

Methodology

In general, the analysis of effects will cover the programmatic management direction (incorporated by amendment in to the Coconino and Tonto national forest plans), management actions, the monitoring plan, and adaptive management. The analysis assumes all necessary mitigation measures, design features, best management practices, and monitoring will be implemented along with management actions. Environmental effects considered include disturbed area and sediment input; water flow and water quality; construction and infrastructure maintenance; non-native fish introduction, and recreation.

Area of Analysis

The project area includes the Fossil Creek Wild and Scenic River (WSR) corridor which approximately consists of a ¼ mile buffer on either side of Fossil Creek. The analysis area includes four 6th code watersheds (Upper Fossil Creek, Lower Fossil Creek, Hardscrabble Creek, and Mud Tanks Draw).

Information Sources

Species occurrence information was obtained by:

- Compiling survey results from agency, academia, and citizen science efforts.
- Inventory and monitoring species and their habitat following established protocols.
- Querying the District Biologist's database for all species observations in Fossil Creek

Affects analysis is accomplished utilizing the following:

- The Forest Service's past recreation use numbers
- The Forest Service's bare ground inventory data
- Soils and Watershed specialist report
- GIS queries of stream lengths and acreages in various categories
- Published literature

Incomplete and Unavailable Information

While there are many macroinvertebrate studies available for Fossil Creek, there is not adequate sampling to provide baseline monitoring data (i.e. Index of Biological Integrity, IBI). Aquatic macroinvertebrate surveys have been conducted in the past, but surveys did not follow ADEQ methods for assessing IBI.

While possible anthropogenic effects on habitat (such as bare area area creation and consequent sediment input) are well documented, an important data gap is in understanding the direct effects of recreation on fish individuals and populations. There are mechanisms by which recreation can be expected to impact fish (i.e. fish startle response recreational water play, personal care product pollution), and there is a considerable body of literature documenting fish stress (see references in effects discussion below). Clear direct effects of recreation, however, are poorly documented.

A final unknown factor is the threshold at which visitor density will result in people dispersing away from recreation areas. Each alternative designates recreation polygons that are intended to focus visitors to sections of the stream that are best suited for recreation (i.e. hardened banks, toilets available, etc.). At some point it is reasonable to expect that visitors will become dissatisfied with the number of people at a site and move to another site, therefore potentially impacting refugia. Though published literature does indicate that crowding can alter visitor behavior and result in displacement, visitor densities that result in such behavior are not well documented and are likely site- and individual-dependent. This analysis therefore assumes that relative visitor density can predict the likelihood of visitors leaving recreation sites and impacting refugia.

Analysis Indicators and Measures

The Fish and Aquatic Resources component of the Biological ORV encompasses the fish species present in Fossil Creek, the macroinvertebrate community present in Fossil Creek, and the habitat that supports aquatic flora and fauna. Of particular importance to the value of the Fish and Aquatic Resources is the exclusively native fish community, which is primarily composed of roundtail chub (FS Sensitive), desert sucker (FS Sensitive), Sonora sucker (FS Sensitive), and speckled dace. Several imperiled fish species have been stocked into Fossil Creek, and spikedace (Endangered) and Gila topminnow (Endangered), are present in the system though neither species is considered established in Fossil Creek. There are several macroinvertebrate species of concern as well, including several caddisflies (some FS Sensitive) and the Fossil Creek springsnail (FS Sensitive). Key habitat components include a variety of suitable habitat types (i.e. riffles, runs, chutes, shallow pools, deep pools, shallow still water), suitable habitat conditions for all life stages (e.g. natural hydrologic and sedimentation regime, spawning substrate, slack water areas for larvae), the absence of non-native fish, a functioning riparian system, and the absence of recreation effects (i.e. pollution, high-levels of recreation).

Fossil Creek is an aquatic system that is managed in the absence of two common anthropogenic impacts: habitat modification via water damming or diversion, and the presence of non-native fish. Habitat modifications alter natural flow regimes, temperature regimes, and substrate, all of which affect the native fish and aquatic invertebrate assemblages. APS diverted flow for hydropower generation in Fossil Creek for a century. Research conducted by NAU showed that water flow restoration increased the number of native fish in the system three-fold (Marks et al. 2010). The potential for future dams and/or diversions to be constructed in Fossil Creek is largely alleviated due to the Wild and Scenic designation that will require evaluation of projects in the corridor to undergo Section 7 analysis. Thus, the aquatic resources (both habitat and fauna) are already largely protected from this aspect of human activity.

Many other anthropogenic habitat modifications also have the potential to adversely affect aquatic habitat and animals by decreasing water quality, such as changes in sediment input into the stream or the presence of bacterial pathogens. Sediment input into streams can be affected by natural events such as flooding and land management activities such as roads and trails, grazing, wildfire, and development. An example of an adverse effect would be substrate embeddedness that reduces the spawning success or survival of fish and/or alters the macroinvertebrate community.

The second major human impact to native fish and invertebrates is the introduction of non-native species, particularly non-native fish. Non-native smallmouth bass and green sunfish were present in most of Fossil Creek prior to the restoration process. These species largely eradicated native fish species from the system. The combination of flow restoration and non-native fish removal resulted in a more than 80-fold increase in native fish abundance but, even more telling, native fish abundance did not improve when flow was restored and non-native fish were not removed (Marks et al. 2010). We therefore view non-native fish as the primary threat to the continued persistence of native species and therefore the Aquatic Resources aspect of the Biological ORV.

Refer to table 3-60 for the measures associated with each of the biological indicators.

Table 3-60. Resource indicators and measures for assessing anthropogenic effects.

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Native Fishery	Presence of only native fish species	Presence of non-native fish above the fish barrier	Yes	Desired Conditions for Fish and Aquatic Invertebrates
Native fish populations	Populations of five native fish species	Native fish populations are not negatively impacted by anthropogenic effects	Yes	Desired Conditions for Fish and Aquatic Invertebrates

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Water flow	Existing base flows, natural flow regime	Stream gauge data	Yes	Desired Conditions for Free Flow, Water Quality, and Water Quantity
Water quality	Presence of *E. coli*	Colony Forming Units as per ADEQ testing standards	Yes	Desired Conditions for Free Flow, Water Quality, and Water Quantity
Macroinvertebrate abundance and diversity	Index of Biological Integrity	IBI scores not decreasing more than three samples in a row	Yes	Desired Conditions for Fish and Aquatic Invertebrates

Adverse Effect, Degradation, Protection, and Enhancement

The aquatic resources portion of the Biological ORV is based on the presence of many special status fish and rare invertebrate species, as well as the aquatic and riparian habitat needed to support these species. These two groups are most severely impacted by major environmental changes and non-native fish. It is these groups for which WSRA-specific analysis is conducted (indicators, measures, adverse effect thresholds, degradation thresholds, enhancement thresholds, and monitoring). These analysis elements are used to monitor and correct impacts to the Biological ORV. While actions may be taken in response to effects to these elements, monitoring is not necessarily included in the adaptive management framework because there is no uncertainty about required actions. General definitions of adverse impact, degradation, protection, and enhancement for population and habitat components of the fish and aquatics portion of the Biological ORV are as follows. Specific thresholds associated with these definitions are provided below. The specific indicators for adverse impacts, degradation, and beneficial effects for the various wildlife habitat and population components are included in table 3-61, table 3-62, and table 3-63 respectively.

Adverse Impact to Fish and Aquatic Resources Populations

The fish and aquatic resources population component of the biological ORV would be adversely impacted if public use, development, or administrative use result in aquatic habitat changes or negatively impact the size (number of fish), structure (population metrics such as length-frequency), or requirements of a population of native fish, populations of aquatic macroinvertebrates, or populations of Fossil springsnails in the Fossil Creek corridor.

Degradation of Fish and Aquatic Resources Populations

The fish and aquatic resources population component of the biological ORV would be degraded if native fish populations (population size, structure) are being negatively impacted by non-native fish or if public use, development, or administrative use impact the size, structure, or requirements of an established population of native fish, populations of aquatic macroinvertibrates, or populations of Fossil springsnails to the extent that a reduction of population viability in the Fossil Creek corridor is likely.

Protection and Enhancement of Fish and Aquatic Resources Populations

The fish and aquatic resources population component of the biological ORV is protected if no non-native fish are present above the permanent fish barrier and the size and structure of established populations of native fish, aquatic macroinvertibrates, and Fossil springsnails support long-term species viability in the Fossil Creek corridor. Opportunities for enhancement include expanding interpretation and educational programming related to fish and aquatic resources intended to reduce human impacts to these species' populations, actions that would enhance water quantity and quality, and supporting inventories and research intended to improve the understanding of fish and aquatic resources populations.

Adverse Impact to Fish and Aquatic Resources Habitat

The native fishery habitat component of the biological ORV would be adversely impacted if non-native fish that are likely to be invasive are present above the permanent fish barrier or if terrestrial (especially riparian) habitat, water quantity, or water quality indicators display adverse impacts because of their influence on the condition of fish and aquatic species. Fossil springsnail habitat would be adversely impacted if the function of occupied springs is trending downward as a result of public use, development, or administrative use.

Degradation of Fish and Aquatic Resources Habitat

The native fishery habitat component of the biological ORV would be degraded if non-native fish populations have increased to the point that native fish populations are being impacted (changes in population size, structure) or if terrestrial (especially riparian) habitat, water quantity, or water quality indicators are degraded because of their influence on the condition of fish and aquatic species. Fossil springsnail habitat would be degraded if public use, development, or administrative use interfere with occupied springs' ability to attain and maintain functional condition in the long term.

Protection and Enhancement of Fish and Aquatic Resources Habitat

The native fishery habitat component of the biological ORV is protected if no non-native fish are present above the permanent fish barrier and terrestrial habitat, water quantity, and water quality are protected because of their influence on the condition of fish and aquatic species. Fossil springsnail habitat is protected if public use, development, or administrative use are not causing a downward trend in the function of occupied springs. Opportunities for enhancement include expanding interpretation and educational programming related to fish and aquatic resources that is intended to reduce human impacts to habitat, actions that would enhance water quantity and quality and spring function, and supporting research intended to improve the understanding of fish and aquatic resources habitat requirements.

Adverse Impact Thresholds

Table 2-61. Indicators for adverse impacts for the various aquatic habitat and species components

Resource Element	Adverse Impact would be indicated when:
Native Fishery	…a single non-native invasive fish is found above the fish barrier.
Native fish populations	…a Fossil Creek population of native fish is negatively impacted (population size, structure) due to anthropogenic impacts for one year relative to prior survey data.
Water quality	… if exceedances of state water quality standards that are attributed to public use, development, or administrative use are detected, such as through the presence of human or pet waste in areas that may result in water contamination. Specific indicator(s) and sampling locations may be selected to indicate an adverse impact.
Macroinvertebrate abundance and diversity	…two consecutive samples at one site showing a decline in invertebrate abundance and diversity.

Degradation Thresholds

Table 3-62. Indicators for degradation for the various aquatic habitat and population components

Resource Element	Degradation would be indicated when:
Native Fishery	… native fish populations are being negatively impacted by non-native fish (i.e. population declines, reduction in smaller fish counts).
Native fish populations	…a Fossil Creek population of native fish is negatively impacted (population size, structure) by anthropogenic impacts for more than one year relative to prior survey data.
Water quality	… if any segment of Fossil Creek is included on the federal Section 303d (Clean Water Act) listing of waters not attaining minimum water quality objectives.
Macroinvertebrate abundance and diversity	…three consecutive samples at one site showing a decline in invertebrate abundance and diversity.

Protection and Enhancement Thresholds

Table 3-63. Indicators for protection and enhancement for the various aquatic habitat and population components.

Resource Element	Maintain or Enhance would be indicated when:
Native Fishery	… no non-native fish individuals found that specialists (AGFD, FWS, USFS) consider likely to be invasive in Fossil Creek.
Native fish populations	… fish species that are currently not distributed throughout the creek expand their distribution.
Water quality	… public use, development, or administrative use do not result in exceedances of state water quality standards.
Macroinvertebrate abundance and diversity	…consistent surveys show maintenance of invertebrate abundance and diversity and find high IBI values.

Affected Environment –Baseline and Existing Condition for Special Status Species and Critical Habitat

This section describes the affected environment for the fisheries and aquatic invertebrates portion of the biological ORV. It provides general baseline at the time of designation (2009) for background information and a general history of the system, followed by existing conditions. All analysis is done on existing conditions only.

General Baseline Condition

This section describes the condition of aquatic resources in Fossil Creek as of 2009. The 2004 restoration resulted in habitat free of non-native fish, and the four common native fish (roundtail chub, desert sucker, Sonora sucker, speckled dace) populations grew dramatically (Marks et al. 2010). Four endangered fish species (spikedace, loach minnow, Gila topminnow, and razorback sucker) were stocked into Fossil Creek (Robinson and Mosher 2018). The intent of stocking the first three species was to establish new populations in Fossil Creek; razorback sucker were stocked into Fossil Creek with the hope that they would utilize the stream as a "grow out" area, thus moving into the Verde River at a size large enough to avoid most predators. Table 3-64 indicates baseline conditions for each resource element.

Table 3-64. Resource indicators and measures for the baseline condition

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Baseline Condition
Native Fishery	Presence of only native fish species	Presence of non-native fish above the fish barrier	No non-native fish present above the fish barrier
Native fish populations	4 species of native fish are abundant and five other species present	Catch per unit effort	Roundtail chub, speckled dace, desert sucker, and Sonora sucker abundant; Gila topminnow, longfin dace, razorback sucker, loach minnow, and spikedace present or possibly present.
Water flow	Steady base flows, natural flow regime	Stream gauge data	43 Cubic Feet of Water per Second (CFS)
Water quality	E. coli	Colony forming units (see Soil and Watershed specialist report)	Meets ADEQ standards
Macroinvertebrate abundance and diversity	Index of Biological Integrity	IBI scores not decreasing more than three samples in a row	IBI scores passing (ADEQ 2008)

Recreation Impacts as of 2009

Recreation occurring along Fossil Creek increased dramatically after restoration of full flows in 2005. Visitation during the high use season in 2006 was around 20,000 people but by 2011 had increased to 95,000 people (Rotert

2013b). Recreational activities in Fossil Creek, particularly before camping was restricted and capacity controls were implemented starting in 2011, resulted in resource damage including denuded and compacted soils both adjacent to the creek as well as in the uplands, an increase in trash and human waste, damage to trees, small wildfires, etc. In addition the sheer number of recreationists resulted in direct disturbance to wildlife in Fossil Creek. For example two black-hawk nests were abandoned by the historic Fossil Springs dam and by the waterfall when recreation numbers increased from 37,000 people/high use season to 81,000 people per high use season. No negative effects to fish populations were observed; in fact fish populations increased, in large part due to strong 2008 and 2010 flood events (Rinker and Rogers 2018). Beginning in 2011 capacities were controlled by closing entrances when parking areas filled up. When the permit system was implemented in 2014, recreation use and the resulting impacts really decreased. Fishing in the upland stock tanks may occur because non-native fish have been detected in various locations.

Existing Condition

The native fish species present in Fossil Creek prior to restoration continue to thrive. Populations of roundtail chub, desert sucker, Sonora sucker, and speckled dace appear resilient to natural flooding events, and longfin dace populations remain small but present (Rinker and Rogers 2018). Initial 5-year repatriations of spikedace, loach minnow, Gila topminnow, and razorback sucker are complete, and future augmentations are not currently planned (Robinson and Mosher 2018). Loach minnow and razorbacks suckers are not found in Fossil Creek and these repatriations are considered to have failed (Robinson and Mosher 2018). Spikedace and Gila topminnow repatriations have been more successful in that natural reproduction has been detected for both species, and Gila topminnow was found in the creek by the hundreds (Robinson and Mosher 2018; Rinker and Rogers 2018). However, the success of both species occurred during a period of several years where Fossil Creek did not see significant flooding events. The most recent AGFD survey data (fall 2017) indicates populations of both species have declined, perhaps due to large flooding events during the winter of 2016-2017 and spring 2017. The long-term viability of spikedace and Gila topminnow in Fossil Creek is thus in question.

Because razorback sucker repatriation efforts have failed and there are no planned stockings due to unsuitable habitat (the stream is far too small), this species is not considered in this analysis (Robinson and Mosher 2018). The repatriation failure is also true for loach minnow (Robinson and Mosher 2018). However, ongoing research is attempting to identify habitat and food requirements of loach minnow and spikedace and a field site includes Fossil Creek (Ben Koch, pers. comm.). This work could help determine why loach minnow were not able to utilize Fossil Creek above the dam and identify any other sites in Fossil Creek where these species may persist. For this reason we will continue to analyze loach minnow in this analysis. Table 3-65 indicates existing conditions for each resource element.

Table 3-65. Resource indicators and measures for the existing condition

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Existing Condition
Native Fishery	Presence of only native fish species	Presence of non-native fish above the fish barrier	No non-native fish present above the fish barrier
Native fish populations	4 species of native fish are common and three other species present	Catch per unit effort	Roundtail chub, speckled dace, desert sucker, and Sonora sucker, and longfin dace present and presumed stable; Gila topminnow and spikedace present but possibly declining (Rinker and Rogers 2018)
Water flow	Steady base flows, natural flow regime	Stream gauge data	43 Cubic Feet of Water per Second (CFS)
Water quality	E. coli	Colony forming units (see Soil and Watershed specialist report)	Meets ADEQ standards

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Existing Condition
Macroinvertebrate abundance and diversity	Index of Biological Integrity	IBI scores not decreasing more than three samples in a row	IBI scores passing (Adams 2012)

Desert sucker, *Catostomus clarkii*

Distribution and Status

Desert sucker (*C. clarkii*) is a medium-sized member of the sucker family (Catostomidae) common between 1,000 and 6,500 feet elevation in the Bill Williams, Salt, Gila, San Francisco, and Verde River drainages in Arizona and New Mexico. Desert sucker is generally common and considered stable throughout its range (USDI FWS 2009a). The species is not listed as federally protected, but is listed on the Regional Forester's Sensitive Species list (USDA 2013).The State of Arizona lists the species as 1B Species of Greatest Conservation Need (AGFD 2012)

Habitat Requirements

This species uses medium to moderately large streams, at elevations ranging from 500 to 8,800 feet and rarely occurs in reservoirs. Desert suckers are usually found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble (AGFD 2002a). Desert suckers are adapted to a wide range of temperatures from warmer rivers to trout streams. Desert suckers spawn in late winter or early spring on graveled riffles, and hybridization between the desert and Sonora suckers has been known to occur (AGFD 2002a). In Fossil Creek they can be found in all aquatic habitat types and are one of the more common species in swift riffles (Marks et al. 2010).

Desired Condition

The desired condition for desert sucker is that the species remains well established throughout Fossil Creek. The population is resistant to natural events such as flooding, and anthropogenic impacts such as non-native fish introductions will be quickly identified controlled so that populations remain system-wide where there is suitable habitat.

Existing Condition

Desert sucker still occurs throughout most of its range and populations are considered stable (USDI FWS 2009a). They are common in Fossil Creek and are found throughout the system, primarily in pools, backwaters, and runs. AGFD snorkel surveys in 2017 detected desert suckers in more than 85% of pools between Irving Falls and the fish barrier (Rinker and Rogers 2017).

Threats

The desert sucker is stable throughout most of its range (USDI FWS 2009a). Habitat modifications through flow regime alteration, dewatering, and increased sedimentation from land management are threats to populations (AGFD 2002a; USDI FWS 2009a). Competition with and predation by non-native fish are a threat to nearly all native fish (Minckley and Marsh 2009). In Fossil Creek, the desert sucker population is primarily threatened by non-native fish and habitat alteration from land management activities that affect aquatic systems (i.e. bank destabilization, sedimentation).

Sonora sucker, *Catostomus insignis*

Distribution and Status

Sonora sucker (*C. insignis*), also known as the Gila sucker, is a large member of the sucker family (Catostomidae) common between 1,000 and 6,500 feet elevation in the Gila, Verde, Bill Williams, and San Francisco River Basins of Arizona and New Mexico. The species is not federally listed but is Sensitive on the Region 3 Forester's List (USDA 2013b) and is a Tier 1B Species of Greatest Conservation Need in the State of Arizona (AGFD 2012).

Habitat Requirements

This species use medium to moderately large streams, at elevations ranging from 500 to 8,800 feet and neither species occurs in reservoirs. The species is usually found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble (AGFD 2002b, Minckley and Marsh 2009). Sonora suckers are adapted to a wide range of temperatures from warmer rivers to trout streams. Sonora suckers spawn in late winter or early spring on graveled riffles, and hybridization between the Sonora and desert suckers has been known to occur (AGFD 2002b). In Fossil Creek they can be found in all aquatic habitat types, though they are less common in swift riffles (Marks et al. 2010).

Desired Condition

The desired condition for Sonora sucker is that the species remains well established throughout Fossil Creek. The population is resistant to natural events such as flooding, and anthropogenic impacts such as non-native fish introductions will be quickly identified controlled so that populations remain system-wide.

Existing Condition

Sonora suckers still occur throughout most of their historical range and populations are considered stable (AGFD 2002b, USDI FWS 2009b). They are common in Fossil Creek and are found throughout the system in nearly all habitat types (Marks et al. 2010). AGFD snorkel surveys in 2017 detected desert suckers in more than 60% of pools between Irving Falls and the fish barrier (Rinker and Rogers 2017).

Threats

The Sonora sucker is stable throughout most of its range (AGFD 2002b; USDI FWS 2009b). Habitat modifications through flow regime alteration, dewatering, and reduced habitat quality from land management are threats to populations (AGFD 2002b; USDI FWS 2009b). Competition with and predation by non-native fish are a threat to nearly all native fish (Minckley and Marsh 2009). In Fossil Creek, the Sonora sucker population is primarily threatened by non-native fish, crayfish, and habitat alteration from land management activities that affect aquatic systems (i.e. bank destabilization, sedimentation).

Roundtail chub, *Gila robusta*

Distribution and Status

Roundtail chub is a member of the *Gila* species complex found throughout the Colorado River basin. As noted in the introduction, there is some taxonomic uncertainty for the classification populations within the *Gila* complex. Fossil Creek was previously thought to maintain two species of chub, the roundtail chub (*Gila robusta*) and headwater chub (*Gila nigra*) (Minckley and DeMarais 2000). Taxonomic changes to the genus *Gila* have resulted in the combination of three Gila species (*G. robusta, G. nigra,* and *G. intermedia*) into the species *Gila robusta* (Page et al. 2016). Consequently, the Proposed Threatened status of roundtail chub and headwater chub was withdrawn by the US Fish and Wildlife Service in 2017 (USDI FWS 2017a). In this analysis we use the most recent available data for chub (a single species in Fossil Creek), but we also recognize that the taxonomic status of the genus *Gila* may not be certain (i.e. Marsh et al. 2017, Moran et al. 2017) and future changes to both the taxonomic and legal status are possible.

Roundtail chub is found in the upper and lower Colorado River Basins. Roundtail chub was historically considered common throughout its range in the Gila and Zuni Rivers in New Mexico; the Black, Colorado , Little Colorado, Bill Williams, Gila, San Francisco, San Carlos, San Pedro, Salt, Verde, White, and Zuni Rivers in Arizona; and numerous tributaries within those basins.

Conservation agreements and associated plans have been developed for roundtail chub in the upper and lower Colorado River Basin. Populations in Arizona are managed under the ‘Arizona Statewide Conservation Agreement for Roundtail Chub (*Gila robusta*), Headwater Chub (*Gila nigra*), Flannelmouth Sucker (*Catostomus latipinnis*), Little Colorado River Sucker (*Catostomus spp*.), Bluehead Sucker (*Catostomus discobolus*), and Zuni Bluehead Sucker (*Catostomus discobolus yarrowi*)’ (Arizona Agreement; Arizona Game and Fish Department

2015a). Some actions have been implemented as a result that benefit and help conserve roundtail chub, such as the establishment of new populations in nonnative fish-free habitats and the development of broodstock for use in establishing and augmenting populations. These plans also include numerous actions to help reduce the threats to roundtail chub.

On the Coconino National Forest, roundtail chub are considered present in the Little Colorado River drainage, East Clear Creek, and Verde River tributaries including Sycamore Creek, Oak Creek, Spring Creek, Red Tank Draw, Walker Creek, Beaver Creek, Wet Beaver Creek, West Clear Creek, Willow Valley Creek, the lower Verde River, and Fossil Creek. They were historically present in the upper Verde River in Grindstone Wash River, Dry Beaver, and Cherry Creek. There are approximately 370 miles of potential roundtail chub habitat within the Coconino Forest boundary.

Habitat Requirements

Roundtail chub are found in warm and cool water rivers and streams (USDI FWS 2017b). They are often found in areas of the deepest pools and eddies of mid-sized to larger streams, and often utilize cover (boulders, undercut banks, and vegetation) (Minckley and Marsh 2009). In Fossil Creek they can be found in all aquatic habitat types(Rinker and Rogers 2018).

Desired Condition

The desired condition for roundtail chub is that the species remains well established throughout Fossil Creek from Fossil Springs downstream to the permanent fish barrier. The population is resistant to natural events such as flooding, and anthropogenic impacts such as non-native fish introductions will be quickly identified controlled so that populations remain system-wide.

Existing Condition

Chub are a common fish species in Fossil Creek, found throughout the system in nearly all habitat types. AGFD snorkel surveys in 2017 detected roundtail chub in nearly 80% of surveyed pools (Rinker and Rogers 2017).

Threats

Threats to roundtail chub are most recently fully examined in an AGFD status assessment (Jones et al. 2014) and an USFWS Species Status Assessment Report (USDI FWS 2015) and are incorporated by reference into this specialist report. While threats include land management practices and alteration of natural hydrographs, predation and competition with nonnative aquatic species along with dewatering of habitat are the most significant threats to roundtail chub in the lower Colorado River Basin (USDI FWS 2015). Threats to roundtail chub will likely be exacerbated by changes to climatic patterns in the southwestern U.S. due to increasing drought and reduction of surface waters if the predicted patterns are realized (USDI FWS 2015). In Fossil Creek, the roundtail chub population is primarily threatened by non-native fish and habitat alteration from land management activities that affect aquatic systems.

Gila topminnow

Distribution and Status

Gila topminnow is a small viviparous fish that historically inhabited springs, cienegas, and slow moving side channel habitats of the Gila River. The natural history and distribution of the Gila topminnow is covered in detail in the 1984 Recovery Plan (USDI FWS 1984) and the draft revised Gila topminnow Recovery Plan (Weedman 1996). That information is incorporated by reference into this specialist report.

On the Coconino National Forest, the middle Santa Cruz lineage Gila Topminnow was stocked into Fossil Creek, Spring Creek and Sheepshead Canyon in Yavapai County (Robinson and Mosher 2018). Arizona Game and Fish have also surveyed Walker Creek in Coconino National Forest and have proposed this area as a potential suitable location for Gila topminnow.

Gila topminnow were stocked into Fossil Creek six times from 2007 to 2011. This reintroduction appears to have been successful based on AGFD monitoring. Gila Topminnow have expanded their distribution in the creek, and over half of the individuals captured were <20 mm TL, indicating they had reproduced (Robinson and Mosher 2018).

Habitat Requirements

Topminnow are found in headwater springs and vegetated margins of intermittent and perennial streams and rivers (AGFD 2001). In Fossil Creek they are found along stream edges and in still, vegetated margins and backwaters.

Desired Condition

The desired condition for Gila topminnow is that the species remains present in Fossil Creek. The population is resistant to natural events such as flooding, and anthropogenic impacts such as non-native fish introductions will be quickly identified controlled.

Existing Condition

Gila topminnow populations declined following winter 2016-2017 floods with only two fish detected between Irving Falls and the fish barrier (Rinker and Rogers 2017). Though still present in Fossil Creek, their ability to establish in this lotic system is in question.

Threats

The reasons for decline of Gila topminnow includes dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing nonnative fishes (USDI FWS 2008, Weedman 1999). In Fossil Creek, the Gila topminnow population is primarily threatened by natural flooding. Anthropogenic threats include non-native fish, and habitat alteration from land management activities that affect aquatic systems (i.e. bank destabilization, sedimentation).

Loach Minnow, Including Designated Critical Habitat

Distribution and Status

Loach minnow are small cyprinids that specialize in riffle habitats and are restricted to the Gila River and its tributaries. The natural history and distribution of the loach minnow is covered in detail in the recovery plan (USDI FWS 1991a) and reclassification to endangered with revised critical habitat (USDI FWS 2012). This information is incorporated by reference into this EIS.

A detailed status of the loach minnow is found in the final rule uplisting to endangered (USDI FWS 2012) and is incorporated in this specialist report by reference. Loach minnow repatriations into Fossil Creek are deemed to have failed (Robinson and Mosher 2018).

Habitat Requirements

Loach minnow are found in shallow, turbulent, swift-flowing riffles over gravel and cobble substrate. Male loach minnow excavate nests under cobbles in early spring, so unembedded cobble substrate is a critical habitat feature for spawning. The travertine nature of Fossil Creek may make unembedded cobble a rare habitat feature.

Desired Condition

Loach minnow have been stocked into upper Fossil Creek where unembedded cobble occurs and habitat was thought suitable. These stockings have not appeared to have resulted in a sustainable population and stocking ceased in 2013 (Robinson and Mosher 2018). The desired condition for loach minnow is that habitat monitoring continues so that stockings may be attempted again if suitable habitat can be found.

Existing Condition

Loach minnow stockings ceased in 2013. Though difficult to detect, loach minnow are not thought to persist in Fossil Creek (Robinson and Mosher 2018).

Threats

Dewatering of stream reaches, impoundment, livestock grazing, habitat alteration, and introduced nonnative fish have been the greatest threats to loach minnow populations (AGFD 2012; USDI FWS 2012). If suitable loach minnow habitat were found in Fossil Creek, the loach minnow population would primarily threatened by non-native fish, and habitat alteration from land management activities that affect aquatic systems (i.e. bank destabilization, sedimentation).

Critical Habitat

Revised critical habitat for the loach minnow was finalized with the change in status from threatened to endangered (USDI FWS 2012). In total, about 610 miles are designated as critical habitat in the Gila River Basin of Arizona and New Mexico. Eight individual critical habitat units are designated and include the Verde River Subbasin, Salt River Subbasin, San Pedro Subbasin, Bonita Creek Subbasin, Eagle Creek Subbasin, San Francisco River Subbasin, Blue River Subbasin, and Gila River Subbasin.

Critical habitat on the Coconino includes the Verde River from Grindstone Wash downstream to the confluence with Fossil Creek, and the lower portions of Oak Creek, Beaver/Wet Beaver Creeks, and Fossil Creek. Verde River Subbasin, Yavapai County, Arizona.

i. Verde River for approximately 118.5 km (73.6 mi), extending from the confluence with Beaver and Wet Beaver Creek. This mileage does not include the 1.2 km (0.8 mi) belonging to the Yavapai-Apache Nation, which is excluded from this designation.

ii. Granite Creek for approximately 3.2 km (2.0 mi), extending from the confluence with the Verde River.

iii. Oak Creek for approximately 54.3 km (33.7 mi), extending from the confluence with the Verde River.

iv. Beaver Creek and Wet Beaver Creek for approximately 33.3 km (20.7 mi), extending from the confluence with the Verde River. This mileage does not include the 0.2 km (0.1 mi) belonging to the Yavapai-Apache Nation, which is excluded from this designation.

v. Fossil Creek for approximately 22.2 km (13.8 mi) from its confluence with the Verde River upstream to the old Fossil Diversion Dam site.

The primary constituent elements of critical habitat for loach minnow are listed in table 3-66.

Table 3-66. Loach minnow critical habitat – primary constituent elements (from USDI FWS 2012)

PCE #	Primary Constituent Elements
PCE-1	Habitat to support all egg, larval, juvenile, and adult loach minnow. This habitat includes perennial flows with a stream depth of generally less than 3.3 feet, and with slow to swift flow velocities between 0 and 80 cm per second (0.0 and 31.5 inches per second). Appropriate microhabitat types include pools, runs, riffles, and rapids over sand, gravel, cobble, and rubble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitats have a low stream gradient of less than 2.5 percent, are at elevations below 8,202 feet. Water temperatures should be in the general range of 46.4 to 77 degrees Fahrenheit
PCE-2	An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
PCE-3	Streams with no or no more than low levels of pollutants
PCE-4	Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted
PCE-5	No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace

PCE #	Primary Constituent Elements
PCE-6	Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments

Spikedace, Including Designated Critical Habitat

Distribution and Status

Spikedace are small cyprinids native to the Gila River and its larger tributaries. The natural history and distribution for spikedace is fully described in the current Spikedace Recovery Plan (USDI FWS 1991b) and Reclassification to Endangered with revised critical habitat (USDI FWS 2012). This information is incorporated by reference into this BA.

Currently only a few viable populations of spikedace exist within Aravaipa Creek, the Blue River, and the Gila River in the Cliff/Gila area and the Gila River near the Gila Cliff Dwellings. Other populations have been introduced, but it is too early to determine if the populations will become established. A detailed status of spikedace is found in the Final Rule uplisting to endangered (USDI FWS 2012) and is incorporated in this specialist report by reference. The status of spikedace is declining range wide.

There are two recently introduced populations on the Coconino National Forest in Spring Creek and Fossil Creek. The long-term viability of these populations has not yet been confirmed though reproduction has been noted in Fossil Creek (Robinson and Mosher 2018). Recent survey data suggest spikedace populations were displaced by flooding and the viability of spikedace in Fossil Creek is uncertain (Rinker and Rogers 2017).

Habitat Requirements

Spikedace are found in moderate to large streams and utilize mid-water habitat of flowing runs and pools that are typically less than 1m deep. Shear zones and the downstream edges of riffles are also preferred habitat.

Desired Condition

The desired condition for spikedace is that the species expands its distribution in Fossil Creek and becomes established. The population is resistant to natural events such as flooding, and anthropogenic impacts such as non-native fish introductions will be quickly identified and controlled so that populations remain system-wide.

Existing Condition

Spikedace were uncommon in the Fossil Creek through 2016 (Robinson and Mosher 2018, Rinker and Rogers 2018), but the population appears to have declined sharply following winter 2016-2017 floods with only one fish detected between the permanent barrier and Irving falls (Rinker and Rogers 2018). They are considered present for this analysis, but their long-term viability in Fossil Creek is in question.

Threats

During the last century, both the distribution and abundance of spikedace have been greatly reduced throughout the species' range. Competition and predation by nonnative fish and habitat destruction have reduced the historic range of spikedace by about 85 percent (USDI FWS 2012). Threats to the species include stream flow depletion, diversion, habitat alteration and competition with nonnative crayfishes, and predation by and competition with nonnative fishes. Management activities that contribute to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, stream diversion, and poorly managed livestock grazing. Anthropogenic threats to spikedace in Fossil Creek include possible reinvasion by non-native fish and habitat alteration from land management activities that affect aquatic systems (i.e. bank destabilization, sedimentation).

Critical Habitat

Revised critical habitat for spikedace was finalized with the change in status from threatened to endangered (USDI FWS 2012). All critical habitat on the Coconino National Forest is in the Verde River subbasin.

i. Verde River for approximately 170.6 km (105.9 mi), extending from the confluence with Fossil Creek upstream to Sullivan Dam. This mileage does not include the 1.2 km (0.8 mi) belonging to the Yavapai-Apache Nation, which is excluded from this designation.

ii. Granite Creek for approximately 3.2 km (2.0 mi), extending from the confluence with the Verde River in Township 17 North, Range 2 West, northeast quarter section 14 upstream to a spring in Township 17 North, Range 2 West, southwest quarter of the southwest quarter of section 13.

iii. Oak Creek for approximately 54.3 km (33.7 mi), extending from the confluence with the Verde River to the confluence with an unnamed tributary from the south in Township 17 North, Range 5 East, southeast quarter of the northeast quarter of section 24.

iv. Beaver Creek/Wet Beaver Creek for approximately 33.3 km (20.7 mi), extending from the confluence with the Verde River to the confluence with Casner Canyon. This mileage does not include the 0.2 km (0.1 mi) belonging to the Yavapai-Apache Nation and excluded from these designations.

v. West Clear Creek for approximately 10.9 km (6.8. mi), extending from the confluence with the Verde River upstream to the confluence with Black Mountain Canyon.

vi. Fossil Creek for approximately 22.2 km (13.8 mi) from its confluence with the Verde River upstream to the old Fossil Diversion Dam site.

The primary constituent elements of critical habitat for spikedace are listed in table 3-67. The lateral extent of critical habitat for all designations is 300 feet on either side of bankfull stage.

Table 3-67. Spikedace critical habitat – primary constituent elements (from USDI FWS 2012)

PCE #	Primary Constituent Elements
PCE-1	Habitat to support all egg, larval, juvenile, and adult spikedace. This habitat includes perennial flows with a stream depth generally less than 3.3 feet and with slow to swift flow velocities of between 1.9 and 31.5 inches per second. Appropriate stream microhabitat types include glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitat will have a low gradient of less than approximately 1.0 percent, at elevations below 6,890 feet. Water temperatures should be in the general range of 46.4 to 82.4 degrees Fahrenheit.
PCE-2	An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
PCE-3	Streams with no or no more than low levels of pollutants
PCE-4	Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted
PCE-5	No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace
PCE-6	Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments

Aquatic macroinvertebrates

Fossil Creek supports a diverse macroinvertebrate community, with several rare or sensitive species (Adams 2012, Marks et al. 2005, Dinger and Marks 2007, Stevens and Ledbetter 2014). This diversity contributes to the aquatic resources that form Fossil Creek's Biological ORV. Furthermore, macroinvertebrates are a critical link in the food web with their role of transferring energy from primary producers to higher level predators (Marks et al. 2010, Gibson et al. 2018). Macroinvertebrates are a primary food source for aquatic vertebrates (icthyofauna and herpetofauna) and alterations to the food web at the lower levels will have repercussions to these higher-level consumers.

As a group, aquatic macroinvertebrates are often sensitive to environmental disturbance and are thus one of numerous parameters identified as a valid indicator of water quality and normative function for stream ecosystems (ADEQ 2015). Aquatic macroinvertebrates are considered an ecological indicator of water quality and monitored under guidance provided by the Arizona Department of Environmental Quality (ADEQ 2015). Integrated 305(b) Assessment and 303(d) Listing reports (Sutter et al. 2015) with monitoring conducted at various stream segments across the forest . The ADEQ 305(b) report includes such elements as water quality condition, water pollutants, and designated uses. The information provided in the report is based on accepted numeric and narrative standards, and assessment criteria. As part of a biocriteria evaluation, ADEQ uses a macroinvertebrate-based bioassessment to evaluate the health of aquatic communities. The bioassessments are generally used as supporting evidence of impairment or good water quality, in conjunction with physical data and information for other constituents (i.e. nutrients, fecal coliform, *E. coli*). The Coconino National Forest has collected macroinvertebrate data from several sources in the past, including USFS collections (USDA 2018b). These data, when collected consistently, can be used to monitoring watershed status and trend (ADEQ 2015).

From 2010 to 2011 NAU researchers surveyed macroinvertebrates in Fossil Creek following the Arizona warm water Index of Biological Integrity methods to compare invertebrate diversity in the upper, middle, and lower reaches of Fossil Creek (Adams 2012). They surveyed five sites from above the dam to below the permanent fish barrier. The most dominate taxa with the greatest abundance were the dipterans of the Chironomidae and Ceratopogonidae families, specifically at the Below Dam, Purple Mountain, and the Below Barrier sites (the latter two sites are the furthest downstream sampled sites). Increasing sediment changes the benthic habitat in favor of chironomids, Oligochaetes, and other sediment dwellers over mayflies, stoneflies, and caddisflies (EPT taxa) that prefer substrate with greater particle sizes and larger interstitial spaces (Rabeni and Minshall 1997, McClelland and Brusven 1980, Berkman and Rabeni 1987, Waters 1995, Zweig and Rabeni 2001).

Adams (2012) found the site that had the greatest mean insect abundance and richness, Above Dam, (the furthest upstream site), was also the site with the greatest Index of Biological Integrity value (70.8). The two next downstream sites, Below Dam and Above Irving had similar but slightly decreased Index of Biological Integrity values compared to the Above Dam site at 59.4 and 63.2, respectively. The Purple Mountain site, which is located downstream of the Above Irving site in the Middle Reach of the Creek, had the lowest IBI score of 43.1. While the other four sites are considered to be in the attaining assessment range according to the Arizona IBI method, this is the only site that had a score in the inconclusive range. The Arizona IBI classifies any score between 40 and 49 as being inconclusive while a score below 39 is considered to be impaired (ADEQ 2015).

Notable rare macroinvertebrates that have been confirmed in Fossil Creek include the caddisflies *Polycentropus arizonensis*, *Hydropsyche venada*, *Wormaldia arizonensis*, *Metrichia nigritta*, and *Mayatrichia acuna* (Adams 2012, NAU 2005, Dinger 2006, Stevens and Ledbetter 2014). All of these species are relatively rare in Arizona, occurring in between 2.2-17.2% of Arizona streams with limited distributions across the US southwest (Blinn and Ruiter 2006). Threats to these species include general impacts to aquatic habitat (such as water quality or increased embeddedness, Blinn and Ruiter 2006) as well as limited distributions that are more susceptible to disturbance from floods or land management impacts that affect riparian vegetation and water quality. Due to the similarity of environmental needs and threats, these species will be considered as a group for this analysis.

Environmental Consequences for Aquatic Species and Habitat

The Fossil Creek Comprehensive River Management Plan is intended to regulate anthropogenic impacts, both positive and negative, to the stream within the Wild and Scenic River corridor. Many direct and indirect effects will be present in each alternative, but environmental impacts from each effect will vary by alternative depending on the intensity of the effect. For example, recreation will be present in all alternatives; the environmental impact of recreation, however, will differ according to the number of people and types of recreation allowed in each alternative.

Effects Common to All Alternatives

All action alternatives have both programmatic and site-specific components. This section summarizes effects of actions that are identical in all alternatives, including programmatic actions and site specific actions that are present in all alternatives.

Programmatic Actions

Implementation of the CRMP under the action alternatives, including Management Direction, Monitoring, Adaptive Management, and Education, Interpretation, and Research, Refugia, and Mineral and Water rights (General Management, Table 2-1 in Chapter 2 of the EIS) will have an overall positive effect on aquatic species and their habitat compared to the no action alternative. Aquatic resource-specific desired conditions outlined in the CRMP strive towards providing and protecting diverse aquatic habitat, improving the status of special status species and contributing to recovery of these species through protection of their habitats, providing abundant and accessible refugia where species are largely un-impacted from recreation activities, and educating visitors about the consequences of introducing and/or spreading non-native species (fish, plants, crayfish, mussels, and diseases). Aquatic resource-specific standards outlined in the CRMP indicate actions shall be taken by AGFD or USDI FWS should non-native fish be found above the fish barrier, and indicate protective measures needed to prevent the unintentional introduction and spread of terrestrial or aquatic pathogens or invasive plants and animals. Aquatic resource guidelines ensure the permanent fish barrier is inspected by an engineer from BOR at least annually or following a significant flood event and is functioning properly. An objective of obtaining baseline inventory for aquatic invertebrates (via a minimum of three surveys yielding an IBI or similar measure) will give an indication of site-specific diversity and abundance and will help determine if site-specific IBI can be utilized to monitor aquatic macroinvertebrates and whether a new reference measure is required for Fossil Creek. Management approaches mainly involve close coordination with other agencies and species specialists but also allows for the construction of temporary fish barriers and calls for restoring impacted habitat outside of recreation sites. In summary, the guidance specific to aquatic resources will provide a long-term benefit to regionally important populations and special status species, as well as the unique and exceptionally high quality habitat. As a result, CRMP guidance will result in the protection and enhancement of the diversity of species as well and ensure diverse and contiguous aquatic habitat; all of which are criteria for the Biological ORV.

Table 3-68 presents a summary of the effects of programmatic guidance for other program areas on vegetation, wildlife and special status species. Although some Program Areas have different Management Direction components for each alternative (e.g. camping guidance is limited to alternatives that allow camping), this analysis summarizes all aspects of Management Direction regardless of alternative.

Table 3-68. Summary of program level effects of the CRMP on aquatic species and habitat

Program Area	Anticipated Effects to Riparian Species and Habitat
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, and rehabilitating denuded areas outside of recreation sites, all contribute to long term benefits to aquatic species and their habitat.
Riparian Function	Benefits to riparian obligate and aquatic species and their habitat from implementing management direction for proper function riparian areas, ensuring stream channel and banks are stable, and maintaining aquatic management zones.
Vegetation	Intact terrestrial vegetation will reduce erosion potential and decrease sediment input to the stream from roads and other land management activities, benefitting aquatic species and their habitat.
Soil Condition	Minimizing human-created bare areas particularly outside of recreation sites and within AMZ and implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation into Fossil Creek will result in long-term benefits to aquatic species and their habitat.
Geology	Protection of travertine dams, the unique structural and vegetative habitat they create, and the natural processes of accreation and destruction will protect aquatic species and habitat by ensuring the presence pools, particularly in the high-formation reach.
Wildlife, Fish and Aquatic Species	See this report and the Wildlife and Vegetation Specialist's Report
Traditional Cultural Practices	Limiting use of stream banks in Fossil Springs to day use will benefit riparian and aquatic wildlife species and their habitat.

Program Area	Anticipated Effects to Riparian Species and Habitat
Recreation	Impacts to species and their habitat will be reduced when appropriate infrastructure is in place, capacities are appropriately set to minimize or eliminate recreation use outside of recreation sites, entry is managed, developed camping is limited to outside the 100 year floodplain and AMZ, and dispersed camping is limited. In addition, there will be no: new trails across springs or paralleling Fossil Creek to connect recreation sites; no roadside parking; no motorized watercraft; no campfires; no glass containers, and no rope swings. Trails should be located on soils with low erosion hazard, outside of the AMZ, and away from areas with special-status species concerns. Recreation fees and partnerships will ensure resources to implement the CRMP, monitoring, and adaptive management. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience, which will typically mean their behavior supports protection of river values. Most visitors will recreate responsibly, and the majority of visitors will stay within the designated areas. As a result, the refugia in between recreation sites will be largely free of human disturbance including swimming and cliff jumping, and this will benefit riparian vegetation, riparian and aquatic species, and aquatic habitat. Appropriate design and BMPs will ensure that roads, trails, recreation sites and infrastructure will not contribute sediment or pollutants to the stream or otherwise degrade water quality. There will be some denuded areas through the uplands and along the creek banks as a result of recreational activities in recreation sites, but areas outside of recreation sites will remain free of significant human disturbance.
Recreation/Lands Special Uses	Vegetation under powerlines is kept mainly free of tree canopy and this may include riparian vegetation, reducing stream bank cover. Permit holders should provide an education component to their programs and filming should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values. While outfitter/guided activities have the potential to disturb to aquatic species and habitat, impacts will be less than unguided recreation because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities are likewise screened, tailored to reduce impacts to wildlife and habitat, and contribute data needed to make informed management changes.
Roads and Facilities	Proper construction maintenance of roads and facilities will include adequate drainage and will implement BMPs and design features to minimize impacts to aquatic habitat. Unauthorized roads will be decommissioned, obliterated or closed, with priority to roads that intersect stream courses or springs or those that result indirect delivery of sediment to Fossil creek. This will benefit aquatic species and their habitat. In addition, guidance calls for locating recreation infrastructure outside of areas with special status species concerns.
Scenery Resources	There are no negative effects from scenery guidance on aquatic species and habitat. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare ground areas outside of recreation sites, trails and roads will reduce erosion and benefit aquatic habitat.
Special Areas	Act-driven restrictions in special areas indirectly benefit aquatic species and their habitat through minimizing the use of motorized equipment and mechanized travel, thereby reducing sediment input, as well as maintaining free flow and protecting and enhancing river values.
Interpretation and Education	Interpretation and education will mainly result in indirect benefits to aquatic species and their habitat. In addition interpretation infrastructure and organized activities in the uplands will aid in reducing the amount of people recreating along the creek and in the water. I&E events in riparian habitat or in the stream, however, can result in short-term disturbance to aquatic species and impacts to their habitat as described above for recreation.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Site-specific actions

Site-specific actions *common to all action alternatives include*: a monitoring plan; adaptive management based on monitoring results; education, interpretation, and research; withdrawal of the recreation segment from locatable mineral entry; obtaining federally reserved water rights for streamflows; a permit system; access to Stehr Lake, Childs, and Deadman Mesa Road; site administration; number of parking spots and infrastructure at Mazatzal and Homestead West loop; infrastructure at east and west welcome stations; repair and extension of existing gabion; construction of a new vehicle bridge adjacent to existing Fossil Creek bridge; day use opportunities; access for dispersed backcountry camping; camping for administrative activities and special events; camping at Stehr Lake;

possibility of outfitter/guiding activities after a separate needs assessment and prospectus is completed; Mail trail (length and location), maintenance of roads (grading, new drainage improvements, vegetation maintenance and utility maintenance); road hazard mitigation activities (including rock scaling); facilities maintenance; restoration of closed roads, unauthorized roads and trails, and denuded areas (but amount differ by alternatives); armoring recreation sites and trails; and installation of barriers to delineate sites and installation of runoff retention basins, and other drainage features. Refer to Chapter 2 and Table 2-1 for alternative descriptions for details on these actions that are common to all action alternatives.

Chapter 2 of the EIS describes in detail the different actions occurring in each alternative. Table 2-1 (Chapter 2) summarizes the different actions found in each alternative, including open recreation sites, infrastructure, management differences, restoration actions, and capacities. Open recreation sites are summarized in Table 3-62 above, and overall differences between alternatives that are key to aquatic impacts are summarized in table 3-69 Protected stream length is the length of perennial stream above the fish barrier (53,272 ft), and percentages of stream length with recreation access are calculated from that total. The “Feet of stream per person” calculation identifies the distance in feet between visitors if every visitor is recreates along the stream within a designated recreation site. This value can also be interpreted as “one person per X feet.” The “Feet of stream per person” calculation for Alternative D includes only the people allowed by the number of parking spots for creek access locations rather than all possible PAOT. This is a total of 95 parking spots at the Homestead, Heinrich, Fossil Creek Bridge, and Irving sites for a maximum PAOT accessing the creek of 475.

Table 3-69. Corridor-wide lengths of Fossil Creek planned for impact from recreation

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Riparian Acres Disturbed (ac)	26.5	9.3	8.6	13.6	21.6	14.6
Number of Recreation Sites with Creek Access	10	10	7	4	10	10
Stream length with recreation access (ft)	7511	7511	4642	2826	8195	8021
Percentage of protected stream length with recreation access	14.1%	14.1%	8.7%	5.3%	15.4%	15.1%
People at one time (PAOT)	740	560	660	905 total 645 at rec sites	1350	2500
Planned maximum visitor density within recreation sites	10.15	13.41	7.03	4.38	6.07	3.21

General Effects to Aquatic Habitat and Species

In order to avoid redundancy in the species-by-species analysis of effects below, the on-the-ground effects of proposed activities on aquatic species and their habitat are summarized here. Additional, species-specific effects analysis, when data is available, is included in the species-by-species analysis below.

Sedimentation

Erosion and sediment transport are important features of streams and aquatic habitat. Channels are formed by the scouring of their bed and banks and by the transport of sediment through the channel. Natural sediment deposition creates key features of aquatic habitats such as substrate for macroinvertebrates and fish spawning habitat for fish.

The Soils specialist report (EIS Chapter 3) indicates that erosion and sedimentation into Fossil Creek from background Cumulative Effects (including of natural sedimentation from steep, inherently unstable slopes, active landslides, drainages that deliver sediment, loose talus unstable slopes, and debris slides) far exceed predicted sediment delivery from any of the Action alternatives, but this fact can be misleading from an Aquatic Resources standpoint due to the different timing of sediment delivery from natural events compared to sediment delivery from recreational impacts.

However, sedimentation can have adverse effects on Aquatic Resources. Sediment adversely impacts stream fishes directly through changing fish behavior, altering fish physiology, impairing growth, shifting blood chemistry, inducing gill trauma, reducing disease resistance, increasing egg mortality, and direct mortality of juveniles and adults if concentrated enough (Anderson 1996, Argent and Flebbe 1999, Bisson and Bilby 1982). Sediment indirectly affects fish through behavior modifications including increased frequency of the cough reflex, avoidance of suspended sediment, reduction in feeding, and temporary disruption of territoriality. The severity of changes in fish behavior is associated with the timing of disturbance, the level of stress, and the importance of the habitat that the fish may be excluded from (Anderson 1996, Bisson and Bilby 1982, Rice et al. 2001). Other indirect effects on stream fishes from sediment can occur by modifications to stream habitat. These changes include altered channel morphology, loss of spawning habitat, loss of rearing habitat, changes in the food supply (macroinvertebrate assemblage), and decreased over-wintering habitat (Lisle 1989, Miller and Benda 2000, Wood and Armitage 1997).

When land management activities alter the natural levels in a watershed, deleterious effects to the habitat and biota can occur. Roads and trails contribute to the deterioration of soil stability and porosity and increase erosion and compaction. Increased soil disturbance (Rotert 2013) is directly associated with loss of riparian habitat in the Aquatic Management Zone. This results in reduced riparian capacity to filter sediments, reduce intensity of floodwaters, contribute material to the food web, and provide stream shading and cooling. These factors can lead to increased sedimentation into streams and changes in the hydroperiod. Loss of riparian habitat also results in reduced habitat available for riparian species such as aquatic and terrestrial macroinvertebrates, which constitute the primary food source for fish in Fossil Creek.

Sedimentation from recreation activities can have both short and long-term impacts to aquatic resources. Ongoing impacts from recreation sedimentation may be continuous as swimmers and hikers in the stream suspend and redistribute sediment, increasing turbidity and potentially increasing embeddedness in locations that natural sediment deposition would not occur. This source of sedimentation therefore should be viewed differently than overall watershed sedimentation. Most of the predicted sediment load to Fossil Creek occurs in a short timeframe, when sediment is delivered to stream courses from large rainfall and/or rain-on-snow events. Water levels are higher during these events, and thus deposit fine sediments in the adjacent floodplain, rather than in streamcourse channels (Miller and Benda 2000). Floods result in movement of sediment and bedload downstream, while rejuvenating main channel substrates, clearing them of fines. The continuous input of sediment to streamcourses from recreation activities in the Aquatic Management Zone has the potential to clog stream substrates with fine sediments.

Reductions in soil productivity can limit the vegetation potential resulting in decreased precipitation that is taken up by plants. Increased soil compaction decreases the amount of water infiltration into the soil. Both of these factors compound to lead to higher surface runoff and higher flood pulses in stream channels (Belsky et al. 1999). The erosive energy of floods can cause stream channel downcutting or incision causing water to drain from floodplains into the channel resulting in lower ground water tables (Belsky et al. 1999). This results in a narrowing or loss of riparian vegetation because it is left in drier soils. Additionally, with less water entering upslope and riparian soils, less water is available to provide late season flows. Therefore, the higher flows during precipitation events are often followed by low or no flow during the drier weather periods (Belsky et al. 1999, Fleischner 1994).

Because sedimentation depends in part on bare area and sedimentation effects may depend on the number of people recreating in the water, sedimentation rates are expected to increase with the number of visitors in Fossil Creek. Thus this is one factor that is expected to vary between alternatives.

Riparian Function and Bare Area

Lower water tables that reduce or eliminate riparian vegetation affect macroinvertebrate communities. Streamside vegetation provides both allochthonous (produced outside stream system) and autochthonous (produced within stream ecosystem) food sources for macroinvertebrates and the quantity and quality of these inputs plays a critical role in regulating the macroinvertebrate assemblage that is present in the system (Gregory et al. 1991, Gibson et al. 2018). In turn, macroinvertebrates are a primary food source for aquatic vertebrates (icthyofauna and herpetofauna) and alterations to the food web at the lower levels will have repercussions to these higher-level consumers. The terrestrial vegetation has been documented as the foundational energy source in Fossil Creek (O'Neill et al. 2012, Gibson et al. 2018). Additionally, riparian plant communities with rooted plants retard streambank erosion, filter sediments out of the water, build and stabilize streambanks and streambeds, and provide shade and nutrients for aquatic species. Healthy riparian areas act as sponges during high water periods and raise water tables, maintaining streamwater during dry seasons, resulting in more flow throughout the year (Belsky et al. 1999).

The loss of riparian vegetation therefore can result in a negative feedback loop where conditions continue to break down until active management is needed to repair or retard degraded areas. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff (Rabeni and Smale 1995). The Fossil Creek Bare Ground Inventory (Rotert 2013) documents damage and destruction of riparian areas in the Fossil Creek WSR Corridor, as a result of heavy recreational use. Rotert (2013) documented a 61% increase in riparian bare area due solely to camp sites between 2005 and 2009. As of 2013, trails (both designated and social) account for the largest total area of bare ground. As evidenced in prior data from Fossil Creek (Rotert 2013), the presence of social trails increases as the number of visitors increases. These highlights of past and potential impacts to riparian areas are presented here so they can be considered for potential impacts to aquatic resources. Please see the Wildlife, Plants, and Vegetation Report (EIS Chapter 3) for a more extensive discussion. Soil compaction and erosion from recreational use are also documented in the Soil and Water analysis.

Water Flow and Water Quality

Aquatic resources clearly rely on water to exist. Marks et al. (2010) document a 3-fold increase in native fish populations in Fossil Creek when water flows were increased from approximately 3 cubic feet of water per second (CFS) to 43 CFS during the 2004 restoration. All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative.

Aquatic species also rely on high water quality, which includes natural sediment loads and low pollution levels. Vehicle use on roads and at recreation sites may contribute to surface-derived pollutants (oils, fuels, radiator fluids) that can enter streams and adversely affect macroinvertebrates, amphibians, and aquatic reptiles as well as their habitat. Another common water quality concern is *Escherichia coli*, which can be pathogenic to humans and has been found in the mouths of narrow-headed gartersnakes from Oak Creek Canyon (Oak Creek exceeds *E. coli* standards every year). Bacterial infections, which may include *E. coli*, have caused mortality in stressed gartersnakes (Nowak 2006).

Finally, a variety of personal care products (PCPs) such as disinfectants, skin care products, fragrances, sunscreen agents, and pharmaceuticals are known or expected to impact water quality (Braush and Rand 2011), and recreation use can be correlated with high amounts of these chemicals (Mandaric et al. 2017). These can negatively impact aquatic species in a variety of ways, from endocrine disruption to mortality (DiNardo and Downs 2017), and effects can be seen at very low concentrations (Kim and Choi, 2014). The study of environmental impacts from these chemicals in freshwater systems is growing, and the bioaccumulation of some PCP chemicals has already been traced from zooplankton through fish and in bird eggs (Braush and Rand 2011, Gago-Ferrero et al. 2012, Molins-Delgado et al. 2017). Studies in salt-water systems have documented severe environmental impacts (i.e. Dinardo and Downs 2017) to the point that legislators in Hawaii recently banned the

use of certain sunscreens (Gabbard et al. 2018). The potential for environmental impacts of personal care products will increase with increasing anthropogenic use, so PAOT values will be used to predict the potential impact of personal care products on the aquatic environment and comparisons between alternatives.

Construction and infrastructure maintenance activities

Construction and infrastructure maintenance activities can affect fish by directly harming an individual through direct contact, such as a machine driving through a stream and crushing a fish hiding around rocks. This possibility is only likely to occur during construction of the two bridges: the replacement of the 708 bridge in all alternatives and the construction of the bridge to the Irving recreation area in alternatives D, and E. The effects of this can be minimized through implementation of standard BMPs (USDA 2012) and construction plans that do not allow vehicles or equipment in the water. One exception to this is for safety and rescue operations, where rescue vehicles may drive through the stream at the old ford to access the trail to the springs.

Non-native fish introduction

Non-native fish above the fish barrier remain the greatest threats to native fish in Fossil Creek. Sources of non-native fish entering the protected area include fish surmounting the barrier (via barrier failure or human assistance), fish entering the stream from stock tanks within the watershed, and fish introduced intentionally anywhere along the stream. For example, the distribution of smallmouth bass found in the creek in 2010 (hundreds of smaller bass above the fish barrier plus 9 large smallmouth bass at the Homestead recreation site) suggests that both barrier failure (confirmed, flood-deposited boulders altered water flow) and human introductions (unconfirmed) have already occurred in Fossil Creek. Barrier security will not change between alternatives, but the potential for non-native fish introductions increases with increasing recreation (Leung and Marion 2000). Thus, visitor capacity is used to compare the potential for non-native fish introductions between alternatives.

Recreation

In addition to impacts to aquatic habitat, recreation may affect aquatic species directly. Recreation effects may include fishing injuries (Bartholomew and Bohnsack 2005), trampling (Roberts and White 1992; Shakarjian and Stanford 1999; Muller et al. 2003; Smith 2009; Caires et al. 2010), and trash and pollution (Rochman et al. 2013; Hoellein et al. 2014; Kim and Choi, 2014; DiNardo and Downs 2017). All alternatives allow for visitors to access the creek and interact with aquatic habitat and organisms. However, there is very little published data identifying impacts of recreational swimming and similar human behaviors on aquatic systems, particularly in fresh water systems. For example, stress is known to have detrimental physiological impacts that ultimately reduce fitness mortality (Barton and Iwama 1991, Barton et al. 1986, Pearson et al 1992, Skalski et al. 1992, Engas et al. 1996). It is also known that fish are stressed by events such as repeated sounds (Schreck 2000; Smith et al. 2004), which may occur during recreation activities.

Prior data in Fossil Creek may shed light on possible recreation impacts. There are four studies we are aware of that monitor fish populations during the high recreation period prior the current permit system (2008-2010). Northern Arizona University conducted snorkel surveys from 2003-2011; data through 2007 is summarized in Marks et al. 2010, while data from 2008-2011 has not been published. AGFD's Native Fish Program repatriation and monitoring program used minnow traps and seining from 2008-2015 to specifically target repatriated small-bodied fish (Robinson and Mosher 2018), but variation in their methods make their data less usable for common fish species. Marsh and Associates used hoop nets and minnow traps from 2006-2010 (Marsh et al. 2010). AGFD's Region 2 used hoop nets (2009-present) and snorkel surveys (2013-present), these data are summarized in Rinker and Rogers 2018. All of the three pertinent studies indicate that chub, desert sucker, and Sonora sucker catch per unit effort (CPUE) increased in 2008 and 2010 (presumably in response to flooding) and none showed a consistent decline in CPUE during the high use period.

Recreation sites are expected to have a degree of negative impacts from recreation (i.e. bank denuding, bare area creation, riparian function, turbidity increases, and sediment redistribution), but effects to the aquatic environment should be localized within the recreation sites and a short distance downstream. Sediment modeling suggests that

the entire area of each recreation polygon could be completely denuded and there would be only a small increase in total sediment delivered to the stream (see Hydrology specialist's Report). These local effects are not expected to negatively impact aquatic species or aquatic habitat at large. The critical unknown aspect of recreation is the likelihood of impacts extending beyond recreation sites. Visitors experiencing crowding are known to leave crowded situations and seek other recreation areas (Hall and Shelby 2000; Manning and Valliere 2001). In Fossil Creek, this will likely mean leaving a crowded recreation site for a less crowded nearby pool, which may create social trails, new bare area, soil compaction, and other negative impacts.

To facilitate comparison between alternatives of potential recreation impacts and the likelihood of negative impacts to refugia, we calculate a planned visitor density. First we divide the total feet of stream within recreation sites by the maximum allowable people at one time (PAOT). This yields an average density of people recreating in the water or at the creek's edge measured as feet per person (table 3-69). Simply stated, this value is the corridor-wide average number of feet between visitors if every person were recreating at the stream within the recreation sites at one time. To identify where recreation intensity will be greatest, a second calculation of visitor density identifies planned differences in visitor density throughout the creek by reaches. First, the stream is divided into eight hydrologically defined reaches (see the Hydrology specialist's report for details). Then the number of feet within recreation sites in each reach was determined. The number of parking lots serving each reach determines the number of visitors who will recreate in that reach. Table 3-70 p presents the reach end points, the length of each reach, the length of recreation sites within each reach by alternative, and the visitor density within those recreation sites. See the Hydrology specialist's report for further details of how reaches were calculated.

There are some clear issues with the actual numbers in people/foot produced by these calculations. First, the value does not actually represent how people will recreate in Fossil Creek. Some people will be on trails, others at the stream's edge, so there will never be a point when actual recreation density would equal these numbers. Second, the average recreation values assumes even distribution of people at recreation sites, which is not expected to be the case because trail count evidence suggests that many visitors who park at several sites are actually using the waterfall recreation site. That means that some sites will be at lower density than this estimate and others may be at a higher density. Thus, because these values don't especially represent real-world recreation, these actual numbers are not relevant in an ecological or threshold sense. However, because all assumptions and issues will be the same between alternatives, these values are useful in comparing the potential for impacts between alternatives. For example, visitors using recreation sites in Alternative F are estimated at a density of just over 3 feet/person (3 feet between visitors), whereas visitors in the same area in Alternative B are nearly 12 feet/person. Based on the relative crowding of people in each alternative, it is reasonable to predict that in order to escape the high density of recreation some visitors in Alternative F will be more likely to move away from the dispersed recreation site than in Alternative B (Hall and Shelby 2000; Manning and Valliere 2001).

Table 3-70. Lengths of recreations sections by reach, with percentage of recreation stream length and the feet of length between visitors at maximum capacity of each recreation site. See text for calculation methods.

Stream Reach (from Upstream to Downstream)	Total Reach Length (ft)	Alternative A			Alternative B			Alternative C		
		Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person
Upper FC Spring to Historic Dam	2055.1	1785.7	86.9%	14.3	1785.7	86.9%	26.2	0.0	0.0%	Closed
Historic Dam to Waterfall	12156.4	580.0	4.8%	14.3	580.0	4.8%	26.2	6.2	0.1%	Closed
Waterfall to Flume Trail Crossing of Fossil Creek	6573.2	2042.8	31.1%	19.5	2042.8	31.1%	81.7	2042.8	31.1%	14.1
Flume Trail Crossing of Fossil Creek to FC Bridge	6800.6	893.9	13.1%	4.0	893.9	13.1%	9.7	893.9	13.1%	14.1

Stream Reach (from Upstream to Downstream)	Total Reach Length (ft)	Alternative A			Alternative B			Alternative C		
		Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person
Bridge to Sally May Wash	10241.2	1317.9	12.9%	6.3	1317.9	12.9%	5.9	1047.8	10.2%	5.2
Sally May Wash to Unnamed Right Bank Tributary	9112.9	891.0	9.8%	17.8	891.0	9.8%	17.8	651.5	7.1%	32.6
Unnamed Right Bank Tributary to Hardscrabble	23065.3	None	0.0%	NA	None	0.0%	NA	None	0.0%	NA
Hardscrabble Creek to Verde River	6734.3	None	0.0%	NA	None	0.0%	NA	None	0.0%	NA

		Alternative D			Alternative E			Alternative F		
		Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person	Rec. Length	Percent of reach	Feet/ person
Upper FC Spring to Historic Dam	2055.1	0.0	0.0%	Closed	1785.7	86.9%	12.99	1785.7	86.9%	3.0
Historic Dam to Waterfall	12156.4	0.0	0.0%	Closed	754.2	6.2%	12.99	580.0	4.8%	3.0
Waterfall to Flume Trail Crossing of Fossil Creek	6573.2	509.7	7.8%	3.2	2552.5	38.8%	9.92	2552.5	38.8%	3.0
Flume Trail Crossing of Fossil Creek to FC Bridge	6800.6	616.5	9.1%	4.3	893.9	13.1%	4.08	893.9	13.1%	3.0
Bridge to Sally May Wash	10241.2	1047.8	10.2%	8.4	1317.9	12.9%	5.27	1317.9	12.9%	3.1
Sally May Wash to Unnamed Right Bank Tributary	9112.9	651.5	7.1%	32.6	891.0	9.8%	17.82	891.0	9.8%	17.8
Unnamed Right Bank Tributary to Hardscrabble	23065.3	None	0.0%	NA	None	0.0%	NA	None	0.0%	NA
Hardscrabble Creek to Verde River	6734.3	None	0.0%	NA	None	0.0%	NA	None	0.0%	NA

Beneficial Effects

Many of the measures common to all action alternatives will have a positive effect in moving aquatic resources towards the desired future conditions. In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: denuded areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors. Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that harden sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

Effects Unique to Each Action Alternative

In order to avoid redundancy in the species-by-species analysis of effects below, on-the-ground effects of proposed activities on aquatic species and their habitat are summarized here. General effects of factors described in this section are discussed in the section above. Additional, species-specific effects analysis, when data is available, is included in the species-by-species analysis below.

The main differences between alternatives relate to land management activities for recreation and its potential impacts. The primary differences between alternatives for recreation are new construction and infrastructure, the number and location of recreation sites, and the number of visitor allowed at the creek daily (People At One Time, PAOT). Thus, disturbed area and potential sediment input, riparian function, and water quality are key traits that differ by alternative.

Alternative B Direct and Indirect Effects

Disturbed Area

The total disturbed acres (open roads and trails, unauthorized roads and trails, denuded area, developed recreation footprint, and admin sites) is 94 acres; of which, 9.3 acres occur in riparian and 84.7 acres occurs in the uplands. The total length of stream in recreation sites is 7,511 ft, which is 14.1% of the protected stream length (table 3-70). Average visitor density is one person every 13.4 feet (table 3-70), and the visitor density in the reach from Irving to the waterfall is 81.7 feet per person, the lowest of all alternatives (table 3-70). Except for the No Action alternative, this alternative provides for the fewest total acres disturbed by recreation, and the second fewest riparian acres disturbed.

Water Flow and Water Quality

All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative. Along with Alternatives A, E and F, Alternative B has the highest length of stream that can be impacted by recreation. However, the corridor-wide capacity of 640 PAOT is lowest PAOT of all action alts and 170 PAOT less than current management, so water quality problems from recreation are not expected. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

New Construction

In alternative B, new construction would occur at Heinrich and could include a welcome center with 15 parking spaces, indoor/outdoor interpretive displays, short interpretive trail and/or canopy walk, toilet, trash receptacles, one-way loop road, host/administrative site with toilet. In addition, toilets may be installed at the end of the Lewis trail and in the Fossil Springs area providing an overall benefit to improved water quality.

While camping can increase the effects to soil and vegetation and potentially increase the amount sediment input into the stream designating camping in engineered sites, versus allowing dispersed camping, can reduce the amount of disturbance and sediment input. Allowing limiting dispersed camping in the Fossil Springs area can result in negative habitat impacts that can destabilize banks and increase sediment input into the stream.

Recreation

Along with Alternatives A, E, and F Alternative B has the highest length of stream and most dispersed recreation sites with creek access (10) that can be impacted by recreation. However, the corridor-wide capacity of 640 PAOT is lowest PAOT of all action alts and 170 PAOT less than current management. This results in the least potential for direct and indirect recreational impacts to aquatic species. Monitoring will ensure that the overall PAOT is the least likely to result in degradation of river values, including the aquatic resources portion of the Biological ORV.

This number of people at one time is comparable to existing recreation levels and is not anticipated to have detrimental effects to stream-wide distributed species. PAOT in this alternative is not expected to adversely affect

or degrade fish populations in a single year. Annual monitoring and analysis will be frequent enough to detect population declines in time for any necessary management changes to take effect the following year. The average visitor density in alternative B is the lowest of all alternatives (table 3-70), so impacts to refugia are expected to be less than other alternatives.

Beneficial Effects

Refer to the discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative include habitat restoration and a decrease in recreation. Road maintenance would occur to improve drainage and reduce sediment runoff.

Alternative C Direct and Indirect Effects

Disturbed Area

The total disturbed acres (open roads and trails, unauthorized roads and trails, denuded area, developed recreation footprint, and admin sites) is 97.2 acres, of which, 8.6 acres occurs in riparian and 88.6 acres occurs in the uplands. The total length of stream in recreation sites is 4,642 ft or 8.7% of the creek above the fish barrier (table 3-70). The average visitor density is one person per 7 feet of stream (table 3-70). Except for the No Action alternative, this alternative provides for the fewest acres disturbed and second-most area of trail rehabilitation.

Alternative C has the second shortest length of stream that can be impacted by recreation. In general, recreation activities will result in direct disturbance to aquatic species and aquatic habitat as described above. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

Water Flow and Water Quality

All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative. The corridor-wide capacity of 720 PAOT is the second-lowest PAOT of all action alternatives and 90 PAOT less than current management, so water quality problems from recreation are not expected. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (UWDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

New Construction

In alternative C, most new construction is more distant from the stream to permit walk-in access. Construction would occur at Heinrich as an administration and/or host site that is not open to the public. Cactus Flat will be developed with a welcome center and 47 parking spaces, plus 3 stock trailer spaces, indoor/outdoor interpretive displays, a toilet, trash receptacles, picnic tables, and bike racks. The Junction will have 5 parking spaces, temporary parking, a vault toilet, an interpretive kiosk, and a visitor contact station. The Lewis Trailhead will be walk-in only with no parking, and will have a vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail, and a toilet could be built at end of the trail. Toilets may be installed in the Fossil Springs area providing an overall benefit to improved water quality over the long-term.

Recreation

Alternative C has the second-fewest recreation sites (7) and second-lowest length of stream designated for impact by recreation (4,642 ft or 8.7% of total stream length above the fish barrier). The corridor-wide capacity of 720 PAOT is the second-lowest PAOT of all action alternatives and 90 PAOT less than current management. Because visitors are focused in fewer sites, the visitor density is 7 feet per person, which is the second lowest among action alternatives but greater than current conditions (table 3-70). Based on this person density, recreation impacts within recreation sites may be more intense than Alternatives A and B, and less than D, E and F. Even so, the smaller number of recreation sites results in a smaller impact to stream-wide distributed species. Given the visitor density, this alternative has the second-lowest likelihood of refugia being impacted due to displaced recreation.

Beneficial Effects

Refer to the discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 43.7 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures (covering areas with vegetation) to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 2.7 acres of unauthorized trails would be restored using above methods. 3.8 acres of unauthorized roads restored and system roads decommissioned. A total of 37.2 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 21.8 and uplands is 21.9. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 665.4 acres of riparian refugia could be realized.

A total of 86 existing parking spaces at recreation sites would be reduced. This is a reduction of 6 spots at Purple Mountain and 10 spots at Sally May with the closure and restoration of those two sites. Because there would be no motorized access beyond Homestead other parking spots to be closed include 10 spots at Fossil Creek bridge, 21 spots at Tonto Bench, and 18 spots at Irving, and 21 spots at Lewis Trailhead.

A 6.1 mile portion of FR 708 would remain closed to motor vehicles (but available for non-motorized travel and emergency vehicle use). Road maintenance would occur to improve drainage and reduce sediment runoff.

In alternative C there would be no access to the Fossil Springs, botanical area, and historic dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Even though Cactus Flat parking area is new construction, parking here and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback.

Alternative D Direct and Indirect Effects

Disturbed Area

The total disturbed acres (open roads and trails, unauthorized roads and trails, denuded area, developed recreation footprint, and admin sites) is 95.9 acres, of which, 13.6 acres occurs in riparian and 82.3 acres occurs in the uplands. The total length of stream in recreation sites is 2826 feet, or 5.3% of the stream above the fish barrier. Alternative D thus has the shortest length of stream designated for impact by recreation, but it also has the second highest visitor density (one visitor every 4.38 feet of stream) (table 3-70). In general, recreation activities will result in direct disturbance to aquatic species and aquatic habitat as described above. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

Water Flow and Water Quality

All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative. The corridor-wide capacity of 905 PAOT is the third-lowest PAOT of all action alternatives and 95 PAOT more than current management, so water quality problems from recreation are not expected. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

New Construction

In alternative D, new construction includes additional parking spaces at Irving with a new bridge over Fossil to access new shade ramadas and group use sites. There would also be a boardwalk on the south side of the creek and trail to wildlife blind at Irving. There would be a new one mile Rim Trail loop constructed in the vicinity of the existing Bear Trailhead. New construction at Heinrich includes a small welcome center with 10 parking spaces, short interpretive trail and/or canopy walk, toilet, trash receptacles, as well as host/administrative site with

toilet. A 4.1 mile section of 708 would be opened after major repairs (including rock scaling) are completed. Habitat at these sites is primarily upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Some habitat loss for upland species will occur. The board walk may occur in the riparian corridor, but there would be minimal impact over the long-term since its intent is to provide armored access.

Recreation

Alternative D has the fewest recreation sites with creek access (4) and lowest length of stream designated for impact by recreation (2826 feet, or 5.3% of stream length above the fish barrier). The corridor-wide capacity of 905 PAOT is the third-lowest PAOT of all action alternatives and 95 PAOT more than current management. However, site specific parking limits stream access to 95 parking spots at the Homestead, Heinrich, Fossil Creek Bridge, and Irving sites for a maximum PAOT accessing the creek of 475. Because visitors are focused in fewer sites, visitor density is one person per 4.38 feet of stream, which is the second highest density. Based on this person density, recreation impacts within recreation sites may be more intense than all alternatives except F. However, due to the small amount of creek access, this alternative has a relatively low potential for direct and indirect recreational impacts to aquatic species. Given the few stream access points and corresponding increase in refugia, this alternative likely has the lowest impact from recreation.

Beneficial Effects

Refer to the discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 46.4 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 4.5 miles of unauthorized trails would be restored using above methods. 3.8 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restored as well. The total acres restored in riparian is 22.3 and uplands is 24.1. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 661 acres of riparian refugia could be realized.

A total of 73 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Purple Mountain, 10 spots at Sally May, 5 spots at Homestead, 5 spots at Homestead, 21 spots at Tonto Bench, and 21 spots at Lewis.

The Purple Mountain, Sally May, Tonto Bench, and Lewis sites would be closed and rehabilitated. The Lewis and Bear trails would be closed and rehabilitated. A 1.25 mile portion of the Flume trail would be closed and there would be no access to the historic dam, Fossil Springs, or the botanical area. There would be no camping in Middle Fossil, the east side trailheads, nor the Fossil Springs and botanical area. Alternative D also has the shortest length of stream that can be impacted by recreation.

In alternative D there would be no access to the Fossil Springs, botanical area, and historic dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Alternative E Direct and Indirect Effects

Disturbed Area

The total disturbed acres (open roads and trails, unauthorized roads and trails, denuded area, developed recreation footprint, and admin sites) is 114.3 acres, of which 21.6 acres occurs in riparian and 92.7 acres occurs in the uplands. The total length of stream in recreation sites is 8,195 ft, or 15.4% of the stream above the fish barrier (table 3-70). This alternative allows the highest length of stream designated for impact by recreation (10 recreation sites). In general, recreation activities will result in direct disturbance to aquatic species and aquatic habitat as described above. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

Water Flow and Water Quality

All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative. The corridor-wide capacity of 1,350 PAOT is the second-highest PAOT of all action alternatives and 700 PAOT more than current management. Capacity increases will not occur until infrastructure is developed to accommodate that increased capacity and will be accompanied by water quality monitoring, so increases in water quality problems from recreation are not expected. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs (USDA 2012) will reduce sediment input and new construction will be engineered to minimize sediment load when complete.

New Construction

New construction in Alternative E would include: a new welcome center, parking area, and trailhead at Cactus Flat with trails leading from the trailhead; new facilities at Heinrich; additional build-out at Irving including a new bridge across the creek, boardwalk and wildlife blind; a new toilet at the end of the Lewis trail; a new Bear trailhead with a new trail; alternative toilet at Fossil Springs; and a new Rim Trail loop and connector trail. A 4.1 mile section of 708 would be opened after major repairs (including rock scaling) are completed. Monitoring will ensure that new construction doesn't result in degradation of river values, including the aquatic resources portion of the Biological ORV.

Recreation

In addition to allowing the highest length of stream designated for impact by recreation (8,195 ft, or 15.4% of stream length above the fish barrier). The corridor-wide capacity of 1,350 PAOT is the second-highest PAOT of all action alternatives and about 600 PAOT more than current management. Visitor density in recreation sites is one person per 6.1 feet (table 3-70). Visitor density in the reach with the waterfall is one person every 9.9 feet, but alternatives E and F both have the largest recreation sites in this reach (38.8% of the stream in this reach is designated for recreation) (table 3-70). Based on this person density, recreation impacts within recreation sites are expected to be less than only alternative F. The combination of relatively high visitor density and large length of creek access results in a high potential for people leaving recreation sites and impacting refugia. Thus, this alternative has the second highest likelihood for negative recreational impacts to aquatic species and habitat. However, the combination of incremental buildout (with no PAOT increases until infrastructure is prepared) and monitoring will help ensure that the overall PAOT doesn't result in degradation of river values, including the aquatic resources portion of the Biological ORV.

Beneficial Effects

Refer to the discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 40.6 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 2.1 miles of unauthorized trails would be restored using above methods. 3.7 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.5 and uplands is 20.11. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 651 acres of riparian refugia could be realized.

A total of 6 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Tonto Bench.

If human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented.

Alternative F Direct and Indirect Effects

Disturbed Area

The total disturbed acres (open roads and trails, unauthorized roads and trails, denuded area, developed recreation footprint, and admin sites) is 108.7 acres, of which 20.4 acres occurs in riparian and 93.9 acres occurs in the uplands. The total length of stream in recreation sites is 8,021 feet (15.1% of the stream above the fish barrier). This alternative provides for the second greatest acres disturbed by recreation. Alternatives F and E have the highest length of stream that can be impacted by recreation, and F has the highest density of people in recreation sites at 3.21 feet of stream between visitors in recreation sites (table 3-70). The planned visitor density in recreation sites between Irving and the waterfall is 3 feet per person, with 38.8% of that reach within a designated recreation site (table 3-70). This alternative thus has the highest potential for degradation of stream-side habitat in sites without adequate armoring, and the highest potential for people leaving recreation sites and negatively impacting refugia. In general, recreation activities will result in direct disturbance to aquatic species and aquatic habitat as described in the General Effects section.

Water Flow and Water Quality

All alternatives will secure a federal water right, so no anthropogenic alteration of water flow is expected in any alternative. The corridor-wide capacity of 2,580 PAOT is the highest PAOT of all action alternatives and 1,770 PAOT more than current management. This alternative has the highest potential for water quality problems from recreation, such as high *E. coli* CFU values. Construction activities may directly affect aquatic habitat through temporary increases in sediment load, though BMPs will reduce sediment input and new construction will be engineered to minimize sediment load when complete. Because of the rapid capacity increase and lack of a permit system, water quality monitoring may be insufficient to protect water quality.

New Construction

In alternative F, most new construction is distant from the stream to permit walk-in access. Construction would occur at the Cactus Flat site, which will be developed with a welcome center and nearly 400 parking spaces (including parking sites at Homestead and along FR502), plus 3 stock trailer spaces, indoor/outdoor interpretive displays, a toilet, trash receptacles, picnic tables, and bike racks. The Lewis Trailhead will be walk-in only with no parking, and will have a vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail, and a toilet could be built at end of the trail. Toilets may be installed in the Fossil Springs area providing an overall benefit to improved water quality.

Recreation

Alternative F has the second highest number of recreation sites (12) and highest length of stream designated for impact by recreation (8,021 ft, 15.1% of total stream length above the fish barrier). The corridor-wide capacity of 2580 PAOT is the highest PAOT of all action alternatives and 1,770 PAOT more than current management. Visitor density in recreation sites is one person per 3.2 feet per person (table 3-70).Visitor density in the reach with the waterfall is one person every 3 feet, but alternatives E and F both have the largest recreation sites in this reach (38.8% of the stream in this reach is designated for recreation, (table 3-70). Based on this person density, recreation impacts within recreation sites are expected to be the highest of any alternative and also have the highest possibility of recreation spreading outside of recreation sites into refugia. This results in a greatest potential for direct and indirect recreational impacts to aquatic species. Due to the implementation strategy and the need to initiate a permit system to limit capacity, it is unlikely that monitoring will detect impacts to aquatic resources, especially spikedace, in time for management changes to prevent adverse effects or degradation of the Biological ORV.

Beneficial Effects

The Rim Trail would provide an opportunity for diverting recreation from riparian areas, potentially reducing impact to aquatic species and habitat. A total of 40.1 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Two acres of unauthorized trails would be restored using

above methods. A total of 3.9 acres of unauthorized roads restored and system roads would be decommissioned. A total of 34.7 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.4 and uplands is 19.7. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 657.9 acres of riparian refugia could be realized.

Even though Cactus Flat parking area is new construction, parking here and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback. The longer walking distance required to access the stream from the Cactus Flat parking lot (about 3.5 miles from the parking lot to the water fall) may focus recreation in the lower section of the recreation segment.

Effects of Not Implementing the Project Actions (No Action)

Without a comprehensive river management plan the river's outstandingly remarkable values, including aquatic components of the Biological ORV, may not be protected or enhanced with continued implementation of interim management measures. Since NEPA will not have been completed for on-the-ground actions, implementation of needed actions would be delayed during the time NEPA is completed. The CRMP will identify trails and bare areas targeted for restoration rather than the current restoration on an "as needed" basis.

There would be no formal monitoring plan and therefore no consistent or effective way to determine when changes in management (adaptive management) are needed in order to minimize adverse effects to species and their habitat. Education and interpretive materials would be provided to support current management system but would not be focused like they are in all action alternatives. As a result, visitors would have less understanding and be less supportive of river values, resulting in more adverse effects to species and their habitat. The no action alternative does not articulate the concept of refugia so unauthorized trailing and compacted dispersed recreation sites in between the designated recreation sites would not be targeted for closure and rehabilitation. Locatable mineral entry would be possible in the recreation segment and this may result in more direct and indirect effects to species and their habitat.

Overall capacity in the corridor would remain at 810 PAOT. While this is less than Alternatives D, E and F, the no action alternative would allow more PAOT than Alternatives B and C and wouldn't have NEPA completed on any new infrastructure that would accommodate and absorb the impact of 810 PAOT. In addition, the no action alternative does not call for better delineation, surfacing, and installation of water retention basins at any of the parking areas. This can result in creep and enlarging of the parking areas, as well as more run off contributing more sediment and vehicle fluids into Fossil Creek. While some of the action alternatives call for more parking spots than the no action, the action alternatives also provide for more infrastructure and site hardening to accommodate those higher numbers. Any new infrastructure construction would be subject to separate analysis resulting in slower response time in implementing measures to better manage recreation activities in Fossil Creek. Without infrastructure, direct and indirect impacts to aquatic and riparian habitat will be higher.

Species Summaries

Gila Topminnow

Gila topminnow have been reintroduced into Fossil Creek, but this species typically inhabits slow-moving water so they may be more susceptible to high flow events than other native species. The population may therefore be expected to boom and bust with flood events and may require future augmentation. Gila topminnow does not have designated critical habitat.

Continued sediment delivery into Fossil Creek will occur in all alternatives, and sediment from human activities may impact Gila topminnow habitat. All alternatives provide for bare area, road, and trail restoration that will reduce soil disturbance acreage and will reduce sediment input, but increasing PAOT values are likely going to create new bare areas, unplanned trails, and riparian habitat disturbance that require further restoration. This would result in reduced riparian capacity to filter sediments, reduce intensity of floodwaters, and provide stream shading and cooling. Loss of riparian habitat also results in reduced habitat available for riparian species such as

aquatic and terrestrial macroinvertebrates, which constitute the primary food source for fish in Fossil Creek. Water quality may be negatively impacted by increasing visitor use, especially in sites with poor access to toilet facilities.

Loach Minnow

Despite the lack of documentation of the presence of loach minnow in the Verde River for the last several decades, the Verde River and tributaries such as Fossil Creek, are important habitat for the species. It is likely that loach minnow was historically common throughout the Verde River basin but was extirpated as a result of human activities (e.g., development, agriculture, water diversions, etc.) resulting in reduction of riparian habitat, altered species composition, increased presence of exotic fish, decreased surface water availability, changes in stream morphology, and other deviations from historical conditions.

Despite repeated attempts to introduce loach minnow above the dam, this species has not observed anywhere in Fossil Creek for several years (Robinson and Mosher 2018). If there are future stocking attempts, direct effects to loach minnow occur when through-hikers cross the stream or travel in the in the stream itself. Higher numbers of visitors will introduce personal-care-product pollution and may impact water quality. Thus, if new suitable habitat is identified in Fossil Creek and loach minnow are successfully introduced, they are likely to be directly impacted by management actions in the same was as other fish species.

Continued sediment delivery into Fossil Creek and the Verde River will also occur in all alternatives. Sediment has been shown to limit or affect loach minnow habitat by altering macroinvertebrate assemblages, and loach minnow abundance decreases where sediment fills interstitial spaces in the substrate. All alternatives provide for bare area, road, and trail restoration that will reduce soil disturbance acreage that will reduce sediment input, but increasing PAOT values are likely going to create new bare areas, unplanned trails, and riparian habitat disturbance that require further restoration. This would result in reduced riparian capacity to: filter sediments, reduce intensity of floodwaters, and provide stream shading and cooling. Loss of riparian habitat also results in reduced habitat available for riparian species such as aquatic and terrestrial macroinvertebrates, which constitute the primary food source for fish in Fossil Creek. Water quality may be negatively impacted by increasing visitor use, especially in sites with poor access to toilet facilities.

Critical Habitat

Revised critical habitat for the loach minnow was finalized with the change in status from threatened to endangered (USDI FWS2012). In total, approximately 610 miles are designated as critical habitat in the Gila River Basin of Arizona and New Mexico. Eight individual critical habitat units are designated: Verde River subbasin, Salt River subbasin, San Pedro subbasin, Bonita Creek subbasin, Eagle Creek subbasin, San Francisco River subbasin, Blue River subbasin, and Gila River subbasin. The following are primary constituent elements (PCEs) of the loach minnow's designated critical habitat, as outlined by the U.S. Fish and Wildlife Service (USDI FWS 2012):

Designated Critical Habitat PCEs—Loach Minnow:

1. Habitat to support all egg, larval, juvenile, and adult loach minnow: This habitat includes perennial flows with a stream depth of generally less than 3.3 feet, and with slow to swift flow velocities between 0 and 80 cm per second (0.0 and 31.5 inches per second). Appropriate microhabitat types include pools, runs, riffles, and rapids over sand, gravel, cobble, and rubble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitats have a low stream gradient of less than 2.5 percent, are at elevations below 8,202 feet. Water temperatures should be in the general range of 46.4 to 77 degrees Fahrenheit.
2. Abundant prey base: An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
3. Streams with no or no more than low levels of pollutants.

4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.
5. No nonnative aquatic species, or levels or nonnative aquatic species that are sufficiently low as to allow persistence of loach minnow.
6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

PCEs 4, 5, and 6 are likely protected by all alternatives. Unregulated perennial water flow (4 and 6) are specifically protected by ORVs and both protective measures and monitoring are defined in the CRMP. However, PCEs 2, 3, and parts of 1 may be negatively impacted by all alternatives and particularly alternatives E and F due to the higher PAOT values. Continued or increased levels of PAOT may directly impact preferred loach minnow habitat via trampling (riffles and runs with cobble and gravel substrates) and sediment redistribution. Pools are important microhabitats for loach minnow, as they provide perennial water during periods of low flow, and also help maintain habitat connectivity. Higher PAOTs may increase bank instability and social trails that contribute to increased sedimentation and embeddedness (PCE 1) which in turn may negatively affect aquatic invertebrates (PCE 2). Increased pollutants from visitors are expected to be stream wide and may impact water quality as well (PCE 3). Bank instability and social trails are expected to be minimal in Alternatives B-D due to low visitor density. Alternatives E and F, however, may have visitor densities high enough that monitoring and restoration

Continued sediment delivery into Fossil Creek and the Verde River will also occur in all alternatives. Sediment has been shown to limit or negatively affect loach minnow habitat by altering macroinvertebrate assemblages, and loach minnow abundance decreases where sediment fills interstitial spaces in the substrate. All alternatives provide for bare area, road, and trail restoration that will reduce soil disturbance acreage that will reduce sediment input, but increasing PAOT values are likely going to create new bare areas, unplanned trails, and riparian habitat disturbance that require further restoration. This would result in reduced riparian capacity to: filter sediments, reduce intensity of floodwaters, and provide stream shading and cooling. Loss of riparian habitat also results in reduced habitat available for riparian species such as aquatic and terrestrial macroinvertebrates, which constitute the primary food source for fish in Fossil Creek.

Spikedace

Repatriated populations of spikedace, such as that in Fossil Creek, are critically important for the species. It is likely that spikdace was historically common throughout the Verde River basin but was extirpated as a result of human activities (e.g. non-native species, development, agriculture, water diversions, etc.) resulting in reduction of riparian habitat, altered species composition, increased presence of exotic fish, decreased surface water availability, changes in stream morphology, and other deviations from historical conditions.

Spikedace have been introduced to Fossil Creek, though the most recent survey data suggests the population is very small (Rinker and Rogers 2018). Direct effects to spikedace from all alternatives are possible because spikedace will prefer habitat such as pools and runs that are preferred recreation areas and spawn in habitat that may be easily trampled. In Alternatives A-E, degradation of the aquatic ORV and population-level impacts are unlikely occur because monitoring should detect anthropogenic habitat impacts in refugia (i.e. social trailing) before spikedace populations are impacted. Easily initiated management actions may include reduced visitation of an impacted site (fewer permits issued for that site) or site closure. Due to its implementation strategy, Alternative F has a greater potential to degrade the aquatic ORV and have population-level impacts. Though accompanied by monitoring, the rapid build-out and increase in PAOTs may not be able to detect impacts to aquatic habitat and spikedace populations in recreation areas before the whole population is displaced. Easily initiated management actions may include reducing visitation of an impacted site via signage or closing a parking lot.

Continued sediment delivery into Fossil Creek will also occur in all alternatives, and the potential for negative impacts from sediment delivery increase with increasing visitors. All alternatives provide for bare area, road, and

trail restoration that will reduce soil disturbance acreage that will reduce sediment input, but increasing PAOT values are likely going to create new bare areas, unplanned trails, and riparian habitat disturbance that require further restoration. This would result in reduced riparian capacity to filter sediments, reduce intensity of floodwaters, and provide stream shading and cooling. Loss of riparian habitat also results in reduced habitat available for riparian species such as aquatic and terrestrial macroinvertebrates, and reduced riparian vegetation may even disrupt the food web if enough leaf litter input is lost (Cummins 1973).

Finally, the fish barrier makes Fossil Creek highly valued habitat and an extremely valuable population (USDI FWS 2012), and anthropogenic impacts to habitat suitability for spikedace in Fossil Creek may impact the future viability of the species.

Critical Habitat

Revised critical habitat for spikedace was finalized with the change in status from threatened to endangered (USDI FWS Service 2012). In total, about 630 miles is designated as critical habitat in the Gila River Basin of Arizona and New Mexico. Eight individual critical habitat units are designated: Verde River subbasin, Salt River subbasin, San Pedro subbasin, Bonita Creek subbasin, Eagle Creek subbasin, San Francisco River subbasin, Blue River subbasin, and Gila River subbasin. The following are primary constituent elements (PCEs) of the spikedace's designated critical habitat, as outlined by the U.S. Fish and Wildlife Service (USDI FWS 2012):

Designated Critical Habitat PCEs—Spikedace:

1. Habitat to support all egg, larval, juvenile, and adult spikedace. This habitat includes perennial flows with a stream depth generally less than 3.3 feet and with slow to swift flow velocities of between 1.9 and 31.5 inches per second. Appropriate stream microhabitat types include glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitat will have a low gradient of less than approximately 1.0 percent, at elevations below 6,890 feet. Water temperatures should be in the general range of 46.4 to 82.4 degrees Fahrenheit. A prey base consisting of viable populations of native amphibians and native fish species.
2. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
3. Streams with no or no more than low levels of pollutants.
4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.
5. No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace.
6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

Programmatic management direction should maintain or enhance spikedace PCEs 4, 5, and 6 in all alternatives. Unregulated perennial water flow (4 and 6) are specifically protected by ORVs and both protective measures and monitoring are defined in the CRMP. However, PCEs 2, 3, and parts of 1 may be negatively impacted by all alternatives and particularly alternatives E and F due to the higher PAOT values. Continued or increased levels of PAOT may directly impact preferred spikedace habitat via trampling (riffles and runs with cobble and gravel substrates) and sediment redistribution. Pools are important microhabitats for loach minnow, as they provide perennial water during periods of low flow, and also help maintain habitat connectivity. However, higher PAOTs may increase bank instability and social trails that contribute to increased sedimentation and embeddedness (PCE 1) which in turn may affect aquatic invertebrates (PCE 2). Increased pollutants from visitors are expected to be stream wide and may impact water quality as well (PCE 3). Bank instability and social trails are expected to be

minimal in Alternatives B-D due to low visitor density. Alternatives E and F, however, may have visitor densities high enough that monitoring and restoration will be required to prevent impacts to riparian areas and consequent negative impacts to aquatic habitat.

Stream-wide distributed fish species

Roundtail chub, speckled dace, desert sucker, and Sonora sucker are distributed throughout most of the 16km of Fossil Creek protected by the fish barrier. While non-native fish species pose the greatest threat to native fish populations in Fossil Creek, management agencies (AGFD, FWS, BOR, and USFS) have already demonstrated their resolve in rapidly containing and removing a non-native reintroduction (2012). As described above, recreation may impact these species in and perhaps outside of dispersed recreation sites. While populations of these species may be impacted or reduced in dispersed recreation areas, it is expected that 1) unimpacted refugia areas will maintain viable populations of those species, and 2) CRMP monitoring in alternatives B- D due to low visitor density. Alternatives E and F, however, may have visitor densities high enough that monitoring and restoration will be required to prevent impacts to riparian areas and consequent negative impacts to aquatic habitat.

Macroinvertebrates

In addition to being a part of the Biological ORV, macroinvertebrates are a Management Indicator Species for both the Coconino and Tonto National Forests. This requires descriptions of *forest-wide* trends of macroinvertebrate habitat and populations, and an analysis that documents the possible effects of management actions to the forest wide population and habitat trends. Therefore, this analysis (impact to forest-wide trends) differs somewhat from the rest of this analysis (project-specific impacts and impacts to special status species).

All alternatives provide for the use of aquatic macroinvertebrates as monitoring indicators for condition of waterways and riparian areas. Water quality monitoring using the Arizona Department of Environmental Quality standards is also supported under all alternatives. All alternatives support reducing sediment and improving watershed conditions using BMPs (USDA 2012) and restoration activities. All alternatives also promote maintaining or procuring instream flow rights. In addition, aquatic management zones are a component of all alternatives to buffer the stream from accelerated erosion, sedimentation, scouring, and uncharacteristic flooding.

Fossil Creek Macroinvertebrate Existing Condition

Both the Coconino and Tonto National Forests selected macroinvertebrates as indicators for late-seral high and low elevation riparian quality (USDA 1987) and fisheries habitat and water quality (USDA 1985). The Tonto and Coconino National Forests share Fossil Creek as a border and macroinvertebrates are found throughout Fossil Creek (though abundance and diversity is highest at Irving and above, Adams 2012), so there are a total of 14.53 miles of macroinvertebrate habitat considered in this analysis. This length can be compared to 272 miles of perennial stream on the Coconino National Forest (USDA 2018b) and 560 miles of perennial stream on the Tonto National Forest (Lee et al. 2004), so Fossil Creek provides about 5.3% of available macroinvertebrate habitat for the CNF and 2.6% for the TNF (table 3-71). Fossil Creek is entirely below 7000 ft elevation and thus habitat here is considered low elevation riparian for this MIS analysis.

Table 3-71. Perennial stream miles, MIS trends, and analysis area information for the Coconino and Tonto National Forests

Forest	Miles of Perennial Stream	Forest-wide Habitat Trend	Forest-wide Macroinvertebrate Population Trend	Total Stream Miles in Project Area	Percent of Forest Perennial Miles
Coconino NF	272	High Elevation Riparian – Stable Low Elevation Riparian – Stable to Improving	Stable	14.53	5.34%
Tonto NF	560	Water Quality - Stable	Stable	14.53	2.59%

Coconino National Forest data include invertebrate survey data in a dozen watersheds from 1987 through 2011 from Forest Surveys, ADEQ surveys, and Northern Arizona University surveys. Tonto National Forest data include long-term trends for 12 perennial streams and also indicate stable populations (USDA 2005). The most recent measures from the Tonto National Forest indicates a static riparian habitat trend, a static or unknown water quality trend, and stable macroinvertebrate populations (USDA 2005; USDA 2015). Data from the Coconino National Forest have shown variable trends depending on the stream, with seven streams showing an improving trend and five streams a declining trend. Changing environmental factors such as flooding and drought cycles, as well as microhabitat variation between collections (Heino et al. 2004) could also result in the variability seen in CNF macroinvertebrate data (USDA 2013b), Because trend line slopes did not significantly differ from zero, the forest-wide trends for macroinvertebrates and their indicated habitat is considered stable (USDA 2013b). Table 15 shows the number of perennial stream miles in each National Forest, the current indicator habitat and macoinvertebrate trends, and the percentage of each forest's perennial stream miles that is included in this analysis's analysis area. Riparian function has also been measured for the Coconino National Forest. The 2013 assessment of MIS species and habitat documented high elevation riparian as stable (though departed from reference conditions) and low elevation riparian habitat as stable to improving.

Fossil Creek macroinvertebrates have primarily been surveyed by Northern Arizona University and ADEQ. Fossil Creek supports an unusually high macroinvertebrate species richness compared with other northern Arizona streams (Marks et al. 2005), and the stream has consistently achieved attaining status in ADEQ surveys (ADEQ 2008; ADEQ 2010). Invertebrate surveys during and soon after the high recreational use period (sampled in 2010 and 2011 by Adams 2012) in Fossil Creek found similar invertebrate abundance and diversity generally similar to pre-high recreation studies (i.e. Dinger 2006), but did note that emerging invertebrate abundance decreased at the Irving site that that experienced the heaviest recreation (Adams 2012). Diversity and abundance also decreased in two sites below Irving, and in fact the Purple Mountain site did not fell into the "Inconclusive" criteria for ADEQ standards (Adams 2012). This lower diversity is potentially due to aquatic habitat changes from travertine armoring (Adams 2012). Thus, the optimal aquatic macroinvertebrate habitat (greatest abundance and diversity) in Fossil Creek appears to be from around Irving upstream to the springs.

Effects Analysis

The largest amount of disturbed riparian acres in any alternative (26.5 acres in Alt A, table 3-70) is less than 0.3% of the total number of low-elevation riparian habitat on the Coconino National Forest (9,191 acres, USDA 2013b). The indicator habitat (length of perennial stream) will not change under any alternative, the analysis focuses on the differences in habitat quality among alternatives.

All action alternatives provide language for the use of aquatic macroinvertebrates as monitoring indicators for condition of waterways and riparian areas. Habitat restoration will provide positive benefits to riparian and aquatic habitat by reducing unnatural sediment input and restoring terrestrial inputs to the aquatic food web. All action alternatives provide for between 35 and 38 acres of habitat restoration and 4-10 miles of user-created and decommissioned trail restoration, depending on alternative (see EIS Chapter 2).

The primary impact of concern to aquatic invertebrate habitat quality is water quality and substrate embeddedness, which can homogenize habitat, change current flows critical to macroinvertebrate feeding, fill interstitial space in the stream bed, and smother animals (Lenat eta l. 1981, Berkman and Rabeni 1987, Gordon et al. 2004, Schofield et al 2004). Because of required Best Management Practices that minimize effects to aquatic habitat, aquatic environmental impacts from infrastructure development such as roads and parking lots are not expected to differ between alternatives, even though infrastructure plans do differ between alternatives. The number of riparian acres disturbed differs between alternative, with between 8.6 and 21.6 acres disturbed depending on alternative (table 3-70). Recreation, however, may impact riparian habitat, aquatic habitat, and water quality (see General Effects to Aquatic Habitat above) and the number of visitors (and thus intensity of negative impact) differs by alternative. If recreation effects remain within designated recreation polygons, we anticipate no measurable reach-wide effects to riparian and aquatic habitats because recreation sites will be designed around armored banks and well-designed trails. Thus, recreation focused in dispersed recreation sites may locally impact species, but if recreation is limited to the designated recreation polygons we do not expect an

impact to macroinvertebrates at a reach scale. Alternatives with relatively low visitor density where refugia impacts are not expected are Alternatives A, B, and C (table 3-70).

The possibility of high visitor density in Alternatives D, E and F around the Irving and Waterfall recreation sites in could result in visitor displacement into refugia areas, which is includes the section of stream with high macroinvertebrate abundance and diversity. As described above (see General Effects to Aquatic Habitat), such visitor displacement may result in social trails, altered timing and location of sedimentation, increase in sediment load, and increased negative water quality impacts. This in turn may impact macroinvertebrate habitat and populations outside of recreation areas.

Table 3-72. The number of stream miles present in recreation sites and the percentage of total perennial stream miles for each national forest[1]

Forest	Stream miles in Recreation Sites	Percent of Forest Perennial Stream Miles	Average Visitor Density (feet/ person)	Visitor Density from Irving to the Waterfall (feet/ person)
Alt A				
Coconino NF	1.42	0.64%	10.15	19.46
Tonto NF	1.42	0.25%	10.15	19.46
Alt B				
Coconino NF	1.42	0.64%	13.41	81.71
Tonto NF	1.42	0.25%	13.41	81.71
Alt C				
Coconino NF	0.88	0.39%	7.03	14.09
Tonto NF	0.88	0.16%	7.03	14.09
Alt D				
Coconino NF	0.54	0.24%	4.38	3.25
Tonto NF	0.54	0.10%	4.38	3.25
Alt E				
Coconino NF	1.55	0.69%	6.07	9.92
Tonto NF	1.55	0.28%	6.07	9.92
Alt F				
Coconino NF	1.52	0.68%	3.21	3.02
Tonto NF	1.52	0.27%	3.21	3.02

[1]The Average Visitor Density value indicates the number of feet between visitors if every visitor recreates at the stream's edge within recreation polygons. This number is used to predict the likelihood of visitors moving out of recreation polygons and impacting refugia (see Recreation section in General Effects to Aquatic Habitat above).

Negative impacts to habitat in alternatives D, E, and F should still primarily occur within the designated recreation sites which at most comprise more than 10% of the total stream length in Alternatives E and F (table 3-70). However, the unknown but possible impacts to refugia areas (such as water quality degradation, social trails, or in-channel sediment redistribution, see Recreation effects section above) will likely depend on the number of people at one time and consequent visitor density in the selected alternative. Alternative D allows a high anticipated visitor density (one person every 3.2 feet), but only the Irving site, which includes 7.8% of the Irving to Waterfall stream length (table 3-70). Thus, even if negative recreation impacts extend beyond the recreation polygons in Alternative D, the total amount of habitat impacted is still not likely to degrade aquatic habitat reach-

wide. However, Alternatives E and F have both a large amount of stream length designated in recreation polygons (nearly 0.7% of the total perennial stream length of the Coconino NF). Both of these alternatives also have a high visitor density (3-4 feet between people), especially in the stream reach between the Irving and the waterfall where invertebrate diversity is high (Adams 2012). This larger area that is expected to be impacted by recreation, combined with the higher potential for negative impacts to refugia, will all occur in the area of the stream with high seasonal recreation use that is comparable in visitor counts to prior unrestricted use (Rotert 2011).

MIS Conclusions

Low-elevation riparian habitat (Coconino National Forest):

While some riparian habitat, the macroinvertebrate-indicated habitat for the Coconino National Forest, will be disturbed in every alternative, the maximum amount of habitat disturbed is very small when compared with total number of acres on the forest. Thus, riparian disturbance is unlikely to alter the “stable to improving” forest-wide trend of riparian habitat.

Macroinvertebrates and aquatic habitat:

While all of Fossil Creek supports aquatic macroinvertebrates, the most valuable macroinvertebrate habitat that supports the greatest abundance and diversity is from around Irving upstream to the springs. Though the relative stream length of Fossil Creek is fairly small relative to the total number of perennial stream miles in the Coconino National Forest (5.3%) and even smaller for the Tonto National Forest (2.6%), the total miles of stream involved belies the fact that a relatively short stretch of Fossil Creek supports a diverse and abundant macroinvertebrate community that has some of the highest IBI scores in the state (ADEQ 2010; Adams 2012). Recreation impacts such as bank denuding and social trails are known to impact riparian and aquatic habitats, and most recreation in Fossil Creek occurs in the area of greatest macroinvertebrate abundance and diversity.

Aquatic habitat quality and water quality will be positively impacted by terrestrial habitat restoration efforts in all action alternatives.

Due to lower visitor densities, negative recreation effects to aquatic habitat quality and water quality are not anticipated to extend beyond recreation polygons in Alternatives A, B, C, and D enough to impact habitat and macroinvertebrates. Alternative D has higher visitor density, but the amount of habitat that is expected to be impacted in the reach with high macroinvertebrate diversity is still small. Thus, Alternatives A, B, C and D are not expected to negatively impact forest-wide trends in aquatic habitat, water quality, or macroinvertebrate populations for the Coconino and Tonto National Forests. Alternatives A, B, C and D are also not expected to negatively impact aquatic habitat, water quality, or macroinvertebrate populations at the project level.

The higher visitor densities (table 3-70) and consequent unknown but more likely negative habitat impacts outside of recreation sites makes Alternatives E and F more likely to negatively impact aquatic habitat, water quality, or macroinvertebrate populations at the project level. However, the fraction of total forest-wide stream miles in the action area relatively small for the Coconino and even smaller for the Tonto. Thus, despite the possibility of local impacts, Alternatives E and F are also unlikely to negatively impact the forest-wide trends for both the Coconino and Tonto National Forests.

Cumulative Effects Analysis

Appendix B of the EIS describes all Cumulative Effects considered for this analysis.

The spatial boundaries for analyzing the cumulative effects to aquatic resources is comprised of five sixth code watersheds: Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek, and Gap Creek-Verde River, but the portion of Gap Creek is so little that activities in that watershed are negligible in the cumulative effects. These watersheds were selected because there may be downstream indirect effects such as sedimentation and movement of non-native species that result in direct and indirect effects to aquatic species and their habitat. In addition, canyoneering, cross country travel, and use of the Mail Trail connect activities in the

uplands outside of the corridor to the Fossil Creek corridor. The temporal boundaries for analyzing the cumulative effects are 10 years because we anticipate we will have implemented the majority of the proposed action elements within 10 years.

Cumulative Effects to Aquatic Habitat and Species

Past, present, and reasonably foreseeable activities may affect aquatic species and habitat through the loss, destruction, or modification of aquatic habitat and population-level impacts. This can includes impacts that were discussed in above, particularly disturbed area, water flow and water quality.

Past Actions with No or Beneficial Effects

Past activities impacting aquatic habitat and species within the Fossil Creek Watershed include: recreation, hydropower decommissioning, the Heinrich land acquisition, the native fish restoration effort, Fossil Creek interim management activities, maintenance of utility lines, road and trail maintenance, and research and education permits. Recreation, maintenance of utilities, and research and education permits have not had a negative effect on aquatic species and habitat, while the restoration effort and dam decommissioning had significant beneficial effects.

The restoration of 43 CFS of spring flows back into Fossil Creek greatly improved aquatic habitat and increased native fish populations three-fold, while the non-native fish removal allowed a nearly 80-fold increase in the native fish population (Marks et al. 2010). The decommissioning also restored habitat when infrastructure and man-made structures were deconstructed. The Heinrich acquisition increased the amount of riparian and aquatic habitat within the NFS system and reduced the potential for habitat fragmentation. Interim management activities, especially capacity control, since 2005 has incrementally reduced the effects of recreation on natural resources, including fish, wildlife and rare plants.

Ongoing maintenance of roads and trails has contributed to reduced erosion and sedimentation into Fossil Creek and improved water quality and habitat condition for aquatic species, especially macroinvertebrates. Travel Management issued a decision in 2011 effectively eliminating cross country OHV travel and reducing the amount of traffic on roads that pose the greatest risk to soil and water resources. Implementation of the rule through ongoing road rehabilitation and decommissioning should continue to substantially reduce loss of vegetation and soil productivity and reduce sediment delivery into connected streamcourse thereby improving riparian area and water quality into Fossil Creek as roads and disturbed soils revegetate and stabilize over the next 10-20 years.

Research proposals are carefully screened to avoid adverse effects and typically result in useful information that support and drive future land management decisions resulting in better resource protection; for example NAU researchers have documented ecosystem changes and demonstrated the differing impact of restoring water flow as compared to removing non-native fish (i.e. Marks et al. 2010, Gibson et al. 2018).

The USGS stream gage on Fossil Creek has minimal impact to the stream since operation of the stream gauge is wireless and does not involve any access to the creek beyond the existing pipe and transducer which is fixed to the bedrock channel bottom. The benefits from having stream flow data for research, management, and effects analyses outweighs the short-term effects during the initial installation period.

Past Activities with Adverse Effects

Past activities that may have adversely affected fish and aquatic resources and their habitat along Fossil Creek include recreation; maintenance of utilities (such as APS and WAPA power lines, fiber/optic line, 5 mile communication site, water pipelines and local communication lines in Strawberry); road and trail maintenance; research and education permits; short-term effects from maintenance of the native fisheries; hydropower decommissioning activities; development on private land; and water withdrawal.

Recreation occurring along Fossil Creek increased dramatically after restoration of full flows in 2005. Visitation during the high use season in 2006 was around 20,000 people but by 2011 had increased to 95,000 people. Recreational activities in Fossil Creek, particularly before camping was restricted and capacity controls were

implemented starting in 2011, resulted in resource damage including denuded and compacted soils both adjacent to the creek as well as in the uplands, an increase in trash and human waste, damage to trees, small wildfires, etc. No adverse effects to aquatic habitat were documented, but aquatic habitat and water quality were not being monitored regularly. AGFD began annual hoop netting monitoring in 2009 and documented an increase in chub, Sonora sucker, desert sucker and speckled dace populations during high recreation use, indicating the observed recreation did not impact that species. Beginning in 2012 capacities were controlled by closing entrances when parking areas filled up. When the permit system was implemented in 2016, recreation use and the resulting impacts decreased further.

Fishing in the upland stock tanks may occur because non-native fish have been detected in various locations. These non-native fish are a source, that when floods carry them downstream, can become established in Fossil Creek, compromising the native species there. If non-native fish are detected in these stock tanks, NEPA has already been completed to allow rotenone application to remove the non-native fish.

Maintenance of permitted utility sites and lines allows for some removal of riparian trees which reduces habitat and can impact aquatic habitat by reducing overhead cover and allowing increased erosion. The Forest Service had to close the section of FR 708 road between the Waterfall and Fossil Springs Trailheads due to the deteriorating condition of the 708 road, and as a result, rock falls, rilling, and undermining has occurred and has contributed soil and sediment runoff may be negatively impacting water quality.

Without proper screening or detailed permits, research and educational activities can disturb species as well as impact habitat. At least one research project has left supplies at a site on Fossil Creek that remains to be cleaned up.

The maintenance of the native fishery, required during the original restoration and when non-native fish appeared in the native section, required building a temporary fish barrier, treating several miles of stream with a piscicide, repairing of the native fish barrier, and having many people in the riparian corridor and along the stream for weeks. These short-term adverse effects were outweighed by the long-term effects of a non-native free portion of Fossil Creek. Short-term impacts to aquatic species occurred when the historic Fossil Creek Dam was lowered 14 feet in 2009. A subsequent winter storm resulted in severe shearing of banks in the newly unstable sections above the dam, resulting in scoured habitat above and downstream for several miles. In addition the unstable nature of the channel and the high velocity flows from the winter flood damaged the fish barrier about 10 miles downstream.

Existing wells drilled in the Strawberry have resulted in an increase in groundwater withdrawal. In general throughout the southwest, there is concern with reduced instream flows as a result of groundwater withdrawal.

Ongoing and Future Activities

Ongoing and future activities in the riparian corridor include maintaining the native fisheries which may require similar actions as in the past (for example, temporary fish barriers and re-treatment with piscicide), invasive plant treatments, repair and maintenance of utilities, and research and educational events. The ongoing and future effects would be the same as described above. In addition, should future drilling of wells on private land result in decreased instream flow in Fossil Creek, further well drilling can have direct effects to aquatic species in Fossil Creek even though private land is miles away from Fossil Creek.

Grazing

The Ike’s Backbone Allotment has recently been closed within the Fossil Creek analysis area resulting in beneficial effects to wildlife and their habitat (Magilligan and McDowell 1997). In addition, the Deadman Mesa Allotment on the Tonto National Forest, which occurs along the majority of the perennial section of Fossil Creek on the Tonto side, has been vacant for 19 years and there are no foreseeable plans to for reauthorizing livestock grazing at this time. Five other allotments occur in the cumulative effects boundary. Standard structural range maintenance has occurred within the past, present and will continue into the future, including cleaning tanks to their original depth, cleaning out sediment traps, repairing berms, fixing fences, and converting electric fences to

more reliable wire fences. Livestock grazing is managed and monitored to ensure livestock use levels stay within allowable intensities and utilizations so there are no adverse effects to vegetative communities and the wildlife species that depend on them. Because there are no riparian pastures along Fossil Creek, grazing will not have direct effects to riparian and aquatic plants and animals. Great effort has been made to ensure riparian areas are protected, for example livestock on the Fossil Creek allotment are trailed through the Stehr Lake pasture because livestock fencing, to keep livestock out of the riparian, would hinder recreational access.

Cumulative Effects Related to Climate Change in the Southwest

Current climate change in the southwest has been already been observed and documented. The southwest's recent warming is among the most rapid in the nation and in some areas, significantly greater than the global average (Karl et al. 2009). There has been a near 2°F increase in temperatures in the last century, with 110 years of records showing the 2001-2010 decade being the warmest (EPA website, accessed 2016). August in 2015 was the hottest August ever for Phoenix. The length of the frost-free season has increased by 19 days in recent decades (EPA website, accessed 2016). Declines in spring snowpack have been observed in recent decades (Garfin et al 2013 and EPA website, accessed 2016). The highest streamflows occur earlier in the year and there's been a decrease in the total yearly streamflow over the last decade (EPA website, accessed 2016). Changes in phenology (the timing of biological events) has also been observed. Spring is progressively earlier since the 60's.

Predicted changes in Southwest weather include increase temperatures. Temperatures in the southwest are projected to rise 4-6 degrees Fahrenheit under the lowest emission scenarios (by up to 10F under highest emission scenarios) by the end of the century (Defenders of Wildlife website, accessed 2018). Average annual temperatures are projected to rise an additional 3.5°F to 9.5°F by the end of this century, with the greatest temperature increases expected in the summer and fall. The southwest will experience hotter heat waves (Garfin et al 2013). Winters in the southwest will also be altered by having fewer frost days, shortened snow season, less snowpack, more frequently extremely dry and extremely wet winters, increase precipitation outside of summer seasons (Garfin et al. 2013; Karl et al. 2009).

The Southwest will experiences in changes in water availability with more frequent, intense and longer droughts, reduced river flow and soil moisture, increasingly scarce water supplies, increased frequency of floods, and altered timing of floods. Drought conditions are already common in the Southwest and drought periods are expected to become more frequent, intense, and longer. Drought will affect important water sources. Combined with expected population growth, climate change will exacerbate existing stresses.

Finch (2012) sites numerous predictions for changes in Southwest landscapes due to climate change and those pertinent to the Fossil Corridor follow. By 2099, 55% of western landscapes will have climates incompatible with current vegetation types. Pinyon juniper woodlands move northward and upslope. Semi desert grassland expands northward and occupies an area four times that of the present. Great basin shrub/grassland decreases by 40% and becomes fragmented. Great Basin montane scrub declines (69%) and displacement through time. There will be a northward shift of key plant species including saguaro, and creosote bush. Species with small distributions (AZ cypress) experience complete climate disequilibrium early in the century. There will be an increase in and expansion of invasive plant species and invasive cheatgrass shifts northward. It is likely that grass species such as lovegrass, yellow bluestem and cheatgrass increase in the Fossil Corridor.

Phenology—the timing of seasonal activities of animals and plants—is perhaps the simplest process in which to track changes in the ecology of species in response to climate change. Birds, butterflies and wild plants, in particular, include popular and easily identifiable species and thus have received considerable attention from the public. As a result many long-term phenological data sets have been collected. Common changes in phenology include: earlier bird nesting, earlier arrival of migrant birds, earlier choruses and spawning of amphibians, earlier appearance of butterflies, and earlier insect hatching (EPA website, accessed 2016). These may not always match with all of species' life history requirements. Some species may not have advanced their timing of breeding sufficiently to continue reproducing optimally relative to the occurrence of peak food availability, thus becoming mismatched compared with their food sources (EPA website, accessed 2016).

Climate change will present both challenges and opportunities for adaptations for amphibians. Highly aquatic frog species will be challenged as they lose habitat from diminished flows and toad size has been observed to be smaller in temporary pools versus perennial waters (Regan et al 2014). Frogs and toads occupying temporary pools in the intermittent portion of Fossil Creek, along with other Fossil tributaries such as Boulder Creek may experience similar challenges. Tadpoles (great basin spadefoot tadpoles and other species) in warmed pools opportunistically reached metamorphosis 15-17 days earlier with little cost to size (Regan et al 2014) and so amphibians in Fossil Corridor may be able to similarly adapt.

Aquatic habitats in the Southwest will also experience changes due to climate change. A 17% increase in the frequency of stream drying events is expected. Spring and early summer flows in rivers will diminish between 8 and 20% (Jaeger et al. 2014). More frequent and severe droughts will result in altered flows and connectivity in SW streams (Jaeger et al, 2014). Water will become more isolated due to longer stretches of dry channel (Jaeger et al. 2014). Altered flows and reduced connectivity will make aquatic species especially vulnerable. This may be the case in the future for Fossil Corridor's intermitted tributaries. While Fossil Creek mainstem due solely to climate change is unlikely to dry, the high flow events that help cue fish spawning (Minckley and Marsh 2009) may occur at lower intensity, less frequently, or with different timing.

Overall, the anticipated effects of climate change to species habitat (e.g. diminished spring flows in intermittent reaches, altered timing of temperatures, changes to the riparian community (and potential food web changes), altered flood flows (potential disruption of spawning cues)) combined with the direct and indirect effects of implementing the CRMP alternatives, would result in additional effects to aquatic habitat and species.

Groundwater Pumping

Water tables are lowering as a result of ground water pumping and rising temperatures are causing lower flows in major rivers (Karl et al. 2009). At this time, groundwater use from the portion of the regional limestone aquifer that supports perennial flow in Fossil Creek is extremely limited or absent. However, development of a production well in the vicinity of a deep exploratory borehole that was drilled would likely impact discharge at Fossil Springs since groundwater would be withdrawn from the same regional limestone aquifer that supports springs discharge and groundwater extraction would be in close proximity to Fossil Springs.

Summary of Environmental Effects

The Fossil Creek Comprehensive River Management Plan Environmental Analysis embodies a diverse and varied group of possible alternatives and possible environmental consequences. As such, comparison of Alternatives is best done by comparing all Action Alternatives to existing conditions, which is represented by the No Action alternative.

There are many potential anthropogenic actions that will have consequences for aquatic species and habitat. Infrastructure improvements are planned in all alternatives that will have direct or indirect impacts to aquatic species and habitat: bridge construction (one or two bridges); gabion replacement and installation; road closures and maintenance; welcoming centers and picnic areas; trail designations and closures; parking lot closures, installations, or improvement; increases or decreases in bare area due to new trails, campsites, and restoration; infrastructure maintenance around gas and power lines. Though the types and intensity of all of these infrastructure changes differ between alternatives, the direct and indirect impacts between the alternative with the least infrastructure improvements and the greatest (Alternative E) are expected to be minor. All infrastructure will be designed using Best Management Practices with appropriate retention basins, armoring, and other design features to minimize or eliminate impacts to aquatic habitat. Furthermore, the scale of the Fossil Creek watershed creates very large natural events such as floods, such as the 2009/10 flooding that damaged the fish barrier. While there may be environmental impacts from infrastructure, the increase in sediment load will add a relatively small amount to natural flooding events. In essence, the presence or absence of a few well-designed parking lots and such is not expected to have reach-wide environmental impacts that will adversely affect the aquatics aspect of the Biological ORV.

Recreation, however, may negatively impact riparian habitat, aquatic habitat, and water quality (see General Effects to Aquatic Habitat above) and the number of visitors (and thus intensity of negative impact) differs by alternative. Stream-access recreation sites are expected to have some degree of negative impacts from recreation, but generally if recreation effects remain within designated recreation polygons, we anticipate no reach-wide effects to riparian and aquatic habitats because recreation sites will be planned around armored banks and well-designed trails.

Of greater concern are impacts to refugia areas. The higher the number of visitors, the more crowded visitors will be within recreation sites. Crowding increases the chance the visitors will be displaced, leaving recreation sites and recreating in refugia areas (Hall and Shelby 2000; Manning and Valliere 2001). The higher potential for crowding thus results in an increase in the level of impacts to refugia (i.e. creation of social trails and bare area) in areas that are not prepared for recreation with designed trails and planned creek access.

Crowding can be predicted not only by the total number of people per alternative, but also at the reach level based on the number of parking lots at a site. Alternatives with relatively low visitor density where refugia impacts are not expected are Alternatives A, B, and C. Alternatives D, E, and F all have higher average crowding values that may result in refugia impacts. Negative impacts to habitat in alternatives D, E, and F should still primarily occur within the designated recreation sites which at most comprise more than 10% of the total stream length in Alternatives E and F. However, the unknown but possible impacts to refugia areas (such as water quality degradation, social trails, or in-channel sediment redistribution, see Recreation effects section above) will likely depend on the number of people at one time and consequent visitor density in the selected alternative. Alternatives E and F have both a large amount of stream length designated in recreation polygons. This larger area that is expected to be impacted by recreation, combined with the higher potential for negative impacts to refugia, will all occur in the area of the stream with high seasonal recreation use that is comparable in visitor counts to prior unrestricted use (Rotert 2012).

Potential recreation impacts, therefore, differ considerably between alternatives. Table 2-5 summarizes potential impacts to aquatic resources. Three alternatives permit fewer people recreating in the creek than current management (Alts B, C, and D) while Alternative E nearly doubles current capacity and Alternative F more than triples current capacity. Alternative E and F in particular focus many visitors in the reach between Irving and the waterfall, with visitor densities of All action alternatives change the current management style somewhat in that there will be designated parking at specified dispersed recreation sites and adaptive management will attempt to contain recreation impacts within dispersed recreation sites in order to create refugia between recreation sites. Alternatives B-E provide specified site parking, which will encourage visitors to recreate at their designated parking spot. Alternative F and C differ in that the majority of visitors will begin their day at the Cactus Flat parking lot and will disperse to the creek by foot, so visitors in that alternative may be more likely to enter refugia due to the fact that they don't start at a designated recreation site and that the visitor density is much higher.

Table 3-73. Scores ranking impacts[1]

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Disturbed Area	4	2	1	3	5	6
Potential for Water Contamination	4	1	2	3	5	6
Recreation stream access	3.5	3.5	2	1	6	5
Non-native Fish Introduction	3	1	2	4	5	6
Potential for Affected Refugia	2	1	3.5	3.5	5	6
Score	**16.5**	**8.5**	**10.5**	**14.5**	**26**	**29**

[1]Large numbers represent more negative impact. For example, alternative F is ranked 6 for Potential for Affected Refugia, meaning it is the alternative most likely to impact refugia).

Finally, table 3-73 presents a numerical comparison ranking environmental impacts from all alternatives. The greater the potential negative impact, the larger the ranked value in the table (1 = lowest impact, 6 = greatest impact, and average values for tied rankings). Thus the alternative with the lowest cumulative score has lowest potential to negatively impact to aquatic species and aquatic habitat. Alternatives that are tied for a trait are given the average tied value (i.e. Alts A and B have the same recreation stream length, so the average of scores 3 and 4 is 3.5). The Disturbed area ranking is based on the number of disturbed riparian acres. This rank encapsulates effects to riparian habitat (such as bare area) and aquatic habitat (such as sediment input). The potential for water contamination is based on the number of visitors (people at one time) and ranks impacts according to the potential for water contamination by such sources as personal care products and human and pet waste. Recreation stream access is based on the length of stream within dispersed recreation areas and ranks the area that may be impacted by recreation without necessarily requiring restoration. The Potential for Impacted Refugia ranks the likelihood that crowding would occur based on visitor densities within recreation sites resulting in people leaving recreation sites and impacting refugia (i.e. creation of social trails, bare area). Alternatives B, C, and D are fairly similar in their potential to impact aquatic species and habitat, and these alternatives are expected to have lesser impacts than current management. Alternatives E and F also rank similarly and have a greater potential to negatively impact aquatic habitat and species than the No Action alternative.

Even though there will be direct and indirect effects to special status species and their habitat and the level of these effects differ among alternatives, overall *it is the determination that alternatives B-F would not result in enough segment-wide disturbance to constitute adverse effect or degradation*. As a result, aquatic resources will be protected and/or enhanced under alternatives B-F. This is because 1) disturbed areas are small when compared to the overall undisturbed area, 2) BMPs and other guidance will protect resources, and 3) monitoring will occur before and during incremental increases in capacity are implemented in alternatives D, E and F. With the no action alternative, effects to species could occur but would be unknown to managers because there would be no formal monitoring plan, no CRMP, nor forest plan amendments *resulting in adverse effect or degradation of wildlife populations and their habitat.*

Heritage Resources

This section analyzes heritage resources in the context of the CRMP alternatives. As conceptualized in this analysis, the heritage resource is not a single phenomenon. Heritage resources consist of both the Fossil Creek Cultural Outstanding Remarkable Value (ORV) and National Register of Historic Places-eligible historic properties. Historic properties are also referred to in this report as archaeological sites. This distinction is maintained throughout the report but is particularly relevant to Scales of Analysis, Spatial and Temporal Context for Effects Analysis, Management Approach for Traditional Cultural Practices, Management Approach for Heritage Resources, and Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV and Heritage Resources Affected Environment sections.

This analysis has a dual function. In addition to informing the Fossil Creek CRMP/EIS, it functions as the primary document for CRMP/EIS management undertaking National Historic Preservation Act Section 106 compliance. As such, it contains the necessary information and rationale for Heritage Resources “no effect” or “no adverse effect” determinations. A confidential appendix in the specialist report contains an overview and individual Heritage Resources figures. Additional background information for the heritage resources analysis can be found in the specialist report.

Methodology

For Fossil Creek, the heritage resource consists of the Cultural ORV and Heritage Resources. The Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV is defined as Native American traditional cultural practices and ceremonies together with associated sites and spaces in the Fossil Creek area. A healthy Cultural ORV is defined as the Fossil Creek area looking, sounding, and feeling as natural and untrammeled as possible. Heritage Resources are defined as historic properties that are National Register-Eligible (as per the National Historic Preservation act of 1966, as amended, and through promulgated regulations) that intersect with the CRMP alternative disturbance categories. The Fossil Creek area generally, specific places within the Fossil

Creek area, information from cultural practitioners, and observations of physical phenomena across the landscape are all relevant to the analysis. Given this, the Heritage Specialist Report methodology derives from the analytical necessity to utilize multiple data sources and different scales of analysis.

Data Sources

The analysis includes utilization of the results of consultation with traditional cultural practitioners (the Cultural ORV), observations of physical phenomena (components of the Cultural ORV and Heritage Resources), and GIS spatial analysis of ongoing and proposed disturbance to Heritage Resources. Another factor that needs to be taken into consideration is that, phenomenologically, aspects of the Cultural ORV are renewable resources and can become degraded and then improve through time. In contrast, Heritage Resources are non-renewable resources that once they are disturbed cannot be renewed.

The following data sources are utilized in the Fossil Creek Heritage Specialist Report:

- New Tribal Consultation
- New archaeological survey
- Review of previous archaeological survey
- Review of previous Tribal Consultation
- Review of previous research

Tribal Consultation

Tribal concerns regarding the presence of areas of traditional cultural importance and potential effects to those places were gathered directly from the tribes through consultation. Tribal consultation is best carried out through direct face-to-face meetings between federally recognized tribes and the Federal government. Other components of tribal consultation may include sharing of information through letter carried mail, email, and follow-up telephone calls, which supplement the face-to-face meetings. Tribal consultation related to this project is described in detail in Chapter 4.

Scales of Analysis

Heritage Specialist Report analysis takes place at three different scales. First, regarding the Cultural ORV, analysis take place from the scale of the Fossil Creek area as a whole and utilizes traditional cultural practitioner information. The Cultural ORV has specific named places, numerous Heritage Resources are present, and the proposed alternatives have specific disturbance footprints. Given this, analysis is undertaken at the scale of total combined Heritage Resources area as impacted by proposed alternative disturbance footprints. Third, to assess adverse effects, analysis takes place at the scale of the individual Heritage Resource as impacted by individual proposed alternative disturbance footprints.

Spatial and Temporal Context for Effects Analysis

Cultural ORV

For the Fossil Creek CRMP, Heritage Resources consist of the Cultural ORV and Heritage Resources. This is primarily a scalar distinction. Writ large, the Cultural ORV has to do with the whole Fossil Creek area. At a finer-grained scale, Heritage Resources are National Register of Historic Places – eligible properties that overlap with the spatial footprints of the CRMP alternatives.

Regarding direct/indirect and cumulative effects spatial context, the boundaries of Fossil Creek writ large as it relates to the Cultural ORV are fuzzy and depend on what Tribal consultants say they are. Since the analysis of the Cultural ORV depends solely on Tribal consultation, this fuzziness is not an analytical problem. The Fossil Creek Cultural ORV temporal context consists of the duration of the CRMP and includes both direct/indirect and cumulative effects.

Heritage Resources

The direct/indirect and cumulative effects spatial context for Heritage Resources is clearer and is codified in Federal Regulations promulgated for the National Historic Preservation Act.

Confidential Appendix Figure 4 depicts the CRMP alternative disturbance footprints in relation to Heritage Resources. Alternative disturbance footprints are areas where ground disturbance may occur, as well as other direct and indirect effects that may affect Heritage Resources. In this sense, the alternative disturbance footprints equate to an area of potential effect (APE), defined in 36 CFR 800.16(d) as the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties if such properties exist (historic properties = Heritage Resources).

In accordance with 36 CFR 800.11, the spatial analysis for potential effects to historic properties includes the footprints/APEs for all proposed alternatives within the Fossil Creek project area. The temporal analysis for potential effects to historic properties include both the current status of historic properties potentially effected and an analysis of the cumulative effects the proposed alternatives will have to those historic properties. Effects to historic properties are permanent and irreversible.

Direct/Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects are immediate and reasonably foreseeable impacts to historic properties caused by the CRMP alternatives. Direct effects occur at the same time and place and are caused by an aspect of an alternative that alters the National Register of Historic Places (NRHP) - qualifying characteristics or integrity of historic properties and/or associated environmental setting. Indirect effects occur at a later time or are farther removed in distance and time and are caused by aspects of the alternatives that alter the NRHP- qualifying characteristics or integrity of historic properties and/or associated environmental setting.

The temporal boundaries for analyzing direct effects exist throughout the life of the CRMP because implementation of the proposed alternatives have the potential to directly affect historic properties.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects to historic properties include the entire Project area. The temporal boundaries for analyzing the cumulative effects exist for the entire duration of the Project and can extend beyond the completion of the project.

Analysis Indicators and Measures

Resource indicators and measures are defined from the perspective of the Cultural ORV and Heritage Resources. The Cultural ORV indicator and measure consists of what traditional cultural practitioners say about it. Related Cultural ORV indicators and measures consist of the Fossil Creek's river values (water quality, free-flowing condition and other ORVs). If the status of Fossil Creek river values and other ORVs changes then the Cultural ORV changes as well. This is implicit in the desired condition for the Cultural ORV: that the Fossil Creek area looks, sounds, and feels as natural and untrammeled as possible, while allowing for some concentrated recreational use at compatible locations along middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks.

In National Historic Preservation Act parlance, Heritage Resources are the same as historic properties. The Heritage Resources measure is defined as a measure of potential effects to historic properties. An "adverse effect", as defined in 36 CFR 800.5, is found when an undertaking may alter, directly or indirectly, any characteristics of a historic property that qualify the property for inclusion in the National Register of Historic Places (NRHP) in a manner that would diminish the property's integrity of location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the

undertaking that may occur later in time, be further removed in distance or be cumulative. Mitigation is a process to remedy or offset adverse direct and indirect effects through treatment measures agreed upon through consultation with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO), and local governments. Appropriate mitigation through consultation with SHPO, THPO, and local governments is considered a "no adverse effect", but is still considered legally a negative impact to the overall integrity and value of the historic property.

A finding of "no adverse effect", as outlined in 36 CFR 800.5, is when the undertaking's effects do not meet the criteria of adverse effect or the undertaking is modified or conditions are imposed to appropriately mitigate adverse effects. Consultation with SHPO and THPO is required on all no adverse effect determinations to ensure consistency with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines, to avoid adverse effects.

Table 3-74. Analysis indicators and measures used in the heritage resources analysis

Resource Element	Resource Indicator	Measure
Cultural ORV	Whether the Fossil Creek area looks, sounds, and feels as natural and untrammeled as possible, while allowing for some concentrated recreational use at compatible locations along Middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks.	Feedback from traditional cultural practitioners
Cultural ORV	People in the Fossil Creek corridor	Persons at One Time (PAOT)
Cultural ORV	Disturbed area	Acres of ground disturbance
Cultural ORV	Disturbed area restored	Acres of restoration
Heritage resources	Disturbance within heritage resource sites	Presence of disturbance within heritage resource sites
Heritage resources	Adverse effects to heritage resources	Presence of adverse effects to heritage resources

Affected Environment – Baseline and Existing Conditions

Cultural Background

Generally, Fossil Creek is located within the geographical area assigned to the Southern branch of the Sinagua culture (however, see below). The Sinagua name was created in 1939, by Harold Colton, for the prehistoric people who lived in the Flagstaff and Verde Valley areas (Colton 1946:16). Much archaeological work has been conducted within the Northern Sinagua area. Fewer archaeological excavations have been conducted in the Southern Sinagua region, and most of that has been along the Verde River, northwest of the current project area.

Several Paleoindian spear points have been found in the Verde Valley, although no sites attributable to the Paleoindian period have been found. These sites may be present but deeply buried along the Verde River (Macnider et al. 1991:5; Pilles 1987). The Archaic period saw people hunting and gathering in the area (Macnider et al. 1991:5). Maize was likely grown in fields along the Verde River and nearby streams, including Fossil Creek, during the Early Agricultural period.

The bulk of the prehistoric material known from the Fossil Creek WSR corridor dating to the Early Agricultural Period is ascribed to one or the other of two central Arizona archaeological traditions—Hohokam of central and southern Arizona and Southern Sinagua (see above). There have not been any formal archaeological excavations of any sites within the corridor, so it is difficult to assign sites from the Early Agricultural period to either of these cultures with any certainty. The earliest agricultural period sites date to the AD 600s. These were pithouse

settlements situated in areas where wild plants and animals could be obtained and where land suitable for farming was nearby. Both Hohokam and Southern Sinagua pottery is present at these sites.

By the AD 1100s, small pueblos were being constructed, gradually increasing in size. The Honanki phase (AD 1125-1300) saw numerous masonry pueblos and cliff dwellings in the Verde Valley (Pilles 2015). Eventually, a recognizable cultural boundary developed sometime around 1300 AD in roughly the same location as Fossil Creek. To the north, the settlements along the Verde River appear to have been tied, related, or allied with those in the Middle Verde Valley. For the most part, these sites are assigned to the Southern Sinagua cultural tradition. To the south, the sites appear to have been part of a cultural development that spread east and west on both sides of the Verde River from the Agua Fria River to the Tonto Creek divide, and known informally as the "Verde Hohokam".

The Tuzigoot phase (AD 1330-1400) saw population aggregation at a small number of large settlements along the Verde River and its smaller tributaries including Fossil Creek. Defensive features and the placement of sites on the tops of hill also occurred (Pilles 2015). Sometime shortly after AD 1400, people left the area, many apparently heading north—ancestors of the Hopi.

The Yavapai, a Yuman-speaking tribe, arrived in the Verde Valley in the AD 1300s or 1400s. They were hunter-gatherers who moved about in search of game and wild plants. The Tonto-Apache arrived sometime between the AD 1200s and 1450.

The Verde Valley may have occasionally been visited by the Spanish and Mexican military. The area became part of the United States after the War of 1846. In the early 1860s, explorers, miners, and the U.S. military began to encroach on traditional Yavapai and Apache lands. Hostilities between Native Americans and the new arrivals increased. In 1872, General Crook took Yavapai and Apache to the Rio Verde Reservation. About 1,500 people were moved in March 1875 to San Carlos, where they were forced to stay until 1900. However, some families hid out along Fossil Creek and never went to San Carlos (see below). Later, about 200 Yavapai and Apache returned to the Verde Valley. The U.S. government passed legislation in 1934, to create a combined Yavapai-Apache Nation.

The early 1900s saw construction of the Childs and Irving hydroelectric generating plants, including dams, a flume, an aqueduct, and roads along Fossil Creek. Temporary worker camps were constructed, and after work was completed in one area, they moved to the next work site. After completion of the projects, caretaker residences were constructed, with trails and roads maintained to allow access for mail, goods, and repair of facilities.

The Childs-Irving Hydroelectic Plants were named a Historic Mechanical Engineering Landmark in 1971, and were added to the National Register of Historic Places (National Register) in 1991. The facilities were carefully documented before they were decommissioned in 2005 by the Arizona Public Service Company. The dam, Irving Power Plant, and several miles of flume were subsequently removed to restore the original flow of Fossil Creek. The iron aqueduct or siphon pipe was left in place.

Previous Historic and Heritage Resource Inventory

The FCWSRC project area totals 6,371 acres. To date, 1,587 acres (24.91%) has been inventoried. All of the areas potentially impacted by the action alternatives have been surveyed, many of them more than once. Inventories that covered terrain potentially impacted by the action alternatives can be grouped into three categories.

First are those focused on the Childs and Irving Hydroelectric System and related infrastructure. In 1989, Archaeological Consulting Services, Ltd. personnel surveyed the Arizona Public Service Company Childs and Irving Plant facilities along Fossil Creek. They recorded 45 sites within Coconino National Forest and one site within the Tonto National Forest (Macnider et al. 1991). Logan Simpson Design, Inc. personnel surveyed 6.42 miles of the Arizona Public Service NW-1 (Childs to Irving) Transmission Line (a total of 38.9 acres) in Yavapai and Gila Counties in 2009. They recorded 17 sites and three isolated occurrences within the Coconino National Forest and four sites within the Tonto National Forest (Walker et al. 2014).

Second is a survey focused on the Glen Canyon to Pinnacle Peak High Voltage Transmission Lines. In 2011 and 2012, EPG, Inc. personnel surveyed the Glen Canyon to Pinnacle Peak #1 and #2 transmission lines rights-of-way prior to a planned vegetation maintenance project. Most of this project was located within the Coconino National Forest. They identified 142 archaeological sites, 55 previously recorded and 87 newly recorded (Swanson et al. 2013).

Third are those focused on various USFS management activities in the Fossil Creek area. In 2004, for a HAZMAT testing project related to the decommissioning of the Childs-Irving Hydroelectric Power Facility, Peter Pilles of the Coconino National Forest reassessed two sites initially recorded by Macnider et al. (1991) [Pilles 2004]. In 1998, Lawrence Larson and Richard Boston monitored the removal of structures at the Crismon Homestead site, AR-03-04-01-1079 (CNF) [Larson and Boston 1998]. In 2004, James Quinn and Sharynn-Marie Blood of Coconino National Forest surveyed 187 acres within Coconino and Tonto National Forests associated with campsites. They recorded six new sites and four previously recorded sites (Quinn and Blood 2006). In 2010, Travis Bone of the Coconino National Forest examined 11 locations within Coconino and Tonto National Forests prior to the implementation of interim management measures for the Fossil Creek area. He located 10 sites, four of which were new (Bone 2010). In 2017, Ted Neff of the Coconino National Forest reassessed two previously recorded sites (Bone 2010) for proposed vault toilet installation (Neff 2017). Finally, in 2017 for the Fossil Creek Comprehensive River Management Plan/Environmental Impact Statement, personnel from Desert Archaeology, Inc., surveyed approximately 1,169 acres on Coconino National Forest and Tonto National Forest land to re-document known archaeological sites and to locate new archaeological sites within and adjacent to the project area. In all, 57 sites were examined (and five other previously identified sites were combined within these sites). Of these, 36 were previously identified sites and 21 were newly identified sites (Thiel 2018, forthcoming).

Traditional and Contemporary Cultural Uses

The domestic occupation of the Fossil Creek WSR corridor by the Western Apache and Yavapai began several centuries ago and extended into the 1950s. The archaeological evidence is not conclusive, but some researchers have suggested that the Yavapai entered the Verde Valley as early as the 13th Century (Pilles 1981). The details surrounding the arrival of the Apache are equally uncertain, but the Apache likely had entered the area by 1500 AD (Gilpin et al. 2004; KenCairn and Randall 2007). Both groups have occupied portions of Fossil Creek at least intermittently since their arrival in the Verde Valley. Certain Apache and, to a lesser extent, Yavapai clans consider Fossil Creek to have been a central part of their home territory from the beginning of memory (Randall et al. 2009). Although both the Yavapai and Apache lived a nomadic lifestyle, the Apache in particular developed farmland along Fossil Creek and would have returned seasonally to plant and harvest crops.

The Apache likely would have been in residence along Fossil Creek when the first Europeans made their way into what is now Arizona, although the early Spanish explorers never set foot in Fossil Creek. The rough terrain surrounding Fossil Creek initially would have insulated the WSR corridor from the incursion of Anglo settlers that began streaming into the Verde Valley in the 1860s. Life along Fossil Creek probably remained largely unchanged until the late 1860s and 1870s, when the U.S. Cavalry pursued an active campaign against the Yavapai and Apache throughout Central and Southern Arizona.

Everything changed in just a few short years once the U.S. focused their efforts on subduing the Yavapai and Apache. By 1873, only a few Apache families were living in secrecy along Fossil Creek, remaining hidden from government troops. Some of these families survived through the entire Reservation Period (approximately 1871 until 1900) without ever being sent to San Carlos (Pilles 1981; Randall et al. 2009). These few individuals, who were able to continue living in the traditional way, provided an unbroken cultural link between the people whose traditional religious practices predated contact with Anglo settlers and those who were either forced or born onto reservations and subjected to practices aimed at erasing their traditions during the roughly 30 years of incarceration. It would be impossible to measure the importance of the individuals who spent this period living isolated along Fossil Creek in renewing the traditional culture among those who eventually returned from San Carlos.

Once the threat of Indian raids had been eliminated, settlers started to explore Fossil Creek. However, the geology of Fossil Creek provides little arable land, and there is scant evidence that non-Indians spent much time along Fossil Creek in the 1800s. An isolated parcel of land was homesteaded in 1906, but very little is known about how the homesteaders fit into the larger history of Fossil Creek.

The seclusion of Fossil Creek changed in 1900. This is the year Lew Turner filed for water rights in Fossil Creek. This set the stage for the long process that eventually resulted in the development of the Childs-Irving Power System (Effland and Macnider 1991). The rough topography of the area has always made Fossil Creek an isolated place, even to this day, but the construction of the power plant brought with it a bustle of activity that would continue for more than a century.

The construction of Childs-Irving played a critical role in the return of the Yavapai and Western Apache to Fossil Creek. Both the Yavapai and Apache were beginning to leave the reservations at San Carlos, Fort McDowell, and elsewhere in the early 1900s. Many returned to familiar places along the Verde River and the Mogollon Rim, only to find that settlers had taken over their traditional homelands. Others left the reservations in search of wage jobs. This sudden flood of Indians in need of employment and space where they would be allowed to set up camps for their families coincided with the need for huge amounts of manual labor to construct the Childs-Irving system. Many Apache and Yavapai found jobs along Fossil Creek building the power system. Some of the Apache brought their families and stayed, either doing maintenance on the power generating system after initial construction was completed or farming along Fossil Creek.

The construction of the power system provided employment for a large number of Apache and Yavapai who were just moving off the reservation at San Carlos and trying to make new lives in the face of huge changes that had occurred on their traditional lands during their 30-year absence. It provided an economic support system located within a familiar landscape filled with spiritual meaning for these families to rebuild their lives after decades spent incarcerated on reservations. Whether they worked for the power company or not, the families newly returned from the reservations would have reconnected with the relatives who managed to survive along Fossil Creek through the Reservation Period. The return of people to their traditional territory, rich with mythical significance, and a reconnection with traditional practitioners who escaped the effects of reservation life likely reinvigorated traditional religious practices.

By the mid-1950s, much of the work in the power plants had been automated, and very few Indians remained on the payroll. Other Apache had also abandoned their farms, and families moved back onto reservation lands or closer to towns where wage jobs were easier to find. The last of the Apache camps were bulldozed by APS in the early 1950s, thus ending the long history of Apache and Yavapai residential occupation of Fossil Creek forever (Randall et al. 2009).

Fossil Creek played a significant role in two interconnected stories that were occurring in the first half of the 20th century. Unfortunately, there is very little visible evidence left to attest to the fascinating history of hydropower generation that has played out along Fossil Creek over the past 100+ years. Much of the power generating system was removed during the decommissioning process. Traditional Apache camps left little permanent archaeological evidence, and the sites in the Fossil Creek WSR corridor are no exception. However, Fossil Creek continues to be recognized as a place of special religious importance to many traditional Apache and Yavapai (KenCairn and Randall 2007; Krajl and Randall 2009; Randall et al. 2009). Many stories continue to “live” along Fossil Creek that are tied to specific places within the corridor.

It is impossible to unravel the sacred from the secular when considering the traditional cultural use of any landscape by Indian tribes. However, Fossil Creek (Tú Dotł’izh, ‘Blue Water’) and the canyon it lies in clearly rise to the highest level of cultural importance for local tribes (Vincent Randall and Chris Coder, personal communication, March 30, 2011; Wally Davis Jr., personal communication to Noni Nez, November 29, 2011; Bob Bear, personal communication, March 12, 2013). The Apache and Yavapai occupied the Fossil Creek WSR corridor from sometime in prehistory through historic times, and the project area falls within the traditional territories of the *Dilzhé’é*, as well as a few Yavapai clans. The term *Dilzhé’é* is preferred by many Apache over the more common ‘Tonto Apache’ used to refer to those Western Apache who traditionally lived between the San

Francisco Peaks and the Pinal Mountains and between the Verde River and Canyon Creek (KenCairn and Randall 2007). Several *Dilzhé'é* clans, some intermarried with Yavapai, are known to have inhabited portions of the project area or kept farms there (North et al. 2003; Vincent Randall and Chris Coder, personal communication, March 30, 2011). Although specific sites with evidence of Apache or Yavapai occupation are poorly represented in the current archaeological inventory, several specific locations are known to have been inhabited by Apache families during the early 1900s. In addition, the *Dilzhé'é* maintain many place names associated with features in and adjacent to the project area (North et al. 2003; Vincent Randall and Chris Coder, personal communication, March 30, 2011).

Fossil Creek plays a prominent role in the mythologies of both the Western Apache and Yavapai, including some creation stories (KenCairn and Randall 2007; Krajl and Randall 2009). Apache elders have identified several locations within the corridor as being "holy", that is significant beyond that connoted by "sacred" because they are places where humans interacted directly with God/the Creator (Vincent Randall and Chris Coder, personal communication, March 30, 2011; Bob Bear, personal communication, March 12, 2013; Vincent Randall, personal communication, June 2, 2015). Both the Yavapai and Apache continue to conduct ritual visits to Fossil Creek, and one contemporary Apache "Holy Ground" is within the project area. The tribes have clearly demonstrated that Fossil Creek has exceptional traditional cultural value to various Western Apache and Yavapai groups and continues to play an important role in their traditional practices and spiritual wellbeing (Randall et al. 2009).

Cultural ORV and Heritage Resources Conditions

Site condition throughout the corridor is highly variable. Fossil Creek Bridge (AR-03-04-01-740), which is one of the three National Historic Register listed sites, is in good condition but has recently been determined to be under-engineered. This bridge will likely need to be replaced if it is to remain open to vehicular use. The other two properties listed on the National Register comprise the Childs and Irving Power Generating System (AR-03-04-01-011 and -012). Arizona Public Service (APS) decommissioned and almost entirely removed the majority of these two sites in 2005-2010 as part of the agreement to surrender its FERC hydropower license and restore Fossil Creek to full flows. Any components of the system left on the landscape have lost their integrity (except for the Childs Power Plant, which is located outside the project area). Conditions of the agreement also specified that APS would provide some interpretation of the power generating system. There is an expectation by the State Historic Preservation Officer and other interested parties that the Forest Service will maintain this interpretation, as well as provide additional interpretation both within and outside the project area.

Many of the archaeological and cultural sites along Fossil Creek have been impacted by a variety of activities over more than a century of Anglo use and development along Fossil Creek. The original construction of the power system and subsequent maintenance and upgrading of the system throughout much of the 20th century was done without regard to any prehistoric or contemporary cultural sites, so construction activities have heavily impacted or destroyed sites throughout the length of the power system. Subsequent to the initial construction phase, APS made occasional significant modifications to the system that affected the integrity of historic sites associated with the power system itself. For instance, APS removed the house at Sally May and the house at the dam when the employees who lived at these locations were made obsolete by automated monitoring equipment. Another notable event occurred sometime in the early to mid-1950s, when APS bulldozed and "cleaned up" the ad hoc community of housing that the many Apache who worked as maintenance workers on the power system had built for their families on the flat terraces upstream of the Irving Power Plant. It is also apparent that either APS or WAPA intentionally removed most of the historic features at the Purple Mountain camp sometime in the past, probably in the 1980s.

Archaeological sites within the corridor have also been subject to typical impacts associated with public visitation and recreational use, such as artifact collecting and targeted looting. The larger, easily recognized pueblos, including sites AR-03-04-01-1233 and -01-1234, have been heavily impacted by past pot hunting activities, even in relatively inaccessible areas of the canyon. Several of the most obvious sites have suffered substantial losses of integrity. In contrast, most of the smaller sites located on the steep slopes of the canyon have likely escaped detection by forest visitors and are probably nearly undisturbed. Sites that are not made obvious by standing architecture, including site AR-03-12-04-2070, also appear to remain largely unmolested.

Fossil Creek and the terraces immediately adjacent are particularly attractive and have been subject to concentrated recreational use for decades, particularly in the middle stretch of Fossil that is accessible by road (FR 708 and 502). There has always been a minor but consistent use of the flat terraces along the roadways near the creek for winter camping, largely attributable to the popularity of the area for whitetail deer and javelina hunting. Fossil Creek has also long been popular among locals for summer recreation (actually for centuries). Even prior to the return of full flows in 2005, there was enough perennial flow in the creek downstream of Irving to maintain large, blue pools and attractive riparian zones. However, most recreational use was geographically limited. Evidence of recreational use was not widely evident outside of a few popular locations along the roads in middle Fossil and, to a lesser extent, at Fossil Springs. Much of this recreational use was limited to dispersed day use and camp sites within the riparian flood zone.

The generally unmanaged recreational use prior to restoration of full flows to Fossil Creek in 2005 had caused some incidental disturbance at archaeological and known Apache cultural sites. The archaeological sites most heavily affected by recreation prior to restoration of full flows were located in the areas currently known as Fossil Springs, the Lewis Trailhead, Tonto Bench, Old Corral, the site of the former Sally May House, and Purple Mountain. All these sites were historic period or multicomponent sites that had been used on a regular basis as parking and/or camping areas due to their proximity to the creek and the fact that they had relatively flat areas and/or offered shade. The surface of these sites has been heavily disturbed by recreational use, some to the point of having lost most or all of their potential to yield archaeological data. Evidence of human use was not widely evident at sites outside of popular recreation locations located near FR 708.

Media coverage after restoration of full flows increased recreational day use, particularly at the Waterfall and Fossil Springs, and overnight recreational use of the entire corridor. Impacts to heritage resources had steadily increased prior to Congressional designation of the corridor in March of 2009, but the tribes had not indicated that recreational impacts were adversely affecting culturally significant places or their use of those places prior to designation.

Baseline Cultural ORV and Heritage Resources Conditions within the Corridor at the Time of Designation in March of 2009

Visitor use in 2009 is described in the *Affected Environment Common to All Resources* section above. There was limited management of recreation in the area during this time, and many visitors acted with a notable lack of stewardship ethic. As a result, recreation related impacts quickly increased to a point that exceeded levels acceptable to the tribes. In December of 2009, the Yavapai-Apache Nation informed the Forest Service that visitation and resulting impacts were unacceptably high, particularly at certain locations (e.g. Lewis Trailhead and the Waterfall) [Randall, personal communication 2009]. The specific issue of crowding was reinforced in the summer of 2011, when Apache elders reported that there were “too many” people at Fossil Creek (Vincent Randall and Bob Bear, personal communication, June 7, 2011). Based upon this, recreational related impacts were presumably at an acceptable level the year before designation in 2008 but exceeded that level in the following year when designation occurred.

Traditional practitioners had access to natural resources and most places along the corridor without conflict prior to designation. There were no facilities within the corridor at the time of designation to devalue the visual setting for traditional cultural practitioners. Archaeological sites associated with the historic occupation of the Apache and Yavapai were not being substantially degraded by recreational activities.

Tribal interest in cultural interpretation of Fossil Creek was also known at the time of designation. The Yavapai-Apache Nation began expressing an interest in having interpretative signs installed to explain the importance of Fossil Creek during the FERC license surrender planning process, several years prior to designation, and have consistently requested interpretation since that time. No signs had been installed at the time of designation, and none focused on tribal values have been developed since then.

Cultural ORV and Heritage Resources Conditions from Designation through 2013

As described in the *Affected Environment Common to All Resources* section above, the level of recreation continued to increase rapidly after the wild and scenic designation in the spring of 2009. The Western Apache informed the Forest Service that recreational impacts were adversely affecting cultural values within the corridor after the 2009 summer high use season. Crowding continued to be an issue, as Apache elders returning from Fossil Creek in the summer of 2011 reported that there were "too many" people at Fossil Creek (Vincent Randall and Bob Bear, personal communication, June 7, 2011). Some types of recreational behavior, such as drinking, cliff jumping, and swimming were perceived as being disrespectful at several locations particularly sacred locations. Several other resource areas, including Recreation, also observed deteriorating conditions after designation. The Forest Service determined that the density of vehicles on the roads was creating a threat to public safety and that the impacts resulting from the visitor impacts were degrading numerous resources.

Seasonal capacity controls and other interim measures were implemented in 2011 as described in the *Affected Environment Common to All Resources* section to slow or reverse this downward trend. As result of interim measures, the YAN has noted a considerable improvement in conditions from their worst in 2011.

Visitor use through 2013 is described in the described in the *Affected Environment Common to All Resources* section above. As a result of increasing visitation, recreation-related impacts quickly increased to a point that exceeded levels acceptable to the tribes. In December of 2009, the Yavapai-Apache Nation informed the Forest Service that visitation and resulting impacts were unacceptably high, particularly at certain locations (e.g. Lewis Trailhead and the Waterfall) (Randall, personal communication 2009).

Bare ground presents a potentially serious problem because it disrupts the natural setting of the Cultural ORV, and it leads to increased erosion within Heritage Resources. The bare ground monitoring described in the *Affected Environment Common to All Resources* section indicated that the potential for these impacts increased through 2011 and subsequently began to decrease.

The preceding discussion demonstrates that recreational use has grown rapidly and is resulting in substantial increases of impacted areas. Existing recreation areas have been greatly expanded and many new recreation and camping areas have been created by visitors over the past decade. The effects to archaeological and traditional cultural sites presumably increased in concert with increasing recreational use after restoration of full flows and the resulting surge of publicity regarding the riparian recreation opportunities available along Fossil Creek. Social media continues to drive an ever-increasing demand for water based recreation in Fossil Creek.

Interim management, including capacity controls, has resulted in overall improvements in several environmental conditions. The ubiquity of trash and human and pet waste has declined, something that members of the YAN have commented on. The total amount of denuded area in the Fossil Creek corridor decreased 19% between 2011 and 2012, the first decrease since data collection began in 2002. Vegetation became reestablished on a total of 3.69 acres of bare ground from 2011 to 2012. The total denuded area in open campsites (above the historic dam and downstream of the bridge) decreased by 8% since 2011, with 0.34 acres of ground becoming reestablished with vegetation. Total denuded area in closed campsites (between the historic dam and the bridge) decreased by 40% since 2011, with 0.76 acres of ground becoming reestablished with vegetation (Rotert 2012). There has been a noticeable reduction in the number and size of roadside pullouts. Improvements to the Waterfall Trail and selected creek access trails in Middle Fossil have reduced the total denuded area from social trails. While capacity control and camping restrictions have improved vegetative cover, part of that recovery is certainly attributable to optimal monsoon conditions combined with the numerous area closures in 2012.

Existing Cultural ORV and Heritage Resources Conditions, 2016 to Present

Cultural ORV and Heritage Resources conditions from 2016 to present have improved due to two factors. First, beginning in 2016 and continuing to the present, a reservation system has been instituted running from April 1st through October 1st. Under this system a maximum of 148 vehicles are allowed along Fossil Creek. This threshold is based on the number of marked parking spaces available at the various recreation sites along the creek. Second,

in the Spring of 2017 eight vault toilets were installed at Mazatzal, the Junction of 502 and 708 roads, Homestead Upper Loop, Homestead Lower Loop, Fossil Creek Bridge, Tonto Bench, Irving, and the Waterfall Trailhead.

From April 1st through October 1st, the reservation system has resulted in a smaller number of visitor vehicles (equating to a smaller number of visitors) parking in marked spaces within established recreation areas. The result has been a smaller number of visitors spread more evenly throughout the Fossil Creek corridor. Phrased another way, there has been a lessoning of visitor congestion. Fewer vehicles parked in established spaces and fewer visitors spread more evenly throughout the corridor has also led to a decrease in the amount of denuded area within the corridor. A more stable erosional environment with respect to Heritage Resources is a positive outcome from a decrease in the amount of denuded area. The visual impression is one of more vegetation. The presence of vault toilets has resulted in a decrease in the amount of human waste and trash along Fossil Creek. The overall results and impressions are fewer visitors more evenly spread (less congestion) throughout the corridor, a trend toward less bare earth/soil and increasing vegetation, and less trash and human waste.

From the perspective of traditional cultural practitioners, a healthy Cultural ORV consists of Fossil Creek looking, sounding, and feeling as natural and untrammeled as possible. The Yavapai – Apache Nation was consulted and approved the vault toilet locations (Yavapai-Apache Nation Tribal Consultation, February 9, 2017). The Yavapai – Apache Nation has also told the USFS that the reservation system and the vault toilet installation have improved the condition of the Cultural ORV to an acceptable condition (Yavapai-Apache Nation Tribal Consultation, June 26, 2017). In sum, the Yavapai – Apache have stated that the Cultural ORV was in a reasonably healthy condition prior to decommissioning and restoration of full flows in 2008. From 2008 until the implementation of the reservation system in the Spring of 2016 and the installation of vault toilets in the spring of 2017, the Cultural ORV was in a generally degraded condition despite some USFS interim measures and capacity controls. Since the Spring of 2016, the reservation system coupled with vault toilet installation and other interim measures have improved the health of the Cultural ORV to an acceptable level.

The Cultural ORV is defined from the point of view of traditional cultural practitioners, principally the Yavapai – Apache Nation, and any changes to its condition (i.e. Adverse Effect, Degradation, Enhancement) are defined from their point of view as well. Phenomenologically, the Cultural ORV is a renewable resource and can be degraded and subsequently enhanced by management actions. Heritage Resources are National Historic Preservation Act (NHPA) – eligible properties and adverse effects to them are defined as per regulations promulgated for the NHPA. Phenomenologically, Heritage Resources are non-renewable resources that cannot be degraded and then enhanced and vice-versa.

Adverse Impact to Cultural Values

The Western Apache and Yavapai traditional and contemporary cultural values ORV would be adversely impacted if traditional cultural practitioners, principally the Yavapai-Apache Nation, determine that the Fossil Creek area fails to look, sound, and feel as natural and untrammeled as possible while allowing for some concentrated recreational use at compatible locations along Middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks.

Degradation of Cultural Values

The Western Apache and Yavapai traditional and contemporary cultural values ORV would be degraded if traditional cultural practitioners, principally the Yavapai-Apache Nation, determine that the accumulation of adverse impacts impairs the Fossil Creek area at the segment-wide and long-term scales.

Protection and Enhancement of Cultural Values

The Western Apache and Yavapai traditional and contemporary cultural values ORV is protected if traditional cultural practitioners, principally the Yavapai-Apache Nation, describe Fossil Creek as looking, sounding, and feeling as natural and untrammeled as possible while allowing for some concentrated recreational use at compatible locations along Middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks. Opportunities for enhancement include expanding interpretation and educational programming

related to traditional and contemporary cultural values in the Fossil Creek area, actions that manage recreational use in a way that maintains access and protects river corridor resources; and providing opportunities for traditional cultural practitioners to actively participate in the management of Fossil Creek.

Environmental Consequences

Spatial Definitions

The Cultural ORV and Heritage Resources effects analysis in large part depends on definitions both of what are cultural places across the Fossil Creek landscape and the disturbance types, particularly ground disturbing, that will be apparent during future management. Below, The Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV, Heritage Resources, Developed Recreation Areas, Roads, Trail Disturbance, Other Disturbed Areas, and Trails and Creek Access are defined. Collectively, Developed Recreation Areas, Roads, Trail Disturbance, Other Disturbed Areas, and Trails and Creek Access are labeled as "disturbed areas" even through during future management they may be restored and/or allowed to regenerate, will not be subject to blanket disturbance across their entire areas, and in some instances are defining parts of Heritage Resources.

Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV: Native American traditional cultural practices and ceremonies together with associated sites and spaces in the Fossil Creek area. Associated sites and spaces equates to the Fossil Creek area and specific spaces within the Fossil Creek area. These specific spaces are: the Flume Construction Camp; Bah' Loon's Place; Purple Mountain Work Camp – Ash Trees Growing Downward; and Dance Ground – Emory Oaks.

Heritage Resources: Archaeological sites/historic properties that are National Register-Eligible (as per the National Historic Preservation act of 1966, as amended, and through promulgated regulations) that intersect with the CRMP alternative disturbance categories.

There is spatial overlap between the Western Apache Traditional and Contemporary Cultural Values associated sites and spaces and Heritage Resources. The overlap is manifest in that the Fossil Creek area contains specific traditional and contemporary cultural values associated sites and spaces and that these individual sites and spaces are also Heritage Resources properties. Given this, the heritage resources effects analysis will consider the whole Fossil Creek area, as well individual spaces that have both traditional and contemporary cultural values significance and National Register eligibility.

Developed Recreation Areas: Within Developed Recreation Areas, a number of activities potentially can involve ground disturbance. These include parking, signs, kiosks, campsites, vault toilets, gates, visitor contact stations, trash receptacles, interpretive trails and/or canopy walks, administrative sites, shade ramadas, bridges, boardwalks, wildlife blinds, and corrals. The proposed alternatives only define developed recreation areas and do not further specify what kinds of activities, including ground disturbing, may be proposed to take place within the areas. Given this, determining the effects of potential ground disturbing activities can only be done in a general sense. Regardless, the USFS is committed to avoiding adverse effects to Fossil Creek Heritage Resources during the life of the CRMP. Specifically, however, for future proposed management activities involving ground disturbance, undisturbed areas of Heritage Resources will be avoided and/or archaeological monitoring will be done to ensure that there are no adverse impacts to Heritage Resources.

Roads: All roads within the project area currently exist and are unpaved. Future maintenance activities will occur within existing road prisms. The 708B road and a few segments of the 502 road within currently used and proposed recreation areas, as well as road 502 segments within the Stehr Lake Work Camp site, will no longer be used with CRMP implementation and the road segments will be restored or allow to regenerate.

Trail Disturbance: This category consists of existing trails, including unauthorized, user-created trails. Many of these, particularly unauthorized trails, are slated for restoration/regeneration as a part of the implementation of the action alternatives.

Other Disturbed Areas: This category consists of existing disturbed areas outside of in-use/proposed developed recreation areas. These areas are slated for restoration/regeneration as a part of the implementation of the action alternatives.

Trails and Creek Access: These are trails and creek access paths, many of which currently exist, that will either be formalized or constructed as part of the action alternatives.

Spatially, from the traditional and contemporary cultural values perspective, the Fossil Creek area is defined as the CRMP Project Area. This is the 6,371-acre area that includes the Fossil Creek Wild and Scenic River Segments, as well as adjacent areas where proposed Forest Service Fossil Creek management will take place.

Within the Fossil Creek project area, a total of up to 126.3 acres is proposed to be disturbed by the various alternatives.

Thirty-five Heritage Resources may be impacted by disturbance from the various alternatives.

Programmatic Analysis of the Effects of Management Direction on Heritage Resources

Implementation of the CRMP under the action alternatives, including Management Direction and Monitoring, Adaptive Management will result in reduced effects to the Cultural ORV and Heritage Resources compared to the no action alternative. As is the case throughout this analysis, Management Direction for heritage resources is articulated from the perspective of both the Cultural ORV and Heritage Resources. For each, desired conditions are defined and then guidelines and management approach are established (see above). Below is a summary of the effects of management direction for other program areas on the Cultural ORV and Heritage Resources. This analysis summarizes all aspects of Management Direction regardless of alternative.

Table 3-75: Summary of programmatic level effects of the CRMP on the cultural ORV and heritage resources

Program Area	Anticipated Effects to the Cultural ORV and Heritage Resources
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, and rehabilitating denuded areas outside of recreation sites, all contribute to the health of the Cultural ORV.
Riparian Function	Implementing management direction for proper functioning riparian areas will maintain the health of the Cultural ORV
Vegetation	Intact terrestrial vegetation will reduce erosion potential and contribute to the stability of Heritage Resources.
Soil Condition	Minimizing human-created bare areas, particularly outside of recreation sites, and restoration to reduce erosion and sedimentation into Fossil Creek will result in the maintenance of the health of the Cultural ORV and the stability of Heritage Resources.
Geology	Protection of travertine dams, the unique structural and vegetative habitat they create, and the natural processes of accretion and destruction ensure the preservation of a key characteristic of Fossil Creek which in turn maintains the health of the Cultural ORV.
Wildlife, Fish and Aquatic Species	Maintaining Wildlife, Fish, and Aquatic species Habitat is a key aspect of preserving the natural character of Fossil Creek and thus the Cultural ORV.
Traditional Cultural Practices	See the rest of this report's content.
Recreation	Impacts to the Cultural ORV and Heritage Resources will be reduced when appropriate infrastructure is in place, visitor capacities are appropriately set to minimize or eliminate recreation use outside of recreation sites, entry is managed, developed camping is limited to outside the 100 year floodplain, and dispersed camping is limited. In addition, there will be no new trails across springs or paralleling Fossil Creek to connect recreation sites. Recreation fees and partnerships will ensure resources to implement the CRMP, monitoring, and adaptive management. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience, which will typically mean their behavior supports protection of river values including the Cultural ORV. Most visitors will recreate responsibly, and the majority of visitors will stay within the designated areas. As a result, the refugia in between recreation sites will be largely free of human presence and this contribute to the health of the Cultural ORV. Appropriate design and compliance with Section 106 of the NHPA will ensure that roads, trails, recreation sites and infrastructure will not increase erosion and degrade water quality or result in adverse effects to Heritage Resources.

Program Area	Anticipated Effects to the Cultural ORV and Heritage Resources
Recreation/Lands Special Uses	Vegetation under powerlines is kept mainly free of tree canopy and this may include riparian vegetation, reducing stream bank cover which could impact the Cultural ORV. Permit holders and filming permitees should provide an education component to their content and should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values, including the Cultural ORV. While outfitter/guided activities have the potential to disturb Heritage Resources, impacts will be less than unguided recreation because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities are likewise screened, tailored to reduce impacts to the Cultural ORV and Heritage Resources, and contribute data needed to make informed management changes.
Roads and Facilities	Proper maintenance of roads and facilities will include mitigations to avoid adverse effect to Heritage Resources. Unauthorized roads will be decommissioned, obliterated or closed following mitigations to avoid adverse effects to Heritage Resources. Construction and maintenance of facilities will follow mitigations to avoid adverse effects to heritage resources.
Scenery Resources	There are no negative effects from scenery guidance on the Cultural ORV and Heritage Resources. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare ground areas outside of recreation sites, trails and roads will reduce erosion and contribute to the stability of Heritage Resources and to the overall health of the Cultural ORV.
Special Areas	Act-driven restrictions in special areas indirectly benefit the Cultural ORV and Heritage Resources through minimizing the use of motorized equipment and mechanized travel thereby reducing erosion, as well as protecting and enhancing river values.
Interpretation and Education	Interpretation and education will mainly result in indirect benefits to the cultural ORV and Heritage Resources. These benefits can include visitors who are respectful of Fossil Creek and use proper etiquette when encountering Heritage Resources.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV Effects Analysis

The Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV consists of Native American traditional cultural practices and ceremonies, together with associated sites and spaces in the Fossil Creek area. For analysis purposes, spatially, the ORV can be defined as the 6,371-acre CRMP project area. In this figure (Confidential Appendix Figure 4a, 4b, and 4c), the portion of the CRMP project area where alternative disturbance vectors extend to is shown, as well as four named places: Flume Construction work camp, Dance Ground – Emory Oaks; Bah' Loon's Place; and Purple Mountain Work Camp – Ash Trees Growing Downward. The named places are locations that can be distinguished from the Fossil Creek landscape as a whole because they have particular traditional cultural and ceremonial significance. Tribal Consultation with the Yavapai – Apache Nation on June 26, 2017 and August 28th, 2017, confirmed the names and locations of these places. The four places are also historic properties that are considered eligible to the National Register of Historic Places due to their traditional cultural significance, as well as for other significance criteria. All of the named places except the Dance Ground – Emory Oaks are analyzed below as induvial Heritage Resources. Dance Ground – Emory Oaks does not intersect with the footprints of any of the CRMP Alternatives and is thus not analyzed as an individual Heritage Resource.

How would proposed management actions affect the Western Apaches and Yavapai Traditional and Contemporary Cultural Values ORV? Answers to this question are anchored by the desired condition for the ORV: That the Fossil Creek area looks, sounds, and feels as natural and untrammeled as possible, while allowing for some concentrated recreational use at compatible locations along Middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks. The assessment of an untrammeled and natural state is qualitative and can only be made by traditional and contemporary cultural practitioners – the Western Apache and Yavapai. Officially, this occurs during Government-to-Government consultation with the Yavapai – Apache

Nation, as well as other affiliated tribes. Thus, an effects analysis has consisted of asking cultural practitioners about past conditions, current conditions, and future conditions as represented by Alternatives A through F.

Generally, with respect to the ORV, cultural practitioners have told us the following regarding past and current conditions. For this analysis, we are defining past conditions as the time span from the decommissioning of the Childs – Irving hydropower system in 2005 through the designation of Fossil Creek as a Wild and Scenic River in 2009 to the beginning of the interim reservation system in 2016. Current conditions consist of the interim management measures/reservation system-era from 2016 to present. From the Yavapai – Apache Nation perspective, the primary issue with respect to the Cultural ORV was the major increase in visitation after 2005. In fact, the principal way in which Yavapai – Apache Nation members describe the health of the Cultural ORV is through the lens of the number of people in Fossil Creek. Connected to this increase in visitation, cultural practitioners considered the Cultural ORV degraded by secondary impacts such as overcrowding, denudation from parking and foot traffic, and increased trash and human excrement across the landscape. In contrast, the institution of the reservation system for the 2016 high season and its continuation to present and the installation of vault toilets has resulted in Fossil Creek being in a healthy state or looking, sounding, and feeling more natural and untrammeled.

To repeat, the Fossil Creek area looking, sounding, and feeling as natural and untrammeled as possible, while allowing for some concentrated recreational use at compatible locations along middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks, is the definition of the Cultural ORV desired condition. The Yavapai – Apache Nation has told the USFS that it is categorically opposed to Alternative F and its 2,580 PAOT number because, from the Nation's perspective, that amount of people would clearly degrade the Cultural ORV (May 18, 2018, Yavapai – Apache Nation Tribal Consultation; May 21, 2018, Yavapai – Apache Nation Letter to Calvin Joyner, R3 Regional Forester). Put another way, the Fossil Creek area cannot look, sound, and feel natural and untrammeled with that many people visiting it. Also, in the May 21, 2018, letter, the Yavapai – Apache Nation stated that the first come first serve policy during the peak season that will be operative under Alternative F, instead of the current and proven effective reservation system, will hinder and/or preclude Yavapai – Apache Tribal members from easy access to this important traditional place. However, during a June 13, 2018, consultation, the Yavapai – Apache Nation told the USFS that the Alternative F component that closes the Bear (Fossil Springs) Trail and provides access to the Fossil Springs area via the Flume Trail modified for emergency ATV use is acceptable to them. The Yavapai – Apache Nation further indicated specifically that occasional emergency ATV of the Flume Trail in the vicinity of the Flume Construction work camp (see Confidential Appendix Figure 4a, 4b, and 4c) is acceptable.

Table 3-76. Disturbed area (acres) and persons at one time (PAOT) by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Note
Developed Rec Areas	10.8	16.4	18.3	21.5	35.2	31.4	Does not include rec. dispersal areas
Roads	72.1	72.0	71.7	71.6	71.4	70.6	Assumes 40-ft. road width
Trails & Creek Access[1]	7.1	5.7	7.2	2.8	7.8	6.7	Assumes 4-ft. trail width
Other Disturbed Areas[2]	36.3	-	-	-	-		
Disturbed acres TOTAL	**126.3**	**94.1**	**97.2**	**95.9**	**114.4**	**108.7**	
Persons at One Time (PAOT)	810	640	720	905	1,510[3]	2,580	

[1]*Alternative A trails & creek access includes unauthorized trails. Alternatives B-F do not.*
[2]*Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete.*
[3]*This number represents a theoretical maximum. In reality, the starting PAOT will be 810 and will only increase if monitoring and adaptive management indicates that river values are not being degraded.*

The Western Apache and Yavapai Traditional and Contemporary Cultural Values ORV effects analysis indicates that, from both the qualitative and quantitative perspectives, Alternative B would have the fewest effects in that restoration would be accomplished, the smallest amounts of disturbance would take place, and the lowest PAOT number would be implemented.

However, the Yavapai – Apache Nation has also expressed general satisfaction with the health of the cultural ORV under current conditions with a maximum PAOT of 810, installation of vault toilets, and no large-scale restoration efforts. Action alternative implementation would result in restoration and Alternatives B and C would have lower PAOT maximums than currently allowed. Alternative D allows a maximum of 95 more people than currently allowed and we can assume that this small increase (10.5%) would not be a serious concern to the Yavapai – Apache Nation. In any event, regarding all of the action alternatives, adaptive management and monitoring is assumed so concerns expressed by the Yavapai-Apache Nation regarding the maximum Alternative D PAOT would result in management decisions to mitigate the secondary impacts (overcrowding, denudation, increased trash/human excrement) so the health of the Cultural ORV is sustained. Examples of management decisions/actions include closing certain areas to visitation, restoring certain areas, and installing additional facilities.

Adaptive management and monitoring is an important factor when considering alternative E. On the face of it, the 1,510 PAOT, constituting essentially of a doubling of the current capacity, would be a non-starter for the Yavapai – Apache Nation. In reality, though, any increase above current capacity as a part of operations under Alternative E would be done under a monitoring and adaptive management regime that would include management decisions/actions that would mitigate the secondary impacts of higher maximum PAOTs.

The same cannot be said of Alternative F. We can assume that for the Yavapai – Apache, no management decisions or actions targeting the secondary impacts of PAOT numbers at Alternative F maximum levels could result in the continued health of the Cultural ORV. However, as mentioned above, the closing-the-Bear-Trail-and-modifying-the-Flume-Trail-for-emergency-ATV-use component of Alternative F is acceptable to the Yavapai – Apache Nation.

Heritage Resources Effects Analysis

In addition to the Cultural ORV, the effects of the proposed alternatives on Heritage Resources needs to be taken into consideration. Heritage Resources include three of the four named places identified for the Cultural ORV. A total of 35 Heritage Resources intersect with the disturbance vectors of the six CRMP Alternatives (see table x and Confidential Appendix Figure 4). These 35 properties total 187.91 acres of Fossil Creek terrain.

A number of Heritage Resources intersect with the spatial footprints of the CRMP Alternatives but were not considered further for this analysis for a number of reasons. Table 3-77 lists these sites and the reasons they were not carried forward for further analysis.

Table 3-77. Heritage resources not carried forward for analysis

Site Number	Name	Reason
01-0011	Childs-Irving Flume	Decommissioned, see Historic Preservation Plan (Neal and Martin 2003)
01-0012	Irving Power Plant	Decommissioned, see Historic Preservation Plan (Neal and Martin 2003)
01-0263	Original Childs-Irving Road (502 Road)	Not Eligible to the National Register
01-0740	Fossil Creek Bridge	Listed on the National Register and Will be Left in Place When a New Bridge is Installed
01-1137	Lithic Scatter	Not Eligible to the National Register
01-2086 and 04-1629	Fossil Creek Road (708 Road)	Not Eligible to the National Register
04-1364	Mail Trail on the Tonto Forest Site	Will Not be Analyzed Further By Forest Supervisor's Decision

Quantitatively, the amount of Heritage Resource area proposed to be disturbed ranges from a high of 22.63 acres for Alternative A to a low of 10.31 acres for Alternative D (Table 3-78). From the perspective of percentage of total Heritage Resource acreage (the total acreage of the Heritage Resources that are impacted by the alternatives) proposed to be disturbed, the amounts range from 12.04 to 5.49 percent (Table 3-78). Recalling that Alternative A includes as disturbed 36.30 acres of terrain to be restored and that Alternatives B through F (the Action Alternatives) assume this acreage will be restored, the amount of disturbance proposed for Heritage Resource

areas ranges between 5.49 and 8.23 percent. Confidential Appendix Figure 4 graphically shows the relationship between archaeological site areas and areas of proposed action alternatives disturbance.

Table 3-78. Total archaeological site area disturbed by alternative (acres)

	All Alts.	Action Alts.	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Total Archaeological Sites Disturbed	35	32	32	29	25	22	31	30
Total Archaeological Site Area Disturbed (Acres)	25.99	15.57	22.63	11.85	10.47	10.31	15.47	12.04
% of Total Archaeological Site Acreage*	13.83	8.29	12.04	6.31	5.57	5.49	8.23	6.41

** = Total Archaeological Site Area = 187.91 acres (35 Sites Total)*

Proposed disturbance to Heritage Resources needs to be clarified from the perspective of previously disturbed areas and areas slated for restoration. Table 3-79 denotes the total Heritage Resource area disturbed by individual alternative disturbance. For all alternatives, Developed Rec. Areas and Roads disturbance, as well as most of the trails, constitute disturbance that took place prior to the designation of Fossil Creek as a Wild and Scenic River in 2009. Thus, this disturbance is previously extant and does not constitute new disturbance, even though it is counted as such in the alternatives. In fact, concerning the roads in particular, these disturbance vectors are often components of Heritage Resources and have been defined as Heritage Resources themselves (see Heritage Resources not carried forward for analysis Table).

Table 3-79. Total archaeological site area disturbed by individual alternative disturbance type (acres)

Alternative Disturbance Type	Total Archaeological Sites Disturbed	Total Archaeological Site Area Disturbed (Acres)	% of Total Archaeological Site Acreage*
Alt. A Developed Rec. Areas	6	2.68	1.43
Alt. A Roads	15	5.36	2.85
Alt. A Trail Disturbance	20	0.68	0.36
Alt. A Other Disturbed Areas	13	13.90	7.40
Alt. B Developed Rec. Areas	7	4.73	2.52
Alt. B Roads	15	6.71	3.57
Alt. B Trails and Creek Access	13	0.42	0.22
Alt. C Developed Rec. Areas	5	3.54	1.88
Alt. C Roads	14	6.60	3.51
Alt. C Trails and Creek Access	11	0.32	0.17
Alt. D Developed Rec. Areas	4	3.46	1.84
Alt. D Roads	14	6.63	3.53
Alt. D Trails and Creek Access	6	0.22	0.12
Alt. E Developed Rec. Areas	10	8.37	4.45
Alt. E Roads	15	6.71	3.57
Alt. E Trails and Creek Access	16	0.39	0.21
Alt. F Developed Rec. Areas	9	4.79	0.42
Alt. F Roads	15	6.70	3.57
Alt. F Trails and Creek Access	14	0.56	0.30

** = Total Archaeological Site Area = 187.91 acres*

As noted above, Alternative A – the no action alternative, which we are analyzing but, as per the Wild and Scenic River Act, cannot be chosen – includes as disturbed 36.30 acres of terrain to be restored. Given all of this, actual proposed disturbance consists of some Trails and Creek Access areas and some, as yet not clearly defined, smaller areas within Developed Rec. areas. When this is taken into consideration and from a general aggregate

perspective, the potential amount of ground disturbance to Heritage Resources from the Action Alternatives is miniscule to almost non-existent (see Table 3-79).

However, as comforting as this may be from the Heritage Resources preservation perspective, the USFS as a Federal Agency must comply with Section 106 of the National Historic Preservation Act of 1966 (as amended and through promulgated regulations). To achieve Section 106 compliance and to extend the effects analysis to scale of the individual Heritage Resource, below each of the 35 Heritage Resource properties is considered. The resources are described, the potential impacts of the various alternatives assessed with the aid of high resolution aerial photographs and spatial analysis (see Table 3-79 in the specialist report and Confidential Appendix Figures 4 - 74), and a description of how adverse effects will be avoided is provided.

Heritage Resource-Specific Analysis

Detailed analysis of impacts to 35 specific heritage resource sites can be found in the *Heritage Resources Specialist Report*. As mentioned, the goal of the CRMP is to avoid adverse effects to Heritage Resources. For 19 of the Heritage Resources, implementation of the action alternatives will result in no adverse effects. For 16 Heritage Resources, either archaeological monitoring, or trail rerouting, or prohibition of ground disturbing activities in certain areas will result in no adverse effects for the life of the plan (see Table 3-80).

Table 3-80. Specific mitigations to avoid adverse effects to heritage resources

Heritage Resource Number	Specific Mitigation to Avoid Adverse Effects
01-0700	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-0701	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-1079	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-1177	The Proposed Trail will be Rerouted to the East to Avoid Impacting the Resource
01-1834	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-2269	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-2273	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-2276	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
01-2277	No Ground Disturbing Trial Maintenance Activities Will Occur Within the Resource Boundaries
04-0282	No Ground Disturbing Trial Maintenance Activities Will Occur Within the Resource Boundaries
04-0815	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
04-1728	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
04-2071	Archaeological Monitoring Required in Conjunction With Any Ground Disturbing Activities
04-2366	The Proposed Trail will be Rerouted to the South to Avoid Impacting the Resource
04-2370	No Ground Disturbing Trial Maintenance Activities Will Occur Within the Resource Boundaries
04-2372	No ground disturbing restoration or regeneration activities will take place within the site boundary during the implementation of the action alternatives

Cumulative Effects Analysis

Cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Heritage resources constitute the environment under consideration in this analysis. For Fossil Creek, Heritage Resources consist of both the Cultural ORV and Heritage Resources (see above). Cumulative effects analysis depends on the focus, either Heritage Resources or the Cultural ORV.

For Heritage Resources, the Coconino and Tonto National Forests have complied with Section 106 of the National Historic Preservation Act, including Tribal Consultation, regarding past and present actions. This compliance has resulted in no adverse effects to Heritage Resources. No adverse effects equates to no cumulative effects. Looking ahead to reasonably foreseeable future actions, the same assumption is operative. The Coconino and Tonto National Forest will comply with NHPA Section 106 resulting in no adverse/cumulative effects.

A cumulative effect is likely, either negative or positive, to the Cultural ORV from the incremental impact of implementing an action alternative or a decision that combines elements of the action alternatives. Appendix B of the CRMP presents a list of past, present, and reasonably foreseeable future actions. These include past actions

related to the decommissioning of the Arizona Public Service (APS) Hydrologic Power System from 2004 to 2010 and present actions related to Fossil Creek Interim Recreation Management and Resource Protection begun in 2011. The potential cumulative effect should be viewed from the fact that the Yavapai – Apache Nation indicated that the Cultural ORV was in an unhealthy state due to a past action (the time period after decommissioning of the APS Hydrologic Power System) until a present action (institution of interim management measures) restored its health. If monitoring indicates continued health of the Cultural ORV, Yavapai – Apache Nation members may say there has been a net improvement/positive cumulative effect through time in terms of the health of the Cultural ORV. Conversely, because the Cultural ORV has been in a degraded condition in the past but is currently not in a degraded state with current visitor capacities and other management measures, Yavapai – Apache Nation members may view incremental capacity (PAOT) increases negatively in the cumulative effects sense from a historical perspective. This may be the case in spite of the fact that secondary impacts of increased capacity are indicated to be mitigated by management measures from the perspective of other monitoring measures.

While outside factors such as climate change, invasive species, and groundwater use may change the presence and condition of natural features (such as plants, water flow, etc.) that are important to the Cultural ORV, the action alternatives (except for F) are expected to somewhat counteract these changes by allowing management intervention to adapt and possibly limit the potential for cumulative effects to the Cultural ORV.

Adaptive Management Effects Analysis

The implementation of adaptive management as a part of the CRMP will result in the following positive beneficial effects for the Cultural ORV and Heritage Resources: (1) Consultation will continue with traditional cultural practitioners (the Tribes, particularly the Yavapai – Apache Nation; (2) Certain Heritage Resources that are Cultural ORV named places and Heritage Resources will monitored; (3) Consultation and monitoring will ensure that the health of the Cultural ORV is maintained; and (4) Management under the CRMP will mitigate adverse effects to Heritage Resources.

Summary

Degree to Which the Purpose and Need for Action is Met

There is a need to develop a long-term management plan for the enhancement and protection of the Cultural ORV and for the protection of Heritage Resources. Alternatives B-E will provide for the protection and possibly enhancement of the Cultural ORV. However, Tribal Consultation has indicated that Alternative F will not provide for the protection and possible enhancement of the Cultural ORV because the PAOT number is too high and PAOT numbers of this magnitude will restrict access to Fossil Creek by traditional cultural practitioners. Alternatives B-F will provide for the protection Heritage Resources. The rationale for these conclusions is detailed in the Environmental Consequences section and in the summary of environmental effects below.

Degree to Which the Alternatives Address the Issues

Specifically for the Cultural ORV and Heritage Resources, the following issues are highlighted in this analysis:

1. With respect to the Cultural ORV, the Yavapai – Apache Nation raised the issue of visitor numbers along Fossil Creek through time and expressed specific concern regarding high PAOT numbers.

2. As per law, regulation, and policy, the USFS is committed to avoiding or mitigating adverse effects to Heritage Resources. Given this, at multiple scales, this specialist report analyzed the impacts of the action alternatives on Heritage Resources and defined mitigations so that no adverse effect or no effect, regardless of the alternative, determinations could be articulated for all Heritage Resources.

From the perspective of both the Cultural ORV and Heritage Resources, Alternatives B – E best address the above issues. From the vantage of the Cultural ORV in isolation, Alternative F does not address the first issue because

the demand-based theme and rationale of this alternative are in opposition to the high PAOT number concern of the Yavapai – Apache Nation.

Summary of Environmental Effects

To reemphasize, the Fossil Creek area looking, sounding, and feeling as natural and untrammeled as possible, while allowing for some concentrated recreational use at compatible locations along middle Fossil and limited backcountry recreational use focused around the creek and adjacent banks is the definition Cultural ORV. The Yavapai – Apache Nation has told the USFS that it is categorically opposed to Alternative F and its maximum 2,580 PAOT number because that amount of people would clearly degrade the Cultural ORV regardless of management actions to mitigate the secondary impacts of that many people. From Yavapai – Apache Nation perspective, the Fossil Creek area cannot look, sound, and feel natural and untrammeled with that many people visiting it. Further, the Yavapai – Apache Nation has stated that the first come first serve policy during the peak season that will be operative under Alternative F, instead of the current reservation system, will hinder and/or preclude Yavapai – Apache Nation members from easy access to this important traditional place.

In addition to the Cultural ORV, the effects of the proposed alternatives on Heritage Resources needs to be taken into consideration. From an aggregate scale of analysis, a total of 35 Heritage Resources intersect with the disturbance vectors of the six CRMP Alternatives. These 35 properties total 187.91 acres of Fossil Creek terrain. Quantitatively, the amount of Heritage Resource area proposed to be disturbed ranges from a high of 22.63 acres for Alternative A to a low of 10.31 acres for Alternative D. From the perspective of percentage of total Heritage Resource acreage proposed to be disturbed, the amounts range from 12.04 to 5.49 percent. Recalling that Alternative A (cannot be chosen) includes as disturbed 36.30 acres of terrain to be restored and that Alternatives B through F (the Action Alternatives) assume this acreage will be restored, the amount of disturbance proposed for Heritage Resource areas ranges between 5.49 and 8.23 percent. From an aggregate scale of analysis, the potential amount of ground disturbance to Heritage Resources from the Action Alternatives is miniscule to almost non-existent. Because the USFS as a Federal Agency must comply with Section 106 of the National Historic Preservation Act of 1966 (as amended and through promulgated regulations), analysis at scale of the 35 individual Heritage Resources was undertaken so that mitigations allowing no adverse effect or no effect determinations could be articulated. Table 3-80 lists the Heritage Resources where specific mitigations are required to avoid adverse effects. Table 2-5 summarizes the impact to heritage resources across all alternatives.

Short-term Uses and Long-term Productivity

Proposed activities that have a long term benefit to the Cultural ORV and Heritage Resources include maintenance of roads and trails, maintenance of facilities, construction of infrastructure that contains recreation impacts (parking area delineation), and restoration activities.

Proposed activities that may result in disturbance to the Cultural ORV and Heritage Resources over the long term include; day use, camping, and dispersed back country recreation; heavy visitor use along and trails; and construction of infrastructure when it results in new ground disturbance.

Minimizing human-created bare areas particularly outside of recreation sites, implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation will result in long-term benefits or stability regarding the Cultural ORV and Heritage Resources.

In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: denuded areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors.

Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that harden sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for

future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

Overall, the implementation of action alternatives will not jeopardize the long-term productivity or multi-use character of the National Forest System lands.

Unavoidable Adverse Effects

While there will be new ground disturbance with the action alternatives, the acres are a fraction of a percent when compared to the total acreage in the corridor. Implementation of the CRMP management direction, resource protection measures, required monitoring and resulting adaptive management will minimize effects and in some cases, result in beneficial effects. Overall, there are no adverse effects as a result of implementing any of the action alternatives.

Recreation

The 2017 Fossil Creek WSR Resource Assessment identified recreation as one of four ORVs. This section analyzes the effects of Alternatives A-F on the recreation ORV. Possible effects consist of changes in the number of people who can access Fossil Creek, changes in the types of river-dependent recreation activities that people may pursue, and changes in the quality of the recreation experience reported by visitors. Known conditions in 2009, the year of Fossil Creek designation as a Wild and Scenic River, will serve as the reference baseline for the analysis.

This report addresses the purpose and need to complete a Comprehensive River Management Plan for Fossil Creek that protects and enhances the recreation ORV. The analysis includes the proposed management direction for each alternative. Key issues identified from public comments include recreation use and visitor capacity, recreation management, infrastructure development, motorized access, and economic and commercial opportunities.

Methodology

Analysis of potential effects to the recreation ORV focuses on three components: the total amount of recreation access to Fossil Creek, the quality of the experience that people have during their visit, and the types of river-dependent recreation activities that people may engage in during their visit.

Recreation access is assessed by the total possible number of people who may visit during the permit season. This information is based on the number of available permits and can be compared to the baseline condition at the time of designation to evaluate the effect to the recreation ORV.

Quality of the recreation experience can be evaluated using visitor survey research methods where respondents can indicate their perceptions and preferences at the end of their visit. Survey research conducted closest to the year of designation indicates that factors such as trash, toilets, crowding, and availability of camping were the most influential on respondents' experience at Fossil. Assessing the effect of the CRMP alternatives will require a degree of professional judgement, but future survey research can be compared to the results from the baseline study.

Analysis Questions, Indicators, and Measures

Analysis questions for the Fossil Creek WSR corridor are connected both to programmatic direction the CRMP will provide for future management of the corridor and to specific actions proposed under the action alternatives. This analysis will use the following two questions to guide evaluation of the CRMP management direction and the alternatives included in the CRMP EIS.

- How do management actions protect and enhance the recreation ORV?

- How do management actions promote and move towards sustainable recreation and resource management?

This report will use three indicators to address the analysis questions: quantity of recreation access, quality of recreation experiences, and river-dependent recreation activity participation. Measures of these indicators include the number of people able to access Fossil Creek, visitor satisfaction, and available river-dependent recreation activity types. These indicators and measures are explained in more detail in the Summary of River Values and other Resources section.

Analysis Indicators and Measures

River dependent recreation and visitor experience quality are the principal components of the recreation ORV. Due to limited reliable data and the qualitative nature of the recreation experience, analysis of effects of management actions on the recreation ORV must depend on only a few resource elements: public access, experience quality, and river dependent recreation activity participation. Public access can be evaluated by the number of people able to visit Fossil Creek during the April-September peak use season. Recreation experience may be inferred based on proposed management actions in the alternatives that would address the problems identified by survey respondents from 2011, the only reliable source of this information since the year of designation (Lee, 2011). Specifically, these actions would be ones that primarily address trash, toilets, and crowding. A variety of research indicates the negative affect of litter on the visitor experience (Moore et al, 2012; Cole and Hall 2008; Chavez 2001). The number of people encountered has a variable effect on the recreation experience depending in part on the prior experience and expectations of the participants (Chavez 2001; Cole and Hall 2008; Li et al 2003) However, crowding was perceived by 23% of respondents to the most recent visitor survey in Fossil Creek (Lee 2011). Effects to recreation participation can be evaluated by inferring that more recreation availability or infrastructure will result in more potential for public participation in camping, hiking, kayaking, rafting, swimming/wading, fishing, hunting, and wildlife viewing.

Table 3-81. Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
River dependent recreation	Public access	Number of people visiting Fossil Creek	P/N and key issue	Recreation ORV
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	P/N and key issue	Recreation ORV
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	P/N and key issue	Recreation ORV

Information Sources

Visitor Surveys 2004-2006: Survey research conducted by Northern Arizona University before and after decommissioning of the hydropower facilities in Fossil Creek.

Forest Service Visitor Use Data Collection 2006-2017: Information on recreation use and incidents recorded by Forest Service field staff during the summer peak use season.

Visitor Survey 2011: Survey research conducted by Northern Arizona University to determine visitor attitudes and preferences for management of Fossil Creek.

Reservation Data 2016-2017: Basic information collected through the Recreation.gov online parking reservation system including date, zip code, group size, and destination.

Incomplete and Unavailable Information

Baseline information on visitor experiences at Fossil Creek is limited to one survey done in 2011. This will be used as the baseline condition as no other reliable data exist closer to 2009. Existing condition will be based on changes implemented since 2011 that are likely to have affected the primary experience factors indicated by respondents to the 2011 study. The effects analysis will necessarily rely on professional judgement to determine likely changes to the experience caused by implementing management actions.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects to the recreation ORV include the WSR corridor ¼ mile on either side of Fossil Creek, the Fossil Springs trail, and the closed section of FR708, because alternatives in the EIS may change public access to the creek via these routes.

The temporal boundary is the 20 year implementation period of the CRMP. Short-term effects are those associated with construction of facilities that could temporarily restrict recreation access within the WSR corridor, typically up to two years. Long-term effects are those associated with changes to recreation ORV indicators lasting more than one year and up to the 20-year horizon of the CRMP.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects to the recreation ORV are the same as the direct/indirect effects boundary because this analysis area is where future actions may effect recreation access to Fossil Creek.

The temporal boundaries for analyzing the cumulative effects is 1-20 years because this is the implementation period of the CRMP and the period in which future actions may reasonably be foreseen.

Affected Environment – Baseline and Existing Condition

Overview of the Recreation ORV

Fossil Creek provides outstanding opportunities for a variety of recreational activities and it attracts a wide variety of visitors, many of whom return year after year. The stream is centrally located and is a popular destination for people from Phoenix and surrounding areas, Prescott and Chino Valley, the Verde valley, Flagstaff, Payson, Strawberry, Pine, and Tucson (Rotert, 2009). This freshwater source provides essential relief from the desert heat. Visitors enjoy the shade and cooler temperatures from the dense riparian canopy and there is an abundance of deep, clear pools in which to wade, swim and snorkel. The springs that form Fossil Creek keep the water flow constant throughout the year, which is an uncommon and welcome attribute for residents and visitors of the southwest. Travertine formations in the creek tint the water a beautiful blue-green color.

Specific attractions and opportunities include the 72º F. water, springs, swimming/wading, camping, hiking, wilderness appreciation, fishing, wildlife and nature observation, photography, bird watching, and potential cultural and historical site interpretation. Visitors typically access Fossil Creek along the 3.5 miles of road that parallels the creek, by hiking northeast of the road along Fossil Creek to the waterfall, and by hiking or backpacking using the Fossil Springs Trail.

Recreation Opportunities

Swimming/Wading

Fossil Creek has numerous swimming holes and waterfalls now that the dam has been removed and natural flows have returned. Visitors swim, wade, dive off cliffs, swing from ropes, shower under waterfalls, snorkel, and float down riffles and short waterfalls. The constant 72° F. water temperature makes taking a dip enjoyable during most seasons. Swimming was the most popular activity in Fossil Creek during the summer of 2009 (Rotert, 2009).

Groups of families or friends often visit Fossil Creek and many bring their dogs. The most popular swimming holes such as the Fossil Creek Bridge, Irving, and the waterfall sometimes have over 100 people enjoying the water during weekends and holidays (Rotert, 2009).

Camping

Dispersed camping is also a popular form of recreation at Fossil Creek. Visitors use numerous dispersed and undeveloped campsites along the 3.5 miles of road which parallels the creek, near swimming holes, and around the springs.

Hiking

The trail system within the Fossil Creek WSR corridor provides hiking and backpacking opportunities into the area including the Mazatzal Wilderness, Fossil Springs Wilderness and the Fossil Springs Botanical Area. Portions of four designated trails are present in the Fossil Creek WSR corridor: the Flume-Irving Trail (#154), the Fossil Springs Trail (#18), the Mail Trail (#84) and the Deadman Mesa Trail (#17). The first three trails lead into the Fossil Springs Wilderness and Botanical Area. The Fossil Springs Trail from the Strawberry Trailhead receives far more use compared to the lower trailhead of Flume-Irving. In 2002, 32,693 people registered at the two trailheads (Flume-Irving, Fossil Springs). These two trails are most popular May to September. Group size is generally under eight people. The historic Mail Trail receives very low use likely because it is a long, steep trail with regular exposure to the sun, and it doesn't lead to a water feature.

Throughout the Fossil Creek area, there are a number of dispersed user-created trails (non-designated trails created by continuous use) that provide access to the creek at various locations. These dispersed trails are within close proximity to the Fossil Creek Road (Forest Road 708), the Childs Road (FR 502), the Flume Road/Trail (FR 154), and dispersed campsites.

Wilderness

Fossil Creek borders and is surrounded by the Mazatzal and Fossil Springs Wildernesses. Due to the remote nature of Fossil Creek, the rugged, steep-walled lower canyon, and the springs, these wildernesses offer exceptional opportunities for experienced hikers and backpackers to venture into the remote areas, explore primitive nature, and have a true wilderness experience.

Cultural Attractions

The Childs and Irving power plants are designated a National Register Historic District. Previous surveys and predictive models suggest that prehistoric ruins are present in high densities throughout the planning area. All alluvial flats currently used for dispersed camping and picnicking are likely to contain prehistoric resources. Opportunities exist to interpret these cultural resources.

Fishing

After dam removal, the return of natural water flows, and the restoration of native fish species in Fossil Creek, the Arizona Game and Fish Commission approved creating the country's first-ever blue ribbon catch-and-release-only seasonal roundtail chub fishery along Fossil Creek starting in October of 2009. Although the fishery is controversial, many anglers enjoy fishing for native species in their native habitat, an opportunity that is rare in Arizona where most native fisheries have been depleted.

Hunting

Hunting is popular in the Fossil Creek area, especially for deer, javelina, and quail. The Fossil Creek WSR corridor is part of two game management units: 6 and 22. Arizona Game and Fish Department keeps survey and hunt result information by game management unit, but because the Fossil Creek WSR corridor is so small in comparison to the units, we cannot extract meaningful information from these reports about the number of hunters who use the area.

Kayaking and Packrafting

A small number of people kayak or packraft the section of Fossil Creek between the waterfall and Irving or the bridge. Observations from 2009 indicate a very low level of paddler activity (1% of those visitors observed) (Rotert, 2009). However, data collection has only occurred during the summer season which would not include winter/spring high flows popular with creek boaters and is not representative. During the public comment period, several people indicated their desire to retain kayak and packraft recreation in Fossil Creek.

Area Access

One main road accesses the Fossil Creek area. Forest Road 708 (FR 708) runs southeasterly from the town of Camp Verde and Highway 260. FR 708 winds its way down to Fossil Creek, crosses the creek and then after paralleling the creek for approximately 2.5 miles, winds its way back out the canyon to the town of Strawberry and Highway 87. Forest Road 502 runs southwesterly from FR 702 to the Verde River at Childs. FR 708 and FR 502 are maintained at a level 3 for safe travel by a prudent driver in a passenger car

Data collected in 2009 indicate that visitors accessed Fossil Creek from the north (via Camp Verde) and from the south (via Strawberry) in relatively equal proportions with 45% of visitors entering through Camp Verde and 55% of visitors entering through Strawberry (Rotert, 2009). Previous data indicated that close to ¾ of visitors accessed the area via Strawberry (Northern Arizona University, 2007). In 2012, FR 708 was closed by rock fall between the springs trailhead and the waterfall trailhead. This section of the road remains closed to private motor vehicles.

Amount of Recreation Use at Fossil Creek

Because of the year-round water source, Fossil Creek has a long history of recreational use. Before full-flows were restored to the creek, recreation use was not quantified, but still had some unwanted impacts. After the dam was removed, the Forest Service started more consistent patrols of the area and began counting numbers of people and vehicles. During the summer of 2009, rangers patrolled nearly every day to interact with visitors and count people and vehicles. Rangers observed that recreation use grew dramatically 2006-2012, when parking capacity measures were initiated by the Forest Service. In 2009, an estimated 80,745 people entered Fossil Creek during the April-September peak-use season. The highest total number of visitors during the peak-use season was 90,396 in 2012; this is dramatically higher than the approximately 52,000 people visited Fossil Creek during summer 2017 although a total of 136,000 people could enter Fossil Creek during the current reservation system if all permits were reserved each day.

Adverse Effect, Degradation, Protection, and Enhancement

Adverse Effect

Protection of river values is interpreted by the Interagency Wild and Scenic River Coordinating Council as the elimination of adverse effects. A substantial reduction in the condition of a river value in relation to baseline conditions as a result of public use, development, and/or administrative use. An adverse effect is a segment-wide condition that requires immediate management attention. It may be detected by periodic monitoring or by other means. When more than one indicator is monitored for any river value, an adverse effect associated with any one of the indicators constitutes an adverse effect on the value as a whole.

The recreation ORV would be adversely impacted by declines in visitor satisfaction, visitor access to Fossil Creek during the peak use season, or availability of river-depended recreation activities compared to 2009 baseline conditions or by adverse impacts to other river values. A decline in one or more of the three recreation ORV indicators would constitute an adverse effect leading to consideration of adaptive management actions. The indicators and thresholds are described in more detail in Chapter 6 of the CRMP, Monitoring and Adaptive Management. An adverse effect could result from a 5% decline in visitor satisfaction from the best available data closest to the 2009 baseline condition as determined by the Forest Service's National Visitor Use Monitoring (NVUM) or similar survey. An adverse effect is also defined as a 10% reduction in the number of people able to access Fossil Creek during the peak use season compared to the 2009 baseline year. A decline in the third recreation ORV indicator, available river-dependent recreation activities, below baseline condition would also

cause an adverse effect by preventing participation in one or more of the activities which are part of the recreation river value.

Degradation

Degradation is the state in which a river value has been fundamentally altered by public use or development to the point that its condition is reduced below the baseline documented at time of designation. Degradation is a long-term, segment-wide condition. A river value has been degraded when recovery would only be possible through a sustained change in management and a significant investment of financial capital. Degradation may be detected by periodic monitoring or by other means.

The recreation ORV would be degraded by substantial declines in visitor satisfaction, visitor access to Fossil Creek during the peak use season, or availability of river-depended recreation activities compared to 2009 baseline conditions or by degradation of other river values. Degradation of the recreation ORV, on a segment-wide and long-term scale, could be caused by a 15% decline in visitor satisfaction, or a 25% decline in total number of people accessing Fossil Creek for recreation during the peak-use season April 1- October 1. A complete loss of access to one or more types of river-dependent recreations, on a segment-wide and long-term scale, as identified in the Fossil Creek Resource Assessment (Forest Service, as updated in 2018) would also cause a degradation of the recreation ORV.

Enhancement

Enhancement is defined as actions taken to improve the condition of a river value. Such actions improve the conditions of a river value to the point where the river value's condition meets or exceeds the desired condition. Where possible, these actions correct past and present degradation. The state of enhancement is the best possible condition for a river value.

The recreation ORV is protected if visitor satisfaction, visitor access to Fossil Creek during the peak use season, or availability of river-depended recreation activities are maintained at least 2009 baseline conditions and if other river values are protected. Opportunities for enhancement include actions that improve visitor satisfaction, expanding access to and availability of river-dependent recreation activities, and actions that enhance other river values.

Affected Environment – Baseline Condition

Recreational Activity Participation and Recreational Experience Quality (Recreation Segment): In 2009, recreational opportunities in the recreation segment of Fossil Creek were similar to those currently available. According to opportunistic visitor interviews (Rotert 2009), the most common visitor activity in this segment of Fossil Creek was swimming (42%). Camping (29%) was the second most common visitor activity. Other activities visitors participated in included hiking/running, relaxing/getting away and observing the creek. Very few visitors participated in kayaking/rafting (1%) or OHV use (1%). However, it is important to note that this information is not necessarily representative due to the sampling method.

Leading up to the time of Fossil Creek's designation in 2009, visitors had opportunities to interact with and enjoy the free-flowing character of Fossil Creek in 2005; however, visitor use at Fossil Creek increased dramatically in the years following restoration of full flows. For example, in 2006 the estimated number of people at Fossil Creek from May to October (when data was collected) was 20,480 people. In 2009, the estimated number of people at Fossil Creek during the same time period was 80,745, about four times the number of people estimated in 2006 (Rotert 2013). It is possible that the large increase in use levels had an effect on recreation experience quality. About a third of visitors choosing to participate in opportunistic conversations with field staff in 2009 may have felt some level of crowding, since they believed the area would benefit from a permit system in order to manage capacity, but about a quarter indicated that conditions were fine (Rotert 2009).

The most useful research on visitor experiences was collected by Lee in 2011 using a statistically representative survey method. As such, the results of this study provide the most accurate picture closest to the year of designation and therefore will be used as the baseline condition in this analysis. From the survey, visitor results

were mixed regarding the perception of trash and the crowding. While 37.7 percent of visitors perceived trash as the most negative environmental and social condition, 37.9 percent indicated the amount of trash was not bad. While 23.1 percent of visitors perceived the number of people as negative, 31.1 percent indicated the area was not too crowded. Visitors did not report any other conditions as being a substantial issue. Only a small percentage of respondents noted issues such as problems with other people (1.0%), road conditions (1.9%), broken glass (1.2%), or not enough parking (2.2%) (Lee 2011).

Visitors also stated their preferences for some improvements to facilities and infrastructure primarily related to trash disposal (20.7%) and more, or permanent, toilets (11.6% and 20.5%, respectively) (Lee 2011). Conversely, 36.4% of respondents stated that facilities were good as is and 12.8% preferred less development. Most visitors (79.9%) also indicated a desire for some overnight camping in Fossil Creek; of those who favored camping, reasons included the long drive (28.8%) and enjoyment of the area longer (16.2%).

According to limited observations made by Forest Service staff in 2009, about 53% of visitors came from the Phoenix-Metro area. The rest of the visitors came from Flagstaff (8%), Verde Valley (10%), Rim Country, which includes Pine, Payson and Strawberry (7%), White Mountains (2%), Tucson (1%), and Prescott (20%). Also in 2009, 70% of visitors were repeat visitors, while only 30% of visitors were first time visitors. In 2009, approximately 81% of visitors observed by Forest Service staff were considered Caucasian, and 19% of visitors observed were considered Hispanic (Rotert 2013). Overall, in 2009, over half of visitors came from the Phoenix-Metro area, most people were repeat visitors, and most were Caucasian. Again, the conclusiveness of these data is limited by the methods used.

Recreational Activity Participation and Recreational Experience Quality (Wild Segments): The wild segments of Fossil Creek are located within the designated Wilderness areas, both north (Fossil Spring Wilderness) and south (Mazatzal Wilderness) of the recreational segment. Visitors can access the Mazatzal Wilderness from Middle Fossil Creek on the Coconino NF. Access into the Mazatzal Wilderness on the Coconino NF is relatively easy, given that the wilderness boundary is a short distance from the Mazatzal parking area in the Middle Fossil Creek corridor, so visitors do somewhat frequently venture into this area of the Mazatzal Wilderness. However, most visitors only go about a ¼ mile from the wilderness boundary to access a few swimming holes. Very few visitors venture beyond this point, but occasionally visitors camp beyond the first ¼ to ½ mile of the wilderness boundary during the permit season.

Most visitors access Fossil Springs Wilderness via the Fossil Springs trail on the south side of the wilderness coming from Strawberry, AZ. It is also possible to access the wilderness from Highway 260 above the rim via the Mail Trail.

Since the wilderness areas have relatively little visitor use, they offer exceptional opportunities for experienced hikers and backpackers to venture into remote areas, explore primitive nature and have a wilderness experience characterized by solitude, personal reflection, immersion in nature, and self-reliance. No formal studies documenting visitor satisfaction, perceptions of crowding or encounter rates have been conducted in either of these wilderness areas. However, use in these areas is uncommon enough that it is assumed that visitor satisfaction is high (for those looking for a wilderness experience) and that crowding and encounter rates are probably not an issue.

Table 3-82. Resource indicators and measures for the baseline condition

Resource Element	Resource Indicator	Measure	Baseline Condition
River dependent recreation	Public access	Number of people visiting Fossil Creek	80,745 people April 1-Oct. 1
Recreation experience	Experience quality (toilets, trash, crowding)	Existing facilities and management practices	14 portable toilets. No trash removal service. No limits on when and where people can park and visit.

Resource Element	Resource Indicator	Measure	Baseline Condition
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Limited dispersed camping. No limits on swimming/wading, hiking, or boating opportunities.

Affected Environment – Existing Condition

Recreational Activity Participation and Recreational Experience Quality:

Prior to 2012, access to Fossil Creek was essentially unlimited. Anybody who wanted to go to Fossil Creek could do so. As visitation grew, this resulted in increasing congestion along FR 708, vegetation and soil disturbance from unmanaged parking, and blocked access for emergency responders. As a result, in 2009-2011, the Forest Service began managing traffic and parking, delineating parking areas, and restoring disturbed sites, and in 2012 managing capacity by physically limiting visitor access. Challenges with the capacity management practices that began in 2012, particularly safety concerns for FS personnel and the public, led to implementation of a parking reservation system in 2016. The reservation system allows for 148 vehicles per day: 115 vehicles to park at eight designated locations in Middle Fossil and 33 vehicles at the Fossil Springs Trailhead.

In 2012, recreational opportunities in Fossil Creek were similar to those in 2009. In 2012, field observations hinted that visitors participated in similar activities as in 2009, and in similar proportions (Rotert 2012). For instance, the most common visitor activity at Fossil Creek continued to be swimming, with camping the second most common visitor activity. Hiking was again the third most popular activity. Similarly, a much smaller percentage of visitors reported that they were there to use OHVs or to kayak/raft. However, opportunities for camping were restricted to October 2-March 31. The number of people able to access the Waterfall and Fossil Springs dam were also reduced due to fewer parking spaces available at the Fossil Springs trailhead and along FR 708 near the Waterfall trailhead. The Forest Service has not issued any permits for commercial outfitter and guide activities in the project area.

In 2016-2017, the Forest Service took several actions to reduce resource damage and improve the visitor experience including modifying parking at Fossil Bridge, installation of eight permanent vault toilets to replace all but two portable toilets, and construction of hardened creek access trails at Fossil Bridge and Sally May. The Forest Service also provided funding to the Verde Watershed Ambassador program of the Oak Creek Watershed Council to assist with weekend on-site public education, cleanup, and restoration in Fossil Creek. In 2016-on, Fossil Creek was closed to camping in the river corridor during the peak use season April 1-October 1. Dispersed camping continued in the off-season downstream of the Fossil Bridge and in the Fossil Springs area. In the river corridor, campfires have been prohibited since 2010 and glass food containers since 2014.

Overall, current recreation opportunities are more constrained compared to the 2009 baseline condition due to limitations placed on camping and parking. Conversely, the quality of the visitor experience has likely improved due to actions taken to address primary public concerns identified in the 2011 NAU visitor survey. Since that time, the Forest Service has replaced 12 of 14 portable toilets with eight vault toilets, created reservable designated parking, and reduced trash.

Regarding visitation patterns, in 2012, about 59% of visitors choosing to participate in opportunistic conversations with field staff came from the Phoenix-Metro area (a small increase from 2009), but in 2013, the percent of visitors that came from the Phoenix-Metro area increased to 79%. In 2012, 43% of visitors were repeat visitors (compared to 57% first time visitors), and in 2013, the percent of repeat visitors decreased to 33% (compared to 67% first time visitors). In 2012, the estimated proportion of Hispanic visitors increased to 44%, and increased again to 49% in 2013. Reservation data from 2016 revealed that 89% of visitors were from outside the local area. Again, with the exception of the reservation data, the conclusiveness of the existing information on use patterns is limited by the convenience sampling method used to collect the data.

In 1988, 1996, 2002, and annually from 2009 to 2012, dispersed campsites in the planning area were mapped and evaluated. Survey results show that unrestricted camping through the years has substantially impacted many areas adjacent to Fossil Springs and Fossil Creek. The "engineering" of campsites and the search for firewood has resulted in damage to soils, trees and shrubs. Continued camping at the same locations had eliminated the natural vegetation, leaving areas either devoid of ground cover and/or infested with noxious weeds. The 2009 dispersed campsite inventory identified 163 campsites in the Fossil Creek planning area. Most campsites were located along Fossil Creek between Irving and Stehr Lake. The 2009 campsite evaluation estimated that the total amount of denuded area caused by camping activities was four acres within the Fossil Creek WSR corridor (Rotert, 2012). Most campsites from 2009 were located in pinyon-juniper vegetation type, were barren of vegetation, had tree and shrub damage, had numerous social trails, and human waste was apparent.

Recreational Activity Participation and Recreational Experience Quality (Wild Segments): The existing condition of the recreation ORV for the wild segments of Fossil Creek is most likely similar to the 2009 baseline condition. There is little reason to assume that the amount of recreation use or the types of recreation activities in the wild segments have changed substantially since 2009. But again, no formal studies documenting visitor satisfaction, perceptions of crowding or encounter rates have been conducted in either of these wilderness areas.

Table 3-83. Resource indicators and measures for the existing condition (2012-present)

Resource Element	Resource Indicator	Measure	Existing Condition
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 136,160 visitors possible during permit season April 1-October 1
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	8 vault toilets installed, 4 portable toilets, limited trash removal, spatial and temporal distribution of use through permit system reduces weekend crowding at some locations
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Dispersed camping available outside of permit season. No limits on swimming/wading, hiking, boating.

Environmental Consequences

This section evaluates the potential effects of each alternative to the recreation ORV. The analysis includes the effects of the proposed management direction in the CRMP as well as the effects to recreation access, recreation experience, and recreation participation. The cumulative effects of other activities in the planning area are also evaluated. The analysis concludes with summary tables providing a comparison of the effects to the recreation ORV by each alternative.

Management Direction Common to all Action Alternatives

CRMP management direction for recreation is designed to achieve the desired conditions for all alternatives. Generally, outcomes provide for public access and participation in the river-dependent recreation activities identified in the recreation ORV description, including swimming/wading, hiking, camping, non-motorized boating, wilderness appreciation, hunting, fishing, and visiting cultural attractions. Although the action alternatives differ in where recreation activities may occur, all alternatives provide for continued recreation participation in a manner that protects other resources. Management standards and guidelines provide for public safety, resource protection, and a quality recreation experience. Differences between alternatives related to recreation are focused on the number of people at one time, access to specific waterplay sites, camping availability, and the trail system. These differences are addressed in the separate sections for each action alternative below.

Restrictions on generators, motorized watercraft, helicopter landings, recreational shooting, glass containers, and rope swings are continued in all alternatives.

Dispersed camping is available in the wild segments in all alternatives.

Programmatic Analysis of the Effects of Management Direction

Implementation of the CRMP under the action alternatives will preserve the recreation ORV. Below is a summary of the effects on the recreation ORV of management direction for CRMP components.

Table 3-84: Summary of programmatic level effects of the CRMP on the recreation ORV

Program Area	Anticipated Effects to the recreation ORV
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, and rehabilitating denuded areas outside of recreation sites, all contribute to the preservation of the recreation ORV by providing an environment for quality river-dependent recreation experiences.
Riparian Function	Implementing management direction for proper functioning riparian areas will contribute to the preservation of the recreation ORV by providing an environment for quality river-dependent recreation experiences.
Vegetation	Intact terrestrial vegetation will reduce erosion potential and contribute to the stability of streambanks.
Soil Condition	Minimizing human-created bare areas, particularly outside of recreation sites, and restoration to reduce erosion and sedimentation into Fossil Creek will contribute to the preservation of the recreation ORV by providing an environment for quality river-dependent recreation experiences.
Geology	Protection of travertine dams, the unique structural and vegetative habitat they create, and the natural processes of accretion and destruction ensure the preservation of a key characteristic of Fossil Creek which in turn contribute to the preservation of the recreation ORV by providing an environment for quality river-dependent recreation experiences.
Wildlife, Fish and Aquatic Species	Maintaining wildlife, fish, and aquatic species habitat is a key aspect of preserving the natural character of Fossil Creek and contribute to the preservation of the recreation ORV by providing an environment for quality river-dependent recreation experiences.
Heritage and Traditional Cultural Practices	Continuation of traditional Yavapai and Apache practices and preservation of cultural sites contribute to the preservation of the recreation ORV by providing an opportunity for visitors to learn about and appreciate local history and culture during their visit.
Recreation	The CRMP programmatic direction provides for continued recreation participation in a manner that protects other resources. Management standards and guidelines provide for public safety, resource protection, and a quality recreation experience. Restrictions on generators, motorized watercraft, helicopter landings, recreational shooting, glass containers, and rope swings are continued in all alternatives. Dispersed camping is available in the wild segments in all alternatives. Differences between alternatives related to recreation are focused on the number of people at one time, access to specific water play sites, camping availability, and the trail system. The effects of these differences are addressed in the separate sections for each action alternative below.
Recreation/Lands Special Uses	Vegetation under powerlines is kept mainly free of tree canopy which could affect scenery. Permit holders and filming permittees should provide an education component to their content and should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values, including the recreation ORV. Outfitter/guided activities can contribute to quality recreation experiences because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities are screened, tailored to reduce impacts to the recreation ORV, and contribute data needed to inform management decisions.
Roads and Facilities	Proper maintenance of roads and construction of new facilities will include mitigations to avoid short-term negative effects to the recreation ORV. Improved and well-maintained roads and facilities contribute to the preservation of the recreation ORV by helping provide a quality experience for visitors.
Scenery Resources	There are no negative effects from scenery guidance to the recreation ORV. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare ground areas outside of recreation sites, trails and roads will reduce erosion and contribute to a quality recreation experience.
Special Areas	Act-driven restrictions in special areas indirectly benefit the recreation ORV through minimizing the use of motorized equipment and mechanized travel thereby reducing erosion, as well as protecting and enhancing river values. Expansion of the Fossil Springs Botanical Area would increase the area in which the protection and maintenance of physical and biological processes unique to the Fossil Springs area is emphasized. This would benefit the Recreation ORV by supporting protection of the

Program Area	Anticipated Effects to the recreation ORV
	area around the spring source, which would help protect a quality recreation experience in this area. Restricting horse camping within the Botanical Area would reduce the diversity of recreation opportunities in this area; however, this type of use rarely occurs so the magnitude of impact will be negligible.
Interpretation and Education	Interpretation and education will mainly result in indirect benefits to the recreation ORV. These benefits can include visitors who are respectful of Fossil Creek and appreciate their role in preserving river values for the future.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Effects Unique to Each Alternative

Alternative A (No Action)

Management Direction

Not applicable as the No Action alternative would not result in a Comprehensive River Management Plan. General Forest Plan management guidance from the Coconino and Tonto national forests would continue to be applied to the project area.

Recreation Access

Alternative A would continue the existing permit system with possible adjustments as needed to protect natural and cultural resources.

Recreation Experience

Alternative A would continue the existing interim management practices without guidance from a river management plan. Controls on undesirable behavior resulting in ORV impacts would be addressed to the extent possible with educational efforts and possibly short-term closures, without the comprehensive analysis provided by the CRMP development process. Facilities to benefit visitors could be developed on an ad-hoc basis but the process would be slowed by the need for additional National Environmental Policy Act analysis.

Recreation Participation

The No Action alternative would continue to prohibit camping in the river corridor during the popular permit season April 1- October 1. Other current activities would not be limited except possibly on a case-by-case basis if resource-specific monitoring indicated a need.

Table 3-85. Resource indicators and measures for alternative A direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative A Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 135,000 people during permit season subject to change due to monitoring results
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	None planned, but possible on an ad-hoc basis.

Resource Element	Resource Indicator	Measure	Alternative A Direct/Indirect Effects
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Dispersed camping outside of the permit season. No limits on other activities.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than those analyzed in the alternatives. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. The quality of the visitor recreation experience has likely been improved due to past and present actions that have reduced potential crowding, trash, and sanitation issues. Availability of river-dependent recreational activities have generally been unaffected by past and present actions with the exception of camping which has been restricted at certain times and locations since 2010. As the No Action Alternative, Alternative A would not increase or reduce any of these effects to the recreation ORV.

Conclusions

In general, the No Action alternative would result in both positive and negative effects to the recreation ORV. On the positive side, the level of public access would likely be maintained substantially above the 2009 baseline level. Also, recreation activities at popular sites such as Fossil Springs and the waterfall may not be limited. The quality of the recreation experience would also be improved over baseline conditions with less trash, better sanitation, and reduced crowding. However, the recreation ORV would most likely not be further enhanced as improvements to facilities would not be planned, restrictions on undesirable behavior, such as shooting, using motorized watercraft, use of glass bottles, would be short-term or would not go into effect.

Alternative B (Enhanced Protections)

Management Direction

Alternative B includes one unique management guideline: camping in Middle Fossil and trailheads should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events). Limited dispersed camping in the Fossil Springs area should be allowed. The potential effect of this guideline on the recreation ORV is discussed below under Recreation Participation. Other programmatic management direction remains the same for all action alternatives. See table 3-92 for discussion of effects. Recreation Opportunity Spectrum (ROS) classifications do not change in any of the alternatives.

Recreation Access

This alternative provides access for up to 100,800 people during the April 1-October 1 permit season. This use level allows for up to 21,000 more people than the 2009 baseline condition. Access may be limited in the short-term during construction of facilities.

Recreation Experience

Infrastructure development at Heinrich would include a small welcome center for public education and an administrative site to facilitate increased management presence. Parking would be expanded at Fossil Creek Bridge and a composting toilet could be installed in the Fossil Springs area if needed. These improvements would most likely enhance the recreation experience by addressing public education, management presence, and

sanitation issues expressed by visitors. Crowding at specific locations would likely decrease or remain unchanged from current conditions due to reduced PAOT and less parking at some sites.

Recreation Participation

Alternative B allows for year-round camping at designated sites in middle Fossil and limited dispersed camping in the Fossil Springs area. Although camping was unregulated in 2009, camping is currently prohibited within the Fossil permit area during the permit season to mitigate resource damage. This alternative would expand summer camping within limits expected to prevent negative effects.

Parking would be reduced from the existing condition at Homestead, Tonto Bench, Irving, Lewis trailhead, and the Bear trailhead. Parking would increase at Fossil Creek Bridge. Overall, participation in any type of river-dependent non-motorized recreation activity would not be affected by this alternative. However, the total amount of participation would decline by 34,200 people from the current situation due to the lower PAOT limit.

Table 3-86. Resource indicators and measures for alternative B direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative B Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 100,800 during permit season
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	Heinrich: welcome center with 15 parking spaces, indoor/ outdoor interpretive displays, short interpretive trail and/or canopy walk, toilet, trash receptacles, and one-way loop road. Host/ administrative site with toilet. No river access. Fossil Bridge: New bridge. 15 parking spaces; bike racks. Fossil Springs: possible composting toilet
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Year-round camping at designated sites in middle Fossil. Year-round limited dispersed camping in Fossil Springs area. Parking reduced at Homestead, Tonto Bench, Irving, Lewis trailhead, Bear trailhead. Parking increased at Bridge.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. The cumulative effects area includes the project area and connected trail use. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than forecasted trends such as population growth and increasing frequency and severity of drought from climate change, which is expected to increase the demand for recreation opportunities, especially water-based activities. The CRMP, restoration activities, and facilities approved under Alternative B would address the increasing demand for water-based recreation by providing a limit on maximum use and providing for adaptive management should effects result in degradation of one or more ORVs. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. Alternative B would further improve the quality of the recreation experience and increase recreation

opportunities with additional facilities and camping, but would reduce overall recreation access by eliminating some parking.

Conclusions

Alternative B would emphasize resource protection while allowing up to 20,800 visitors above the 2009 baseline level during the permit season. Public access to existing recreation sites would continue, but at a reduced level per day at some locations. Overall experience quality would likely improve as lower numbers of people generate less trash, fewer sanitation issues, and less crowding. However, visitors would not benefit from improved facilities other than a new welcome center at Heinrich. This alternative may reduce opportunities for river-dependent recreation, especially kayaking, as parking is reduced at the Lewis Trailhead and other river access points. Camping opportunities would increase in the area of Fossil Springs where up to three groups could camp per day year-round.

Alternative C (Non-Motorized Experience)

Management Direction

Alternative C includes one unique management guideline**:** Camping in Middle Fossil, trailheads, and other areas within the recreation segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events). The potential effect of this guideline on the recreation ORV is discussed below under Recreation Participation. Other programmatic management direction remains the same for all action alternatives. See table 3-92 for discussion of effects. Recreation Opportunity Spectrum (ROS) classifications do not change in any of the alternatives.

Recreation Access

This alternative provides access for up to 118,800 people during the April 1-October 1 permit season. This use level allows for up to 38,800 more people than the 2009 baseline condition. Access may be limited in the short-term during construction of facilities.

Recreation Experience

Alternative C would make access to recreation sites east of Homestead pedestrian only, including Fossil Bridge, Tonto Bench, Irving, and Lewis trailhead. Sally May and Purple Mountain sites would be closed and restored. Homestead and Cactus Flat would be developed to accommodate most of the parking in the Fossil corridor. While the lower PAOT and vehicle restrictions in this alternative would likely improve sanitation, reduce trash, and further limit crowding, visitors would have to walk up to three miles to access the primary recreation sites in middle Fossil. Thus, crowding would likely increase at Homestead as this would be the primary creek access point that visitors could reach by car, reducing satisfaction for people desiring easier access to popular locations like the waterfall. New picnic facilities would be developed at Cactus Flat, Homestead, Irving, and the Rim Trailhead, improving the recreational experience by providing basic facilities in areas already impacted from regular use.

Recreation Participation

The new Creek View trail with connector to Irving and the new Rim Trail would increase hiking opportunities. But, access to Fossil Springs would be closed by eliminating the eastern mile of the Flume Trail and the portion of the Bear Trail in the Fossil Springs Botanical Area. The net effect would be an increase in trail miles in the Fossil corridor from 18 miles to 21.5 miles. Although this alternative would result in a positive effect to overall hiking opportunities, it would degrade the recreation ORV by preventing access to hiking, swimming/wading, and camping in the unique Fossil Springs area. Camping would be available year-round at Cactus Flat and the Rim Trailhead but would still result in an overall decline in camping opportunities due to the elimination of camping in Middle Fossil and the Fossil Springs area which are the locations where people want to camp. The walk-in requirement will also limit boating access to the creek between the waterfall and Irving as most people may be unwilling or unable to carry or drag their kayaks up to three miles to the popular put-in at the waterfall.

Table 3-87. Resource indicators and measures for alternative C direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative C Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 118,800 during permit season
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	New picnic facilities at Cactus Flat, Homestead, Irving, Rim. Administrative site at Heinrich. Reduced crowding, trash, and sanitation problems at walk-in sites.
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Access to Fossil Springs closed. Tonto Bench, Irving, Waterfall walk-in only potentially reducing boating access. Sally May, Purple Mountain closed. Limited year-round camping only at Cactus Flat, Rim. New Creek View and Rim trails.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. The cumulative effects area includes the project area and connected trail use. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than forecasted trends such as population growth and increasing frequency and severity of drought from climate change, which is expected to increase the demand for recreation opportunities, especially water-based activities. The CRMP, restoration activities, and facilities approved under Alternative C would address the increasing demand for water-based recreation by providing a limit on maximum use and providing for adaptive management should effects result in degradation of one or more ORVs.. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. Alternative C would combine with the effects of previous actions to improve the recreation experience with additional facilities. Public access and opportunities for river-dependent recreation would decline due to reduced parking, closing access to Fossil Springs, reduced camping, and more difficult access for kayaks.

Conclusions

Alternative C would maintain overall use levels above the 2009 baseline condition. Use would be concentrated in the Homestead and Fossil Creek Bridge area as visitors could no longer drive to sites east of Homestead. The overall experience may be more crowded as access is closed to other areas including Fossil Springs, Purple Mountain, and Sally May. However, trash and sanitation issues would likely decline in areas with less use. Participation in recreation activities that contribute to the recreation ORV, such as kayaking, camping, swimming and wading, may be reduced as locations are closed to access or are made more difficult to access. New hiking opportunities would be balanced by the loss of access to the springs via the Bear Trail and the Flume Trail. Due to the uniqueness of the Springs and the lack of similar options elsewhere, prohibiting all access for recreation would have an adverse effect on the recreation ORV.

Alternative D (Motorized Use and Refugia)

Management Direction

Alternative D includes one unique management guideline**:** Camping should not be allowed in Middle Fossil, trailheads, and other areas within the recreation segment, except for special events authorized on a case-by-case

basis (such as special use permits or educational events). The potential effect of this guideline on the recreation ORV is discussed below under Recreation Participation. Other programmatic management direction remains the same for all action alternatives. See table 3-92 for discussion of effects. Recreation Opportunity Spectrum (ROS) classifications do not change in any of the alternatives.

Recreation Access

This alternative provides access for up to 116,100 people during the April 1-October 1 permit season. This use level allows for up to 36,100 more people than the 2009 baseline condition. This option would also allow for opening FR708 from Middle Fossil to Strawberry for all motor vehicles subject to daily permit limits. Maximum capacity includes an additional 40 passenger vehicles per day (200 PAOT) for scenic driving. Scenic driving permits account for all of the additional use above the 2009 baseline use level that would be allowed by this alternative. Access may be limited in the short-term during construction of facilities.

Recreation Experience

While the lower PAOT in this alternative would likely improve sanitation, reduce trash, and further limit crowding at some sites, crowding would likely increase at Homestead, Fossil Creek Bridge, and Irving as these would be the primary creek access points where visitors could park for the day. New picnic facilities would be developed at Irving, and Rim Trailhead. A small welcome station and administrative site at Heinrich would improve visitor education and increase management presence in Middle Fossil. Visitors may experience increased motorized noise from OHVs on the currently closed section of FR 708.

Recreation Participation

In general, Alternative D provides for increased motorized use in Middle Fossil while limiting other activities in areas managed as refugia. Closure of Purple Mountain, Sally May, Tonto Bridge, Lewis Trailhead, Lewis Trail, and access to the Fossil Springs area would limit swimming/wading and kayak opportunities. Camping would be prohibited year-round in Middle Fossil and in the Fossil Springs area, thus eliminating a popular recreation activity identified as a component of the recreation ORV. This alternative would also result in a net decrease of five miles of trails from 18 miles at baseline to 13 miles, reducing opportunities for hiking. As a result, this alternative would degrade the recreation ORV.

This alternative also includes scenic driving for up to 40 additional passenger vehicles per day. Scenic driving is not considered a river-dependent recreation activity and was not included in the recreation ORV resource assessment.

Table 3-88. Resource indicators and measures for alternative D direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative D Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 116,100 visitors during permit season (including 36,000 for scenic driving)
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	Small welcome center and administrative site at Heinrich. New picnic facilities at Irving, Rim Trailhead,
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Access to Fossil Springs closed. Purple Mountain, Sally May, Lewis Trail, Bear Trail closed. Short-term only parking at Tonto Bench, Lewis Trailhead. Parking reduced at Homestead, Parking increased at Bridge, Irving. New Rim Trail. No camping in Middle Fossil or Fossil Springs area.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. The cumulative effects area includes the project area and connected trail use. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than forecasted trends such as population growth and increasing frequency and severity of drought from climate change, which is expected to increase the demand for recreation opportunities, especially water-based activities. The CRMP, restoration activities, and facilities approved under Alternative C would address the increasing demand for water-based recreation by providing a limit on maximum use and providing for adaptive management should effects result in degradation of one or more ORVs. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. The quality of the visitor recreation experience has likely been improved due to past and present actions that have reduced potential crowding, trash, and sanitation issues. Availability of river-dependent recreational activities have generally been unaffected by past and present actions with the exception of camping which has been restricted at certain times and locations since 2010. Alternative D would combine with the effects of previous actions to have both positive and negative effects to the quality of the recreation experience with some new facilities and fewer people at some sites while other people are concentrated at other sites where they may experience more crowding. Limitations on access to Fossil Springs, the waterfall, and a year-round prohibition of camping would reduce or eliminate recreation opportunities such as swimming/wading, kayaking, hiking, and camping that are components of the recreation ORV.

Conclusions

Alternative D would allow for 36,000 more visitors during the peak season than the 2009 baseline condition. All of this additional use would be due to adding scenic driving to the permit system. Sanitation problems, amount of trash, and crowding would likely decline in many locations due to limiting parking to only a few sites. However, visitors would be concentrated at fewer locations, such as Irving, where they may experience more crowding and vehicle noise. Recreation facilities would be improved and expanded at Irving and the new Rim Trailhead contributing to a better experience there. Visitors may experience increased motorized noise from OHVs on the currently closed section of FR 708. Limitations on access to Fossil Springs, the waterfall, and a year-round prohibition of camping would reduce or eliminate recreation opportunities such as swimming/wading, kayaking, hiking, and camping that are components of the recreation ORV.

Alternative E (Enhanced Recreation Opportunities with Phased Implementation)

Management Direction

Alternative E includes two unique management guideline**s** related to camping. Camping in Middle Fossil, trailheads, and other areas within the recreation segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events). In addition, limited camping in the Fossil Springs area should be allowed at designated sites. The potential effect of this guideline on the recreation ORV is discussed below under Recreation Participation. Other programmatic management direction remains the same for all action alternatives. See table 3-92 for discussion of effects. Recreation Opportunity Spectrum (ROS) classifications do not change in any of the alternatives.

Recreation Access

This alternative provides access for up to 243,000 people during the April 1-October 1 permit season. This use level allows for up to 163,000 more people than the 2009 baseline condition. Alternative E would also allow for opening FR708 from Middle Fossil to Strawberry for off-highway vehicles (OHV) for scenic driving subject to a permit limit of 40 OHVs per day (80 PAOT). Access may be limited in the short-term during construction of facilities.

Recreation Experience

The quality of the recreation experience would benefit from additional day use facilities at Cactus Flat, Homestead, Irving, Rim Trailhead which would help manage trash, sanitation, and crowding by distributing visitors to sites designed to accommodate the use. Possible sanitation issues could be mitigated with toilets on the Lewis Trail near the waterfall and at the historic dam near Fossil Springs. However, the addition of up to 40 OHVs per day accessing Middle Fossil from Strawberry may increase motorized noise in the vicinity.

The experience in the Fossil Springs area would be improved due to a reduction in the number of parking spaces at the Bear trailhead from 33 to six. With a total of 30 PAOT in Fossil Springs, problems with trash and sanitation would be mitigated and social conditions would be more consistent with the semi-primitive ROS setting.

Recreation Participation

Alternative E would make camping available year-round at designated sites in Middle Fossil, in the Fossil Springs area, and at the Rim Trailhead. Camping outside of designated sites (dispersed camping) would no longer be allowed at any time in the WSR corridor. The new Creek View and Rim trails would add five miles to the trail system for a total of 23 miles.

This alternative also includes scenic driving for up to 40 additional off-highway vehicles per day accessing Middle Fossil from Strawberry. Motorized trail use is not considered a river-dependent recreation activity and is not included in the recreation ORV resource assessment. Managing motorized trail use by permit will add a new level of complexity to the capacity system. It is likely to be challenging to manage motorized trail use once vehicles enter the permit area. Managing where these vehicles stop and for how long would be difficult and likely to involve a disproportionate commitment of staff time.

Table 3-89. Resource indicators and measures for alternative E direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative E Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 243,000 visits during permit season (including up to 14,400 visits via OHV)
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	New Cactus Flat welcome center, Irving picnic site, Homestead day use facilities and campsites, Creek View Trail, Rim Trail, Heinrich administrative site, possible toilets near waterfall and historic dam if needed.
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Year-round limited camping at designated sites in Middle Fossil, Rim Trailhead, and Fossil Springs area. New Creek View and Rim Trails. Permits for Fossil Springs area reduced. No dispersed camping.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. The cumulative effects area includes the project area and connected trail use. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than forecasted trends such as population growth and increasing frequency

and severity of drought from climate change, which is expected to increase the demand for recreation opportunities, especially water-based activities. The CRMP, restoration activities, and facilities approved under Alternative C would address the increasing demand for water-based recreation by providing a limit on maximum use and providing for adaptive management should effects result in degradation of one or more ORVs. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. The quality of the visitor recreation experience has likely been improved due to past and present actions that have reduced potential crowding, trash, and sanitation issues. Availability of river-dependent recreational activities have generally been unaffected by past and present actions with the exception of camping which has been restricted at certain times and locations since 2010. Alternative E would combine with the effects of previous actions to improve recreation access, generally improve the recreation experience, and provide continued participation in river-dependent recreation activities identified in the recreation ORV resource assessment.

Conclusions

Alternative E would improve recreation access, generally improve the recreation experience, and provide continued participation in river-dependent recreation activities identified in the recreation ORV resource assessment. Visitor capacity would allow for up to 163,000 people above the 2009 baseline as infrastructure is developed to accommodate additional use without degrading natural and cultural resource ORVs. Improved recreation facilities in Middle Fossil would enhance the visitor experience by better managing trash, sanitation, and crowding. The experience in the Fossil Springs area would be enhanced through a reduction in PAOT as a means of controlling trash and sanitation issues without additional development unless necessary. Recreation activity participation would be enhanced by allowing for the reintroduction of camping during the summer months, a popular activity that was curtailed for several years due to resource impacts and safety concerns.

Opening FR708 to up to 40 off-highway vehicles per day entering from Strawberry may adversely affect the recreation experience in Middle Fossil due to additional vehicle noise and potential conflict with OHVs, pedestrians, and other vehicles sharing the road as people walk to their favorite swimming site. Access may be limited in the short-term during construction of facilities.

Alternative F (Demand-based Access)

Management Direction

Alternative F is the only action alternative in which a limited entry system, such as parking reservations, would eventually be eliminated if monitoring indicates that the system was no longer needed. Other programmatic management direction remains the same for all action alternatives. See table 3-92 for discussion of effects. Recreation Opportunity Spectrum (ROS) classifications do not change in any of the alternatives.

Recreation Access

This alternative provides access for up to 472,140 people during the April 1-October 1 season. This use level allows for up to 392,140 more people than the 2009 baseline condition. Although Alternative F initially includes a reservation system which may later be eliminated, the same timeframe was used to calculate access numbers to provide a basis of comparison with the other alternatives. Access may be limited in the short-term during construction of facilities.

Recreation Experience

Alternative F would make access to recreation sites east of Homestead pedestrian only, including Fossil Bridge, Tonto Bench, Irving, and Lewis trailhead. Homestead and Cactus Flat would be developed to accommodate most of the parking in the Fossil corridor. Closing FR 708 upstream of Homestead may avoid repeating the problems with crowding, traffic congestion, and public safety that existed before the Forest Service began capacity controls in 2011.

Increasing the number of people in Middle Fossil nearly six-fold from the 2009 baseline may cause an adverse effect to the visitor experience by concentrating many more people per day in Middle Fossil possibly resulting in increased crowding at primary destinations, particularly the Waterfall, as well as increased likelihood of trash and sanitation issues. As visitors would have to walk up to three miles to access the primary recreation sites in middle Fossil, it is possible that recreation use would be somewhat dispersed to locations closer to the Cactus Flat parking although currently many people choose to walk three or more miles to the Waterfall if they cannot park closer. Additional facilities may be developed at Irving to provide a picnic and water play destination to divert some use from the Waterfall.

Adverse effects to the recreation experience are also likely without an effective limited-entry system. Recreational use in Middle Fossil grew rapidly from 2006 to 2012 leading to implementation of increasingly restrictive capacity management actions. These actions were necessary to reduce traffic congestion, resource damage, crowded and unsanitary conditions, and regular confrontations with frustrated people held at the FR 708 entry gate. While Alternative F will temporarily provide adequate parking for visitors, that capacity is likely to be exceeded as public awareness spreads that a reservation is no longer required to visit. Visitors would no longer be able to plan on having a reserved parking space and will have to beat the crowds to get to Fossil early before the parking lot fills up. In addition, the former problems with frustrated and belligerent people, trash, and unsanitary conditions are likely to return so some degree. In sum, these returning problems may cause an adverse effect to the recreation experience in Middle Fossil for at least one to three years as additional management restrictions are analyzed and approved through the NEPA process.

Recreation Participation

The new Creek View Trail with connector to Irving and the new Rim Trail would increase hiking opportunities. However, the Springs Trail would be closed and decommissioned. Access to the Fossil Springs area would shift to the Flume Trail adding two miles roundtrip with the closure of the Springs Trail. The net effect would be an increase in trail miles in the Fossil corridor from 18 miles to 21 miles, but the hike to Fossil Springs would be a mile longer each way. Dispersed camping would be available throughout the recreational segment in the low-use season. During the high-use season approximately April 1- October 1, camping would be available at up to ten designated sites at Homestead. Closure of FR 708 upstream from Homestead would limit summer kayak access to the creek between the waterfall and Irving as very few people would be willing or able to carry or drag their boats up to three miles to the popular put-in at the waterfall.

Table 3-90. Resource indicators and measures for alternative F direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative F Direct/Indirect Effects
River dependent recreation	Public access	Number of people visiting Fossil Creek	Up to 472,140 during high-use season April 1-October 1
Recreation experience	Experience quality (toilets, trash, crowding)	Improvements to facilities and management	New picnic facilities at Irving, Homestead, Rim. Administrative site at Heinrich. Possible increased crowding, trash, sanitation issues due to higher use concentrated at Middle Fossil sites.
Recreation participation	Availability of camping, swimming/wading, hiking, boating opportunities	Available opportunities	Dispersed camping in recreational segment in winter. Designated camping at Homestead in summer. Six miles of new trails. Walk-in access from Homestead may reduce boating access. Springs access would shift to the longer Flume Trail.

Cumulative Effects

Cumulative effects are those which may result in a change in one of the three resource indicators for the recreation ORV from past, present, or reasonably foreseeable actions. The cumulative effects area includes the project area and connected trail use. Relevant past actions include recreation capacity management, installation of facilities such as toilets, trail maintenance, and creekside restoration projects such as hardening access trails. Current actions include the continuation of the Fossil Creek interim management measures including the parking reservation system and seasonal camping restrictions. There are no reasonably foreseeable actions that are relevant to the recreation ORV, other than forecasted trends such as population growth and increasing frequency and severity of drought from climate change, which is expected to increase the demand for recreation opportunities, especially water-based activities. The CRMP, restoration activities, and facilities approved under Alternative F would address the increasing demand for water-based recreation by providing a limit on maximum use and providing for adaptive management should effects result in degradation of one or more ORVs. Cumulatively, past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. The quality of the visitor recreation experience has likely been improved due to past and present actions that have reduced potential crowding, trash, and sanitation issues. Availability of river-dependent recreational activities have generally been unaffected by past and present actions with the exception of camping which has been restricted at certain times and locations since 2010. Alternative F would combine with the effects of previous actions to increase public access with expanded parking, but reduce the quality of the experience with more people concentrated in Middle Fossil. River dependent recreation opportunities may decline somewhat for kayakers having to carry their boats from Homestead and a longer hike to Fossil Springs with the closure of the Springs Trail.

Conclusions

Alternative F would maintain overall use levels well above the 2009 baseline condition. Use would be concentrated between Homestead and the Waterfall as this section of FR 708 would be closed to motor vehicles during the high-use season. The overall experience may be more crowded due to doubling the available parking from Alternative E which has the next highest level of public use. Trash and sanitation issues would likely increase in Middle Fossil with substantially higher use. Participation in camping and hiking would increase with the availability of summer camping at Homestead. Closure of FR 708 to motor vehicle access at Homestead would reduce opportunities to put in kayaks at the Waterfall. Closure of the Springs Trail would shift Fossil Springs hikers to the longer Flume Trail and may increase the number of people walking or biking down FR708 to access the Waterfall from the Strawberry side of Fossil Creek.

Summary

Degree to Which the Purpose and Need for Action is Met

Table 3-91. Summary comparison of how the alternatives address the purpose and need

Purpose and Need	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Preserve/enhance recreation ORV	Recreation access (number of people during permit or high-use season)	53,000 above baseline	21,000 above baseline	39,000 above baseline	36,000 above baseline (for scenic driving)	Up to 163,000 above baseline (includes up to 14,400 via OHV)	392,140 above baseline
	Recreation experience quality	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	Less crowding, trash, sanitation issues	More crowding, trash, sanitation issues
	Recreation activity participation	Limited camping	Limited camping	Limited camping Less boating More hiking Less swimming access No Springs access	No camping Less hiking Less swimming access	Limited camping More hiking	Limited camping Less boating More hiking

Degree to Which the Alternatives Address the Issues

Table 3-92: Summary comparison of how the alternatives address the key issues

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Recreational use may impact other resources	Effects to natural and cultural resources are addressed in the relevant resource section.						

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Noise and crowding from high levels of recreational use may negatively impact recreation experience	OHV access, other vehicle access, distribution of use	OHV and scenic driving infrequent. Noise limited due to few OHVs, no through-traffic on FR708. Permit system spreads out location and timing of use. Crowding may occur at waterfall site on weekends, but most other locations receive light or moderate use.	OHV and scenic driving infrequent. Noise limited due to few OHVs, no through-traffic on FR708. Permit system spreads out location and timing of use. Crowding at waterfall may be reduced due to less trailhead parking. Other sites in middle Fossil also have less parking.	OHV and scenic driving infrequent. Noise limited due to few OHVs, no through-traffic on FR708. All vehicles park west of Homestead; sites east of bridge are walk-in only. Permit system spreads out location and timing of use. Crowding likely reduced at waterfall due to three mile walk. Crowding may increase at Homestead and the bridge closer to parking areas.	Scenic driving by permit up to 40 vehicles per day. Noise likely to increase between Strawberry side and middle Fossil, but less than if additional vehicles were all OHVs. Permit system spreads out location and timing of use.	OHV use of FR708 by permit up to 40 vehicles per day. Noise likely to increase between Strawberry side and middle Fossil. Permit system spreads out location and timing of use.	OHV and scenic driving infrequent. FR 708 upstream from Homestead closed to public motorized use. Increased recreation use of Middle Fossil. Use may be spread out in Middle Fossil due to road closure at Homestead.
Restricting swimming, particularly at the Waterfall, may negatively impact recreation opportunities and experience	Swimming restrictions	No restrictions. All areas open to swimming within parking capacity.	No restrictions. Parking capacity at waterfall trailhead and springs trailhead reduced. Overall reduction in swimming opportunities due to lower PAOT.	Access closed to Fossil Springs. PAOT reduced. Waterfall and other sites east of Homestead walk-in only. Overall reduction in swimming opportunities.	Waterfall trail and Fossil Springs trail closed and restored. Tonto Bench closed limiting access to popular swimming sites. Parking expanded at Irving. Overall reduction in swimming opportunities.	No restrictions. All areas open to swimming within parking capacity. Capacity reduced at Fossil Springs. Capacity increased at Irving. Overall increase in swimming opportunities due to higher PAOT.	No swimming restrictions. Non-motorized access to Waterfall may reduce numbers there, but may be counterbalanced by the increased number of people able to access Middle Fossil.
Restricting boating (kayaking, packrafting) may negatively impact the diversity of recreation opportunities	Boating restrictions	No restrictions. All areas open to boating within parking capacity.	No restrictions. Parking capacity at waterfall trailhead reduced. Possible overall reduction in boating	Waterfall and other sites east of Homestead walk-in only. PAOT reduced. Overall reduction in boating opportunities.	Waterfall trail closed and restored. Irving parking expanded. PAOT reduced. Overall reduction in boating access.	No restrictions. Parking capacity at waterfall trailhead does not change. Increased PAOT may provide more	No restrictions, but closing FR 708 to motor vehicles upstream from Homestead during high-use season will make it harder to

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
			opportunities due to lower PAOT.			boating opportunities.	transport kayaks to the Waterfall.
Restricting access to the Fossil Springs area eliminates a popular backcountry recreation opportunity	Access restrictions to Fossil Springs	Approximately 165 people per day during permit season. Unlimited outside of permit season.	Approximately 90 people per day during permit season. Unlimited outside of permit season.	Approximately 165 people per day during permit season. Unlimited outside of permit season.	Fossil Springs access trails closed.	Approximately 30 people per day during permit season. Access unlimited outside of permit season.	Access via Springs Trail closed.
Allowing camping in the Fossil Creek corridor, including in the Fossil Springs area, increases the diversity of available recreation opportunities.	Available camping	Dispersed camping available downstream of bridge and upstream of dam outside of permit season. Available year-round in wild segments outside permit area.	Up to 10 designated campsites available in middle Fossil outside of permit season. Dispersed camping in Fossil Springs areas for up to 3 groups of 5 people year-round. Dispersed camping available year-round in wild segments outside permit area.	Up to 3 designated campsites at Cactus Flat and 4 sites at Rim Trailhead. No camping at Fossil Springs. Dispersed camping available year-round in wild segments outside permit area.	No camping available in middle Fossil or at Fossil Springs. Dispersed camping available year-round in wild segments outside permit area.	Up to 10 designated campsites in middle Fossil. 4 sites at Rim trailhead. 3 designated sites in upper Fossil. Sites reserved through permit system available year-round. Dispersed camping available year-round in wild segments outside permit area.	Dispersed camping in Middle Fossil and Fossil Springs limited to low-use season. 10 designated campsites at Homestead in high-use season.
Allowing camping may increase impacts to natural and cultural resources and result in additional trash.	Effects to natural and cultural resources are addressed in the relevant resource section.						
	Amount of trash from camping	No legal camping during permit season. Dispersed camping outside of permit season. Amount of trash from camping during winter is unknown.	Camping limited to 10 designated campsites in middle fossil. Site host present. Dispersed camping for 3 groups in springs area.	Camping limited to 7 designated campsites. Site host present.	No camping allowed.	Year-round limitation of camping to 17 designated sites and possible site host will likely reduce amount of trash left by campers	Camping limited to 10 designated campsites in middle fossil. Site host present. Dispersed camping outside of high-use season. Amount of trash from camping during winter is unknown.
Managing entry into the Fossil Creek corridor with a permit	Percent of people canceling unused permit for refund.	Permits available by phone or internet. $10 per vehicle	Permits may be available on-site with improved cell coverage Permit fees are outside the scope of this analysis and are determined through a separate process.				No permit unless future monitoring indicates a need. Permit fees are

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
system may exclude potential visitors due to technical challenges posed by using the permit system or financial burden of paying a fee.	Number of people requesting technical assistance from Recreation.gov call center.	administrative fee. Few no-shows (12%) bother to cancel unused permits for refunds indicating nominal cost.					outside the scope of this analysis and are determined through a separate process.
Additional infrastructure development may reduce the wild character and scenic integrity of Fossil Creek.	Effects to scenic integrity are addressed in the scenery resource section						
	New development in wild segments	No new infrastructure in wild segments.	Dispersed camping limited to three groups per night. Composting toilet at historic dam if needed.	Purple Mountain parking lot removed. No camping in Fossil Springs area. Springs access trails closed.	Purple Mountain parking lot removed. No camping in Fossil Springs area. Springs access trails closed.	Possible development in upper wild segment limited to three designated campsites and composting toilet if needed.	Dispersed camping in low-use season. Composting toilet at historic dam if needed.
Additional infrastructure, such as toilets, trash facilities, improved parking, informational signage, and designated creek access, may reduce the impacts of recreational use on corridor resources and improve visitor behavior.	Effects on natural and cultural resources are addressed in the relevant resource section.						
Increasing motorized access to the Fossil Creek corridor from the Strawberry side would provide an	Emergency response time is outside the scope of this analysis.						

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
opportunity for motorized recreation, particularly for those from the Strawberry area who may be unable to hike into Fossil Creek, and may decrease emergency response times.	Opportunities for motorized recreation.	Motorized recreation access from SR260 with parking permit during reservation season, unlimited rest of year			Possible scenic driving from Strawberry with any vehicle by permit up to 40 vehicles per day	Possible OHV access from Strawberry by permit up to 40 vehicles per day	Unlimited motorized recreation access from SR 260 with parking limited to available lots.
Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.	Effects on natural resources are addressed in the relevant resource section.						
	Noise, crowding, trash	Motorized use limited to permitted vehicles driving to parking lots. Crowding limited by permit system. Trash limited by PAOT, management presence.	Number of vehicles at one time reduced by approximately 36. Motorized use limited to permitted vehicles driving to parking lots. Crowding limited by permit system. Trash limited by PAOT, management presence.	Number of vehicles at one time reduced by approximately 16. Motorized use limited to permitted vehicles driving to parking lots. Crowding limited by permit system. Trash limited by PAOT, management presence.	Up to 40 additional vehicles with scenic driving permits entering from Strawberry side per day may add to noise. Crowding limited by permit system. Trash limited by PAOT,	Up to 40 additional OHVs with permit entering from Strawberry side per day likely to add to noise. Crowding limited by permit system. Trash limited by PAOT, management presence.	FR 708 upstream from Homestead closed to public motor vehicle traffic. Crowding and trash may increase due to double the number of daily users compared to Alt E.
Limiting public use of Fossil Creek may negatively impact local economies by reducing visitors who may patronize local businesses.	Local spending by visitors	Economic effects addressed in socioeconomics section					
	Number of visitors	Up to 135,000 people during permit season. 55,000 above 2009 baseline. Unlimited at other times.	Up to 100,800 people during permit season. 20,800 above 2009 baseline. Unlimited at other times.	Up to 118,800 people during permit season. 38,800 above 2009 baseline. Unlimited at other times.	Up to 116,100 people during permit season. 36,100 above 2009 baseline. Unlimited at other times.	Up to 243,000 people during permit season. 163,000 above 2009 baseline. Unlimited at other times.	Up to 472,140 people during high-use season. 392,140 above 2009 baseline. Unlimited at other times.
Commercial activities (e.g. outfitters/guides or concessionaires) may increase local	Local spending by visitors.	Economic effects addressed in socioeconomics section					
	Effect on natural and cultural resources	Effects on natural and cultural resources are addressed in the relevant resource section.					

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
economic opportunity, increase recreation opportunities, and limit impacts of recreation on corridor resources by improving visitor behavior.	Recreation opportunities	Minimal commercial activity	Needs assessment and prospectus for outfitter/guide use in Fossil Creek WSR corridor completed within two years of CRMP approval. Would not increase total capacity set by alternatives.				
Authorizing commercial activities (e.g. outfitters/guides or concessionaires) in the Fossil Creek corridor may detract from the wild and scenic character of the area and privilege access for those who are able to pay for services.	Percent of PAOT using commercial outfitter/guide	No authorized commercial activity	Needs assessment and prospectus for outfitter/guide use in Fossil Creek WSR corridor completed within two years of CRMP approval. Would not increase total capacity set by alternatives.				

Summary of Environmental Effects

Effects to the recreation ORV were analyzed using three indicators: recreation access, recreation experience quality, and river-dependent recreation activity participation. The effects from each alternative are summarized in Table 2-5 in Chapter 2. Overall, alternatives A-F preserve recreation access at levels above the 2009 baseline of 80,000 people during the April 1-October 1 high-use season. The degree of enhancement of recreation access varies widely between alternatives with Alternative B providing the smallest enhancement and Alternative F providing the greatest amount of recreation access above the baseline condition.

Alternatives A-E will likely enhance the quality of the recreation experience by reducing conditions that some visitors noted as problems during their visit in 2011, specifically, crowding, trash, and sanitation. Although these alternatives increase overall use, the reservation system spreads out the daily use and includes facility improvements to further distribute use. Alternative F is likely to have an adverse effect on the quality of the recreation experience by concentrating greater numbers of people in Middle Fossil without a mechanism for spreading out the timing of visits during the high-use season.

All alternatives have some effect on participation in one or more river-dependent recreation activities identified in the Fossil Creek Resource Assessment. Alternatives A-C, E, and F limit camping during the high-use season but provide for camping when and where it is compatible with preservation of the other ORVs. Alternative D would reduce hiking opportunities and prohibit all camping which would result in a degradation of the recreation ORV by eliminating a primary recreation activity enjoyed by many Fossil Creek visitors. Alternative C would reduce boating and swimming access and eliminate access to Fossil Springs which would result in a degradation of the recreation ORV due to the uniqueness of the Springs area and lack of other options for having a similar experience in the Fossil Creek WSR corridor. Alternative F would reduce boating access. Alternatives C, E, and F would increase hiking opportunities.

Short-term Uses and Long-term Productivity

There are no foreseeable long-term effects to the recreation ORV from short-term uses proposed in any of the alternatives.

Unavoidable Adverse Effects

Alternatives C and D would close the Fossil Springs area to public access. Due to the uniqueness of the Springs and the lack of similar options elsewhere, prohibiting all access for recreation would have an unavoidable adverse effect on the recreation ORV.

Alternative D would prohibit all camping. Because camping in Fossil Creek is a component of the recreation ORV, completely eliminating this recreation activity year-round would have an unavoidable adverse effect on the recreation ORV.

Irreversible and Irretrievable Commitments of Resources

None of the alternatives in this analysis would result in an irreversible commitment of resources.

Socioeconomics

This section evaluates and documents the environmental impacts of the proposed Fossil Creek Comprehensive River Management Plan and the associated alternatives to social and economic conditions. It provides sufficient analysis to determine if these effects would be significant, and if the proposal and alternatives are in compliance with relevant laws, regulations, and policies.

This socioeconomic report analyzes how the proposed action and alternatives would affect quality of life, human uses and values, environmental justice as well as address economic impacts and financial efficiency. The social analysis area consists of four counties, Coconino, Gila, Yavapai, and Maricopa County. For the economic analysis,

Maricopa County is excluded so that the economic impacts to the smaller communities surrounding Fossil Creek are not washed out by the large metropolitan area of Phoenix, AZ.

Recreation at Fossil Creek was determined to be an Outstandingly Remarkable Value (ORV), which includes swimming, camping, hiking, kayaking, wilderness, cultural attractions, and fishing. Each alternative has the potential to impact these opportunities, as such, they impact the socioeconomic resources listed above. Additional background information for the socioeconomic analysis can be found in the specialist report.

Methodology

Analysis Indicators and Measures

Table 3-93 identifies the resource indicators used to measure changes between alternatives related to social and economic wellbeing in the planning area.

Table 3-93. Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Economic Impact	Economic Activity from Project spending and management decisions: commercial activities and vendors	Employment and labor income, qualitative discussion of commercial activities and vendors	Yes, key Issue	IMPLAN 2015
Financial Efficiency	Financial Feasibility	Present Net Value	No	OMB Circular
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations from management activities, permit fees, and a reservation system.	Identification of low-income and minority populations in the socioeconomic analysis area. Permit use data and qualitative discussion	Yes, key Issue	Executive Order 12898
Quality of Life	Values, Beliefs, and attitudes	Recreation access and opportunities – visitors demand versus supply of permits, diversity of recreation opportunities available	Yes, Key Issue and tied to Recreation ORV	Qualitative analysis

Economic activity in local counties (Coconino, Gila, Yavapai) surrounding Fossil Creek is estimated with input-output analysis using the IMPLAN (Impact Analysis for Planning) modeling system (IMPLAN, 2015). The modeling system allows the user to build regional economic models of one or more counties for a particular year that estimates the economic consequences of activities, projects, and policies on a region. Input-output analysis represents linkages between sectors in an economy. For example, forest visitors spend money on accommodation and food. Accommodation and food service businesses buy supplies from other businesses. The employees of these firms spend their earnings on a variety of goods and services. These transactions result in direct, indirect, and induced effects, respectively, in the regional economy. The model for this analysis uses the 2015 IMPLAN data, which is the latest available dataset.

- The IMPLAN software assumes a static economy; in other words, the software assumes that the industry composition and trade linkages in 2018 would be the same in 2028. Therefore, the employment and income estimates should be considered relative, rather than absolute figures.

- National Visitor Use Monitoring (NVUM) Spending Profiles from the Coconino National Forest will be used to produce job and income estimates. Despite Fossil Creek running along the border of both the Tonto and Coconino NF, the primary route to reach Fossil Creek is through the Coconino National Forest. Visitor spending, which covers all expenses by the travel party within 50 miles of the of the site during their stay in the area, for the Coconino NF is greater than the Tonto NF, $76.60 and $58.60 per party trip, respectively (USDA, 2013 and 2015). Therefore, using the Coconino NF spending profile would produce larger job and income values than if the Tonto NF spending profile was used.

- Employment and labor income estimates provided in this report utilize project cost estimates provided by Forest Service resource specialists and are based on their best approximations. Actual costs may vary, as such, actual employment and income estimates would vary accordingly.

Assumptions regarding 2016 job and income estimates for recreation visitation:

Estimates for employment and income from recreation related visitation typically rely on National Visitor Use Monitoring survey data. These data are too broad to estimate the impact that recreation visitation has on the local economies surrounding Fossil Creek. Instead, data from both the 2016 Visitor Use Summary Use for Fossil Creek Wild and Scenic River report, consolidated by the Coconino National Forest and the 2016 Online Permit Reservation System, connected to Recreation.gov will be used. Use of these data requires several assumptions, as detailed below.

- Recreation data used to complete the recreation economic job and income estimates are based on 2016 Visitor Use Summary data and its final report, which reflects the number of vehicles and people who entered Fossil Creek during the 2016 permit period (May 1 – October 1). It is assumed that each vehicle has five people. The 2016 Online Permit Reservation System data is not used because it does not reflect no-shows that purchased a permit. Also, the 2016 Visitor Use Summary data does not include the ZIP code for visitors, therefore, it is not known if visitors who arrived with a permit were local or non-local visitors[16]. The broader 2016 Online Permit data that calculates who reserved permits does provide the ZIP code for each vehicle. Based on these data, 11.2 percent of permit applicants were from the local area (within 50 miles of Fossil Creek). This value is applied to the 2016 Visitor Use Summary data, assuming that no-show visitors to Fossil Creek occurred equally among local and non-local users. See table 3-94 for details.

    - All trips are assumed to be day trips. There is some dispersed overnight camping that occurs in the Fossil Creek area; however, these trips do not occur during the permit season and are not captured in either the 2016 Visitor Use Summary data or the 2016 Online Permit data. It is possible that visitors are staying overnight in nearby campsites or in local lodging, however, these data are not captured.

    - Employment and income estimates are for non-local visitation only. This represents new money that is coming into the economy. Local visitors would likely spend their money in the local area, regardless of visitation to Fossil Creek. Therefore, local visitor spending is excluded from the estimates.

    - One vehicle equals one permit, and is assumed to be equal to *one party trip* for the purposes of this analysis. This allows the Coconino NF National Visitor Use Monitoring (NVUM) program expenditure profiles to be used to produce economic estimates for recreation visitation. These

[16] A Local Visitor is defined as residing within 50 miles of Fossil Creek. All ZIP codes that had all or a portion of their area within a 50 mile radius of Fossil Creek were included.

data may eliminate some trips, for example, a party trip may also be someone who rode a bicycle or walked into Fossil Creek without reserving a permit, however this type of visitation is minimal.

- To estimate the economic impact of recreation by alternative, the percentage of non-local visitors from 2016 (88.8 percent of visits were non-local) was applied to the maximum number of vehicles (party trips).

In order to assess access to recreation across alternatives, the daily demand for permits will be analyzed against the number of permits available per day. Daily demand for permits is described in the next bullet. However, it is important to note that these values serve as the best available proxy for demand due a lack of information. For example, we cannot know exactly who tried, but was unable to obtain a permit because permits were sold out for their desired visitation date. Therefore, the values presented below represent the minimum demand, the upper bound is not yet known. Future monitoring will help determine if the number of permits available is adequate to meet demand.

- Each alternative will analyze the 2016 daily demand for permits by the number of available permits under the alternative. Daily demand is determined using the number of permits sold divided by the number of total days in the permit period in 2016 (154 days). In 2016, 17,980 permits were sold, thus daily demand for permits was 117, (17,980/154 = 117). Additionally, 3,872 vehicles were turned away from Fossil Creek for not having a permit, approximately 25 vehicles per day. Thus, daily demand for permits totaled 142 in 2016.

- The number of weekend (Saturday and Sunday) permits sold during May through September 2016 was 6,458 as per the date of entry from the 2016 Online Permit data. This means 147 permits were sold for each of the 44 weekend days during the 2016 permit season. The number 147 represents the demand for weekend recreation permits and is slightly less than the total number of weekend permits available, 148 per day.

Table 3-94. Local and Non-Local Daily Visitation Data during 2016 Permit Season (May 1 – October 1) from 2016 Online Permit data and 2016 Visitor Use Summary Report data

	Total Visitors	Percentage of Local Visitors	Local Visitors	Non-Local Visitors
2016 Online Permit data – number of persons	74,958	11.2%	8394	66,564
2016 Online Permit data – number of vehicles	17,980	11.2%	2,006	15,974
	Total	Percentage of Local Visitors	Local Visitors	Non-Local Visitors
2016 Visitor Use Summary Data – number of persons	47,927	11.2%	5,368	42,559
2016 Visitor Use Summary Data – number of vehicles	11,681	11.2%	1,308	10,373

Financial Efficiency is estimated using present net value (PNV). PNV is the current value of future benefits and costs over the life of a project. Calculations of present values in this report use a 4 percent discount rate. This value is commonly used by the Forest Service for evaluations of long-term investments and operations in land and resource management (FSM 1971.3). Inflation can also affect PNV; however, due to the uncertainty of future inflation, Office of Management and Budget (OMB) Circular A-94 (1992) recommends avoiding assumptions about the inflation rate whenever possible. The Coconino NF resource specialists provided estimates of costs by

alternative. Present Net Value weight the cost versus benefits in strictly monetary values, however, there are several non-monetary benefits associated with each alternative that should be taken into consideration.

Information Sources

- U.S. Census Bureau 2000, 2010, 2015, 2016
- Bureau of Labor and Statistics, Unemployment Statistics
- National Visitor Use Monitoring Survey (NVUM), 2013 (Tonto NF), 2015 (Coconino NF)
- Coconino Forest Resource Specialists
- 2016 permit data from the Online Permit Reservation System, from Recreation.gov
- 2016 Visitor Use Summary for Fossil Creek Wild and Scenic River (Smith, B. 2016)
- 2009-2013 Visitor Use Data Collection Project (Rotert, A. 2013)

Incomplete and Unavailable Information

As discussed above, data to determine actual local and non-local visitation is not available due to the 2016 Online Permit Reservation data not reflecting no-show rates; therefore, the percentage of non-local visitors from 2016 Online Permit Reservation System was applied to the actual visitor numbers from the 2016 Visitor use Summary Report.

Cost estimates for the adaptive management program are not yet available. Therefore the project's total cost may be greater than those presented here, in turn, employment and labor income estimates would also be greater.

It is difficult to say with certainty how population growth and changes to Fossil Creek management might impact the demand for permits. It is assumed that demand for visitation will increase overtime regardless of the alternative chosen. Planned monitoring will help determine if recreation demands are being met and the adaptive management policies set forth in the DEIS will allow for adjustments as necessary.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

Fossil Creek is located on the border of the Coconino and Tonto National Forests and the intersection of Coconino, Gila, and Yavapai counties. The spatial boundaries for analyzing the direct and indirect effects to the local economy will include Coconino, Gila, and Yavapai counties. These counties are included because of their proximity to the project area and the economic linkages to the local communities. Maricopa County is also in close proximity to Fossil Creek and accounts for a large portion of recreation visitors. However, it is excluded from the economic analysis because of its relative size and large diverse economy (Maricopa County encompasses the Phoenix Metropolitan area) that will wash out impacts to the smaller communities surrounding Fossil Creek. The social and environmental justice analysis will include the impacts to Maricopa County because a large percentage of visitors to Fossil Creek reside in this area.

The temporal boundaries for analyzing the direct and indirect effects will extend 15 years. Many of the measurable and identifiable social and economic impacts described in this report will occur during this period. Impacts from the proposed action will continue to effect communities well beyond this timeframe, however, social and economic changes, including changes to recreation preferences, cannot plausibly be predicted beyond this temporal time frame.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects are identical to the direct and indirect effects.

The temporal boundaries for analyzing the cumulative effects are also limited to 15 years. This is because other reasonably foreseeable current and future projects outside of this timeline would be difficult to predict and measure.

Affected Environment – Existing Condition

An analysis of existing social and economic conditions is necessary to establish the baseline from which to estimate potential consequences of project management actions. The following section analyzes current conditions and trends related to the social and economic environment of the analysis area, including demographic characteristics and local economic conditions.

Table 3-95. Resource indicators and measures for the existing condition

Resource Element	Resource Indicator	Measure	Existing Condition
Economic Impact	Economic Activity	Employment and labor income	See narrative below. Recreation to Fossil Creek supported 2 jobs and $64,000 in labor income in 2016.
Financial Efficiency	Financial Feasibility	Present Net Value	N/A
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations; Visitation by low income and minority populations prior to reservation system in May 2016.	Identification of low-income and minority populations in the socioeconomic analysis area, Permit use data from 2016 and 2017 if available. Scholarly journals and reports on the impact of fees and reservations on low income and minority populations, Internet and computer access data (Census), NVUM, 2016 and 2017 permit data, Visitor Use Data Collection Project 2009-2013 (Rotert, 2013)	There are low-income and minority populations within socioeconomic analysis area boundaries of this project. See narrative below. Visitation by Hispanics was approximately 26 percent in 2016. Low-income visitation for Fossil Creak is not captured. Low-income visitation to Tonto and Coconino NF is discussed below.
Quality of Life	Values, Beliefs, and Attitudes	Recreation access and opportunities – visitor demand versus supply of permits, diversity of recreation opportunities available	See table 3-94

Demographics

An overview of the population and population change by specific towns, cities, and counties for the planning area is in table 3-96. Maricopa County is by far the most populous county in the study area (4,018,143). It alone accounts for over 50 percent of Arizona's population. Gila County is the smallest county in the planning area (53,556) and among the four counties, it has experienced the least amount of population growth from 2000-2015 (4 percent). Yavapai and Maricopa grew at the same rate as Arizona (~35 percent), and Coconino County (21 percent) grew at a rate slightly higher than the national average (15 percent).

In contrast, Pine and Strawberry Census Designated Places[17] (CDP) experienced little to no population growth from 2000 and 2010, and according the American Community Survey 2011-2015, these communities lost over 40 percent of their populations from 2000 to 2015. Payson (12 percent) grew at a more modest rate compared to Arizona, but was near the national average (15 percent).

Large population growth for a region can indicate growing economic opportunities. In contrast, large reductions in population can indicate lessening economic opportunity and a fragile economy that would be extremely sensitive

[17] Census Designated Places are defined by the U.S. Census Bureau as, "statistical counterparts of incorporated places, and are delineated to provide data for settled concentrations of population that are identifiable by name but are not legally incorporated under the laws of the state in which they are located. The boundaries usually are defined in cooperation with local or tribal officials and generally updated prior to each decennial census".

to economic shocks. Pine and Strawberry CDP have had significant population reductions and are the closest economies to Fossil Creek, as such, they would be particularly sensitive to any economic consequences from management decisions in Fossil Creek.

Table 3-96. Population Change in the Socioeconomic Analysis Area

Location	2000	2010	2011-2015 (ACS 5 year average)[18]	% Change 2000 – 2015	2025 (projected)	2035 (projected)
Coconino County	116,320	134,421	136,701	18%	156,363	164,844
Gila County	51,335	53,597	53,165	4.4%	55,416	54,976
Payson, AZ	13,620	15,301	15,248	12%	N/A	N/A
Pine CDP	1,931	1,963	1,147	-41%	N/A	N/A
Strawberry CDP	1,028	961	430	-58%	N/A	N/A
Maricopa County	3,072,149	3,817,117	4,018,143	31%	4,885,981	5,665,917
Yavapai County	167,517	211,033	215,996	29%	252,122	285,808
Camp Verde, AZ	9,451	10,873	11,008	16%	N/A	N/A
Arizona	5,130,632	6,392,017	6,641,928	29%	9,944,753	9,128,899
United States	281,421,906	308,745,538	316,515,021	12%	347,335,000	370,338,000

Source: U.S. Department of Commerce 2000a, 2010, 2016; Population Projections: Arizona Department of Administration, 2015

Race and Ethnicity

The race and ethnicity of the planning area population is in table 3-97. Arizona has a Hispanic population nearly twice the national average (30 percent), and it is the largest population after non-Hispanic Whites (58 percent) (Department of Commerce, 2016). Maricopa County is nearly a mirror image of Arizona's population as a whole. Yavapai County is the least racially diverse county in the planning area. It has a much smaller Hispanic population (14 percent) and a much larger non-Hispanic White population (81.5 percent). Gila and Coconino counties stand out due to their large American Indian populations (14 and 27 percent, respectively). Coconino County encompasses portions of the Hopi and Navajo Indian Reservations, and Gila County encompasses portions of the Fort Apache and San Carlos Indian Reservations. Yavapai County also encompasses the Yavapai-Apache Indian Reservation. While this reservation is quite small in numbers, both Yavapai and Western Apache American Indians draw modern and traditional cultural values from the Fossil Creek planning area.

Understanding the diversity of the planning area is important because different groups of people value public lands differently. For example, Hispanic communities do not utilize public lands in proportion to their population (Hansis, no date). The Hispanic population in the United States is the fastest growing population. The way Hispanic communities value public lands, especially amongst the large Hispanic population in Arizona, is an important consideration for managing public lands and is discussed in more detail, below.

Table 3-97. Race and Ethnicity, 2010

Location	Hispanic	Non-Hispanic	Non-Hispanic individuals by race				
			White	Black	American Indian	Asian	Two or more races
Coconino	13.5%	86.5%	55.2%	1.1%	26.5%	1.3%	2.1%
Gila	17.9%	82.1%	65.9%	0.4%	14.2%	0.5%	1.1%
Payson	9.7%	90.3%	85.8%	0.3%	2.2%	0.6%	1.2%

Location	Hispanic	Non-Hispanic	Non-Hispanic individuals by race				
			White	Black	American Indian	Asian	Two or more races
Pine	2.6%	97.4%	95.0%	0.2%	0.5%	0.4%	1.0%
Strawberry	3.4%	96.6%	94.4%	0.0%	0.7%	0.5%	0.9%
Maricopa	29.6%	70.4%	58.7%	4.6%	1.6%	3.4%	1.9%
Yavapai	13.6%	86.4%	82.0%	0.5%	1.3%	0.8%	1.6%
Camp Verde	16.4%	86.6%	73.9%	0.4%	5.9%	0.4%	2.7%
Arizona	29.6%	70.4%	57.8%	3.7%	4.0%	2.7%	1.8%
United States	16.3%	83.7%	63.7%	12.2%	0.7%	4.7%	1.9%

Source: U.S. Department of Commerce 2010

Population Density

Table 3-98 provides information on the population densities for the planning counties. Areas with higher population densities are often associated with greater economic activities and opportunities, in contrast, they can also place higher demands on scarce resources.

Maricopa County has a population density nearly five times the national average and over 7 times Arizona's average. In contrast Coconino, Gila, and Yavapai counties have much lower population densities, all less than half of Arizona's average.

Table 3-98. Population Density

Location	People per square mile 2000	People per square mile 2010
Coconino County	6.2	7.2
Gila County	10.8	11.3
Maricopa County	333.8	414.9
Yavapai County	20.6	26.0
Arizona	45.2	56.3
United States	79.6	87.4

Source. U.S. Department of Commerce 2000b, 2010

Median Age

The age of the population surrounding Fossil Creek is relevant since different age groups often have different needs, values, and attitudes related to national forest management. For example, aging populations may have mobility requirements that may affect recreational preferences, such as a higher demand for easily accessible camping spots, facilities, and trails.

In general, the U.S. population is growing older. According to Glasglow and Brown (2012), older persons are disproportionately located in rural areas. Comparing median ages in table 3-99, Arizona, Maricopa and Coconino counties remain slightly younger than the U.S. This younger median age is likely impacted by the influence of multiple universities in the area (e.g. Northern Arizona University and Arizona State University). However, Gila and Yavapai counties are much older than the state and national median, as are the rural communities surrounding Fossil Creek.

Pine and Strawberry CDP have median ages above 60 years, indicating that the majority of residents are retirees or soon to be retirees. This has several economic implications, such as labor supply, spending, savings, productivity, economic growth, and income per capita (Bloom et al, 2011). How behaviors would change or the severity of negative consequences are difficult to glean, but older residents in the Fossil Creek area may be more

sensitive to any changes made to the planning area than younger residents. Older median ages surrounding the Fossil Creek area might also reflect a dearth of economic opportunity for younger workers.

Table 3-99. Median Age

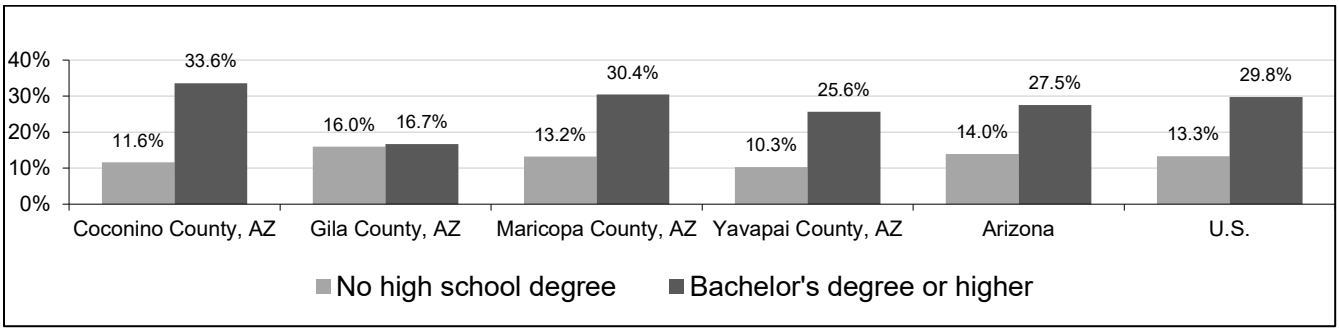
Location	2000	2010	2011-2015 (ACS 5 year average)
Coconino County	29.6	31.0	30.8
Gila County	42.3	47.9	48.6
Payson, AZ	48.9	53.1	56.9
Pine CDP	52.8	59.2	62.6
Strawberry CDP	53.9	60.5	68.9
Maricopa County	33.0	34.6	35.6
Yavapai County	44.5	49.2	51.3
Camp Verde, AZ	42.0	44.0	47.8
Arizona	34.2	35.9	36.8
United States	35.3	37.2	37.6

Source: U.S. Department of Commerce 2000, 2010, 2016

Educational Attainment

Education level attained is one of the most important indicators of economic success and wellbeing. Evidence suggest that for each level of higher education attained earnings also increases (Cheeseman and Newburger, 2002). Additionally, a community with a more educated workforce tends to have higher incomes, grow faster, and withstand recessions better.

With the exception of Gila County, the planning area counties have similar education levels compared to Arizona and the United States. Gila County has a slightly higher population of people without a high school degree, and a much smaller population of individuals with a bachelor's degree or higher. Gila County is also the poorest county in the planning area, as can be observed in median incomes in figure 3-51. Education attainment data for the smaller communities of Payson, Pine, Strawberry and Camp Verde are available, however, due to small sampling sizes, these data are not robust enough to draw meaningful conclusions.



Source: U.S. Department of Commerce 2016a

Figure 3-51. Educational Attainment (2011-2015 ACS five year average)

English Language Abilities

In order to communicate forest plans and understand the needs, values, and abilities of the local population, it is important to understand if any barriers to using the English language exist. If the local population is not able to effectively communicate in English, it may be required to involve interpreters or other methods of community engagement.

Coconino and Maricopa counties have small communities who do not speak English well. In Maricopa County, this is likely due to the high population of Hispanic individuals. Coconino County does not have a large Hispanic

population, but it does have a large Native American population whose first language might not be English. Of the lower 48 states, Arizona has the largest population of Native American's who speak their Native language, which is largely Navajo (U.S. Department of Commerce, 2011).

Table 3-100. English Language Abilities (2011-2015 ACS five year average)

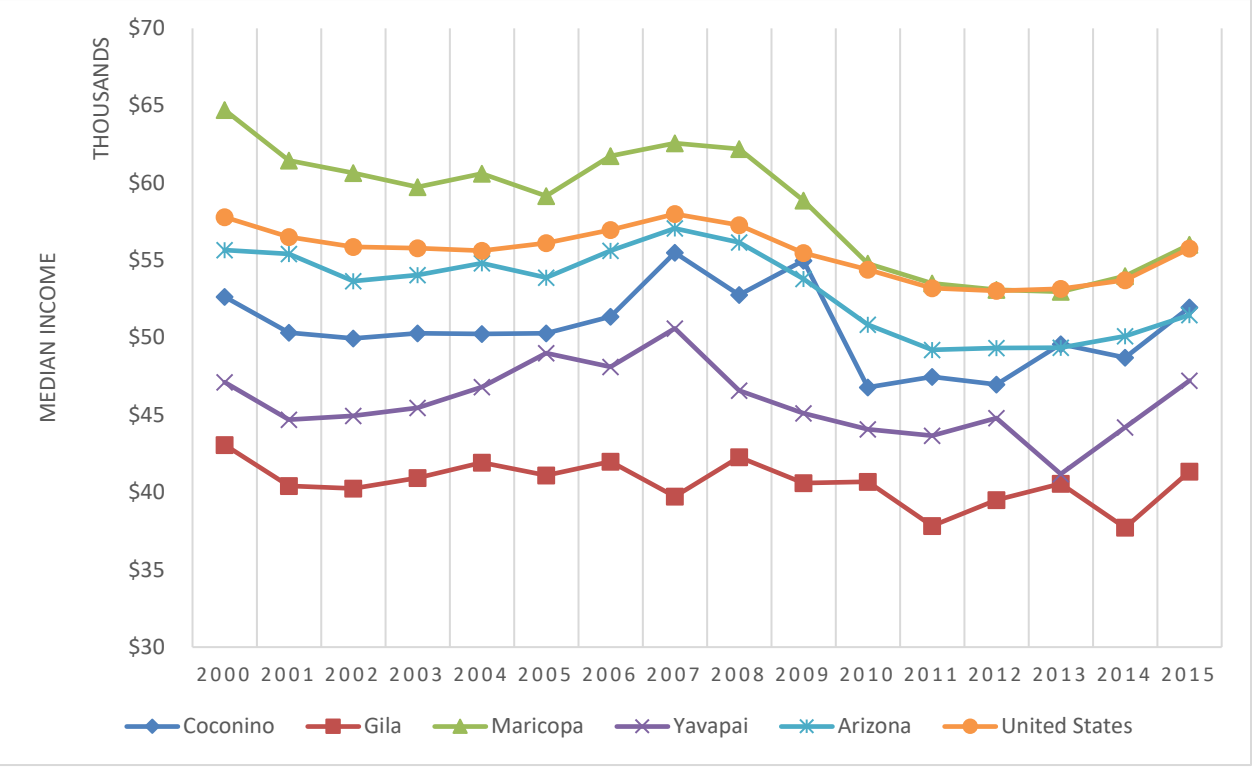
Location	% of the population who speak English less than well
Coconino County	7.0
Gila County	3.8
Maricopa County	9.5
Yavapai County	3.6
Arizona	9.1
United States	8.6

Source: U.S. Department of Commerce 2016

Economic Characteristics and Wellbeing

Income

In 2015, Arizona's median household income was $4,300 below the national average. Prior to the Great Recession in the late 2000s, Arizona's median household income averaged only $1,200 less. This indicates that Arizona has been slower to recover after the Great Recession than the U.S. overall. Maricopa County has median income equal to the United States, prior to the Great Recession, it maintained a median income $3,800 greater than the United States. Gila County has the lowest median income in the planning area, and has been approximately $10,000 less than Arizona's median since 2000. Yavapai County has the second lowest median income and has been approximately $6,000 less than Arizona's median since 2000. Coconino County has a median income approximately equal to Arizona's median, and is wealthiest county adjacent to Fossil Creek.



Source: U.S. Department of Commerce, 2015

Figure 3-52. Median Household Income, 2015 inflation adjusted dollars

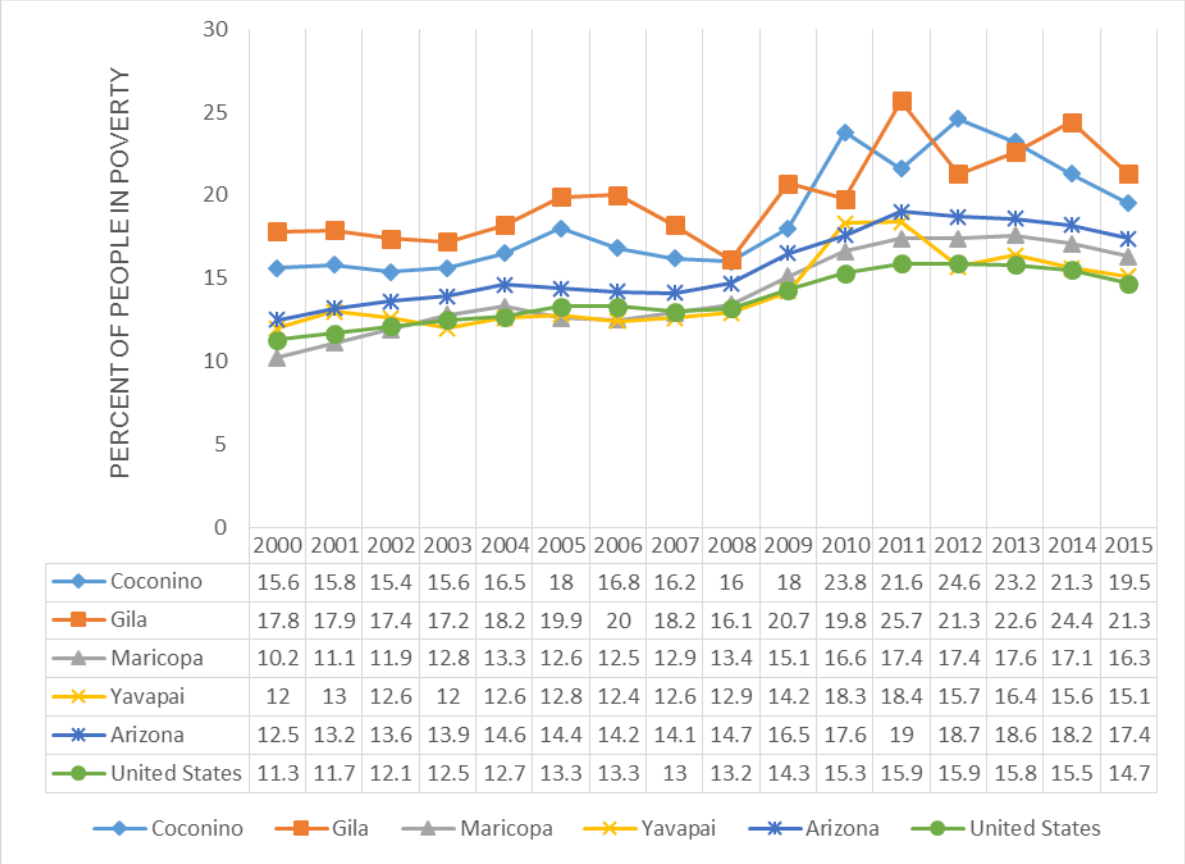
Poverty

Figure 3-53 below provides the percent of the population living in poverty for each of the planning area counties. For comparison, Arizona and the United States are also included. Poverty is an important indicator of economic well-being. People living in poverty have different needs, values, and attitudes and may view access to public lands in a completely different context than those who are wealthier. Economically disadvantaged individuals and families may also be disproportionately affected by any changes to public lands if their livelihood depends on its use.

Gila and Coconino counties experience the highest levels of poverty in the planning area. Poverty for these two counties climbed to nearly 25 percent during the Great Recession and remains approximately 20 percent. Maricopa and Yavapai counties have a lower poverty rate than Arizona and have negligibly higher rates than the U.S. average.

Data in figure 3-53 is provided in aggregate, which may mask important distinctions with regards to who is living in poverty. For example, in the planning area, 41 percent of families who are living in poverty are single mothers with children under the age of 18 (U.S. Census 2016 ACS). Additionally, the USDA has recognized that rural child poverty reached record high levels in 2012. Child poverty is an especially important consideration because it can have compounding lifelong impacts.

Poverty in the planning area is particularly high for both Hispanic and American Indian Populations. In the four county planning area, poverty among Hispanics is 29 percent, double non-Hispanic rates (14 percent) (U.S. Census 2016 ACS). Poverty rates for American Indian populations are even higher, 37 percent poverty of the population is living in poverty, over double the poverty rate for White alone populations (16 percent) (U.S. Department of Commerce, 2016).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Coconino	15.6	15.8	15.4	15.6	16.5	18	16.8	16.2	16	18	23.8	21.6	24.6	23.2	21.3	19.5
Gila	17.8	17.9	17.4	17.2	18.2	19.9	20	18.2	16.1	20.7	19.8	25.7	21.3	22.6	24.4	21.3
Maricopa	10.2	11.1	11.9	12.8	13.3	12.6	12.5	12.9	13.4	15.1	16.6	17.4	17.4	17.6	17.1	16.3
Yavapai	12	13	12.6	12	12.6	12.8	12.4	12.6	12.9	14.2	18.3	18.4	15.7	16.4	15.6	15.1
Arizona	12.5	13.2	13.6	13.9	14.6	14.4	14.2	14.1	14.7	16.5	17.6	19	18.7	18.6	18.2	17.4
United States	11.3	11.7	12.1	12.5	12.7	13.3	13.3	13	13.2	14.3	15.3	15.9	15.9	15.8	15.5	14.7

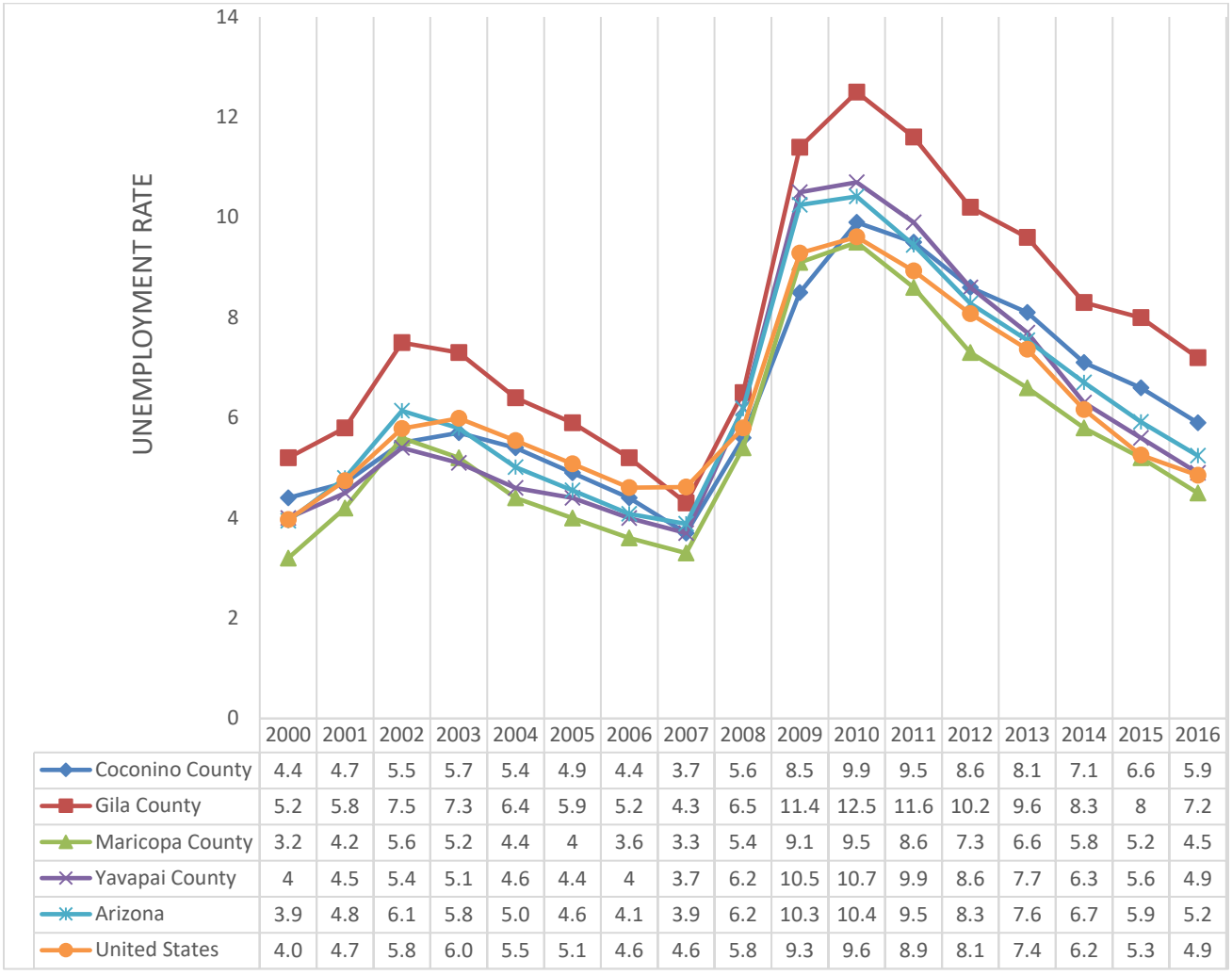
Source: U.S. Department of Commerce 2015

Figure 3-53. Percent of People Living in Poverty

Unemployment

The unemployment rates for the four counties in the planning area are provided in figure 3-54, for comparison, Arizona and the United States are also provided. The rates for the four counties shown are unadjusted data. This means the data is not corrected for seasonal changes that effect unemployment, such as weather, holidays, school openings/closings, etc. Data is typically adjusted to smooth trends and make it easier to compare data month to month. However, county level data is typically not available seasonally adjusted; data reported below for Arizona and U.S. are seasonally adjusted.

Maricopa and Yavapai counties have the lowest unemployment rates in the region, are slightly less than Arizona's rate, and approximately equal to the United States. Historically, Gila County has generally had slightly higher unemployment rates than the other counties, but fared worse during the recession and is slower to recover from it. Coconino County has maintained an unemployment rate slightly higher, but within 1 percent of Arizona's rate.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coconino County	4.4	4.7	5.5	5.7	5.4	4.9	4.4	3.7	5.6	8.5	9.9	9.5	8.6	8.1	7.1	6.6	5.9
Gila County	5.2	5.8	7.5	7.3	6.4	5.9	5.2	4.3	6.5	11.4	12.5	11.6	10.2	9.6	8.3	8	7.2
Maricopa County	3.2	4.2	5.6	5.2	4.4	4	3.6	3.3	5.4	9.1	9.5	8.6	7.3	6.6	5.8	5.2	4.5
Yavapai County	4	4.5	5.4	5.1	4.6	4.4	4	3.7	6.2	10.5	10.7	9.9	8.6	7.7	6.3	5.6	4.9
Arizona	3.9	4.8	6.1	5.8	5.0	4.6	4.1	3.9	6.2	10.3	10.4	9.5	8.3	7.6	6.7	5.9	5.2
United States	4.0	4.7	5.8	6.0	5.5	5.1	4.6	4.6	5.8	9.3	9.6	8.9	8.1	7.4	6.2	5.3	4.9

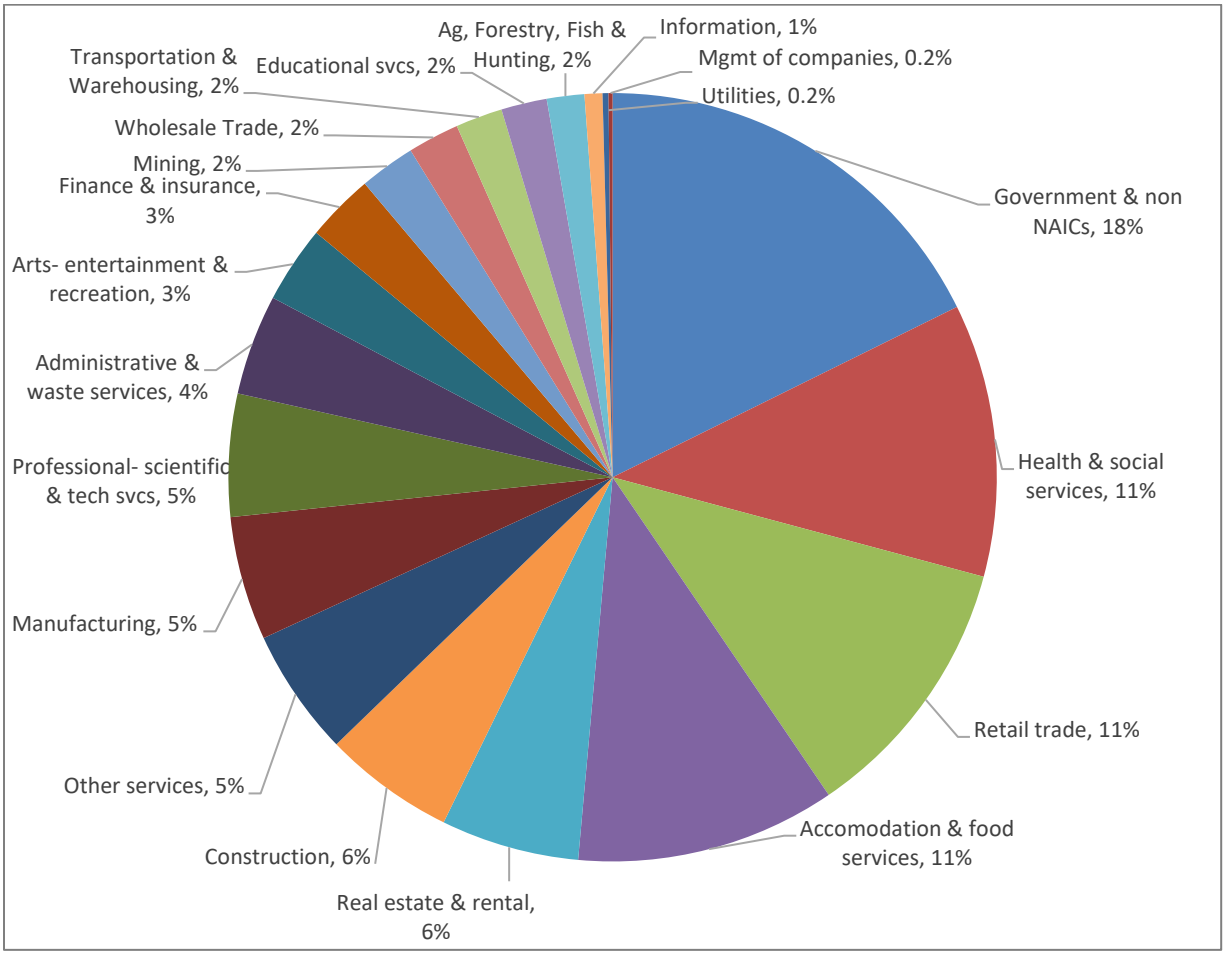
Source: Bureau of Labor and Statistics, 2016

Figure 3-54. Unemployment Rate, 2000-2016 Annual Averages

Employment by Industry

Figure 3-55 provides a visual of employment by industry for Coconino, Gila, and Yavapai counties. Maricopa is excluded, as previously discussed, because Maricopa County includes Phoenix metropolitan area and its inclusion would wash out the smaller counties' economic information. The three counties employed 197,000 people in 2015. The top employer was the government, followed by health and social services, retail, and accommodation

and food services. Together, these four industries make up just over 50 percent of the economic planning area's employment. Accommodation and food services and retail trade are two industries that would be impacted by visitor spending at Fossil Creek.



Source: IMPLAN, 2015

Figure 3-55. Employment by industry for Coconino, Gila, and Yavapai Counties

Employment supported by the Tonto and Coconino National Forests

In 2014, the Coconino National Forest contributed 3,280 jobs and $126 million in labor income (U.S. Department of Agriculture, 2016a) annually to the local area. These jobs were primarily from recreation and visitor spending, followed by forest resource management and investment, forest products, and livestock grazing. These jobs were in the accommodation and food services, government, retail, agriculture and professional and scientific sectors. Recreation alone accounted for 1,600 jobs and $57 million in labor income (U.S. Department of Agriculture, 2016a).

In 2014, the Tonto National Forest contributed 3,260 jobs and $166 million in labor income (U.S. Department of Agriculture, 2016b) annually to the local area. Despite having less employment, considerably more income is generated by activities on the Tonto NF. This is because, unlike the Coconino NF, mining is occurring on the Forest; employing nearly 1,400 people and accounting for $91 million in labor income. After mining, the majority of employment is supported by forest resource management, forest products, and livestock grazing. These jobs support the same industries as the Coconino NF - the accommodation and food services, government, retail, agriculture and professional and scientific sectors. Unlike the Coconino NF, recreation and visitor spending does not contribute significantly to local employment. Recreation on the Tonto NF supported 190 total jobs and $7.4 million in labor income (U.S. Department of Agriculture, 2016b).

These values do account for visitation to the Fossil Creek area, however, it is not possible to parse out the direct economic impact strictly to Fossil Creek with the information provided in these reports. Instead, data are based on NVUM visitor spending and actual visitation data generated by both the 2016 Summary Visitation report and the 2016 Online Permit data system as described in the methodology section of this report.

In 2016, it is estimated that recreation visitation to Fossil Creek supported 2 jobs and $64,000 in labor income, based on 2016 Visitor Use Summary data and estimates for the number of non-local visitors (42,559).[19] These jobs occurred in the retail and accommodation and food services sector. This is unsurprising, as visitors likely purchase food, gas, ice, and various sundries necessary for an enjoyable day trip.

Environmental Justice

In 1994, President Clinton issued Executive Order (EO) 12898. This order directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Environmental justice (EJ) is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision-makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that will avoid or mitigate those impacts. According to USDA DR5600-002, key terms are defined as follows:

Environmental Justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by, government programs and activities affecting human health or the environment.

Minority means a person who is a member of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Minority Population means any readily identifiable group of minority persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities.

Low-Income Population means any readily identifiable group of low-income persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities. Low-income populations may be identified using data collected, maintained and analyzed by an agency or from analytical tools such as the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty.

Human Health and/or Environmental Effects as used in this Departmental Regulation includes interrelated social and economic effects.

The emphasis of environmental justice is on health effects and/or the benefits of a healthy environment. The CEQ has interpreted health effects with a broad definition: “Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities or Indian Tribes …when those impacts are interrelated to impacts on the natural or physical environment” (CEQ 1997).

As established by the Race and Ethnicity section above, there is a large Native American population living in the economic analysis area (Gila, Coconino, and Yavapai counties). The area is critically important to certain Native American populations, specifically the Yavapai Apache Nation, and a component of this importance is their

[19] These values were derived using methodology and assumptions described in Methodology section.

continued ability to access the area. On the Coconino NF and Tonto NF, visitation by American Indians was 3.2 percent of visits percent (2015 NVUM) and 1.8 percent (2013 NVUM), respectively. Although this visitation is a small portion of the total visitation to the forests, access to the land to sustain their way of life is very important for these communities.

Additionally, there is a large Hispanic population in Maricopa County; while excluded from the economic analysis area, a significant volume of visitors to Fossil Creek reside there. As such, the Hispanic communities within Maricopa County may be impacted by management decisions regarding Fossil Creek, particularly the cost of permits and access to the online ordering system. Additionally, low median incomes for Gila and Yavapai counties, and high levels of poverty for Gila and Coconino counties indicate the presence of low-income environmental justice populations susceptible to impacts from management decisions. These impacts could come as the result from a reduction in visitors – which would reduce the economic impact to the surrounding communities of Payson, Strawberry, Pine, and Camp Verde. Additionally, user fees could also make visitation less affordable, reducing the ability of low-income populations to visit. The effects of user fees on environmental justice communities is discussed in detail below. The impact of management decisions on members of an environmental justice community will be evaluated by alternative.

Environmental Justice and User Fees

Currently, permit fees to visit Fossil Creek do not generate revenue for the Coconino or Tonto National Forest. The fee strictly covers the administrative cost paid to operate the online permit reservation system by recreation.gov. The permit reservation system was implemented in 2016 in order to limit the number of people at one time and vehicles entering the area to reduce the environmental and social impacts of unmanaged recreation. Several commenters recommended increases in permit fees to enter the area to cover the cost of management activities in order to provide a quality recreation experience, by both limiting the volume of people and covering the cost of desired and necessary recreation infrastructure (none of the CRMP alternatives propose this) but this action would be subject to its own environmental review process if and when it is proposed. Although not part of the proposed action and alternatives, the effects of instituting fees to cover infrastructure and management costs are addressed generally in this report, along with the impacts of the current permit fee system. In 2017 and 2018, the fee to obtain a permit to visit Fossil Creek is $10 per vehicle.

Visitation to Fossil Creek by Hispanic populations has been quite high compared to the Coconino and Tonto National Forests and other Federal land recreation sites throughout the nation. On the Coconino and Tonto NF visitation by Hispanics was 7 percent (2015 NVUM) and 20 percent (2013 NVUM), respectively. For comparison, visitation by Hispanics to all National Forests from 2011-2015 was 5.7 percent (2015 NVUM). While visitation to these national forests are higher than the national average, Arizona's Hispanic population is nearly twice the national average, therefore higher numbers are expected.

Visitation to Fossil Creek by Hispanic persons was estimated to be 26.6 percent[20] in 2016, higher than both Coconino NF and Tonto NF Hispanic visitation estimates reported above. In 2013, a convenience sample of visitors to Fossil Creek concluded that nearly half of all visitors to Fossil Creek were Hispanic. These estimates have significant limitations and cannot be used to draw meaning statistical inference. Additionally, it is impossible to compare 2013 and 2016 data due to differences in sampling and methodology. However, the possibility that visitation declined after the implementation of a user fee highlights the need for further research and data collection related to minority visitation to Fossil Creek.

The income of Fossil Creek visitors is not captured, however, annual household income data is captured in the NVUM survey. These data are presented in table 3-101. Visitors to the Coconino NF have higher household incomes relative to both the Tonto NF and the national visitor average. 58.6 percent of visitors to the Coconino NF had a household income in excess of $75,000 annually. In comparison, only 43.7 percent of visitors to the Tonto NF had incomes in excess of $75,000. The Tonto NF also had more visitors at the lower end of the income spectrum compared to the Coconino NF and the national visitor average. Based on available data, it is difficult to

[20] This value was determined by analyzing the last names of permit applicants.

determine with any certainty if low-income households are being disproportionately impacted by user fees. However, research suggests that low-income individuals are more sensitive to fees, as described below.

Table 3-101. Percent of National Forest Visits[21] by Annual Household Income

Annual Household Income Category	Coconino NF Visits, 2015 (%)	Tonto NF Visits, 2013 (%)	National Average, 2011-2015 (%)
Under $25,000	7.8	15.7	10.2
$25,000 to $49,999	13.8	15.7	18.2
$50,000 to $74,999	19.9	24.9	22.3
$75,000 to $99,999	14.0	19.8	17.6
$100,000 to $149,000	22.6	20.0	16.0
$150,000 and up	22.0	3.9	15.7

Source: U.S Department of Agriculture, 2013, 2015

Natural resource and outdoor recreation use on Federal lands by minority populations does not occur at levels proportional to their populations (Johnson et al, 2006). Two schools of thought have emerged as to why minority populations do not participate in outdoor recreation; the *Ethnicity Theory*, and the *Marginality Theory* (Bowker, 1998). In short, the Ethnicity Theory explains low participation in outdoor recreation by minorities as the result of a different set of values about recreation (Bowker, 1998). Put simply, minorities don't participate in outdoor recreation because their communities do not value the experience. The Marginality Theory proposes that there are structural barriers to participation in outdoor recreation, such as a lack of discretionary funds, transportation, or a lack of understanding of facilities available (Bowker, 1998). According to Green, et al (2012) Hispanic populations do not participate for the following reasons: 1) not enough time due to employment, 2) safety problems, 3) can't understand the language, and 4) feel afraid of forests. Neither money nor transportation was found to be statistically significant reasons for participation in outdoor recreation among Hispanics, suggesting that a lack of participation is due to social constructs and not economical.

Johnson et al (2004) found that Hispanic populations did not value wilderness lands any less than Whites. However, valuing land does not equal visitation or participation in outdoor activities on public lands, which is lower for Hispanic populations. Johnson et al (2007), posited that lack of visitation may be due to overarching social and cultural differences and did not find any evidence that awareness of public lands, knowledge of Forest Service's multiple use mandate, nor attitudes about fees impacted visitation. In contrast, Bowker et al (1998) found that Hispanic populations are priced out of outdoor recreation activities at a higher rate than non-Hispanics. Their study found that for a $10 increase in price per person per trip would result in a reduction of 8.26 percent of Hispanic person trips and only a 1.28 percent reduction in person trips by whites.

Further research by Bowker (1999) determined that Hispanics are less likely to support user fees and that people with higher income were more likely to support user fees, which suggests that, "fees do have a discriminatory impact on the poorer segments of society." Surprisingly, 96 percent of Bowker's (1999) data sample did support user fees, which indicates that fees may be generally accepted, as long as the value isn't placing an undue burden on low-income individuals. More (2000) found a "clearly broad-based support for fees", however, they have a, "major discriminatory impact on low-income respondents". Additionally, low-income respondents were less likely to have visited state parks, forests, or National Forests, and stated that fees were a major factor (More, 2000). Further research suggests that fees are acceptable as long as they are implemented fairly and there is transparency in what the fees are used for (Chung et al, 2011).

Research suggests that some visitors find access to basic necessities: bathrooms, trash removal, and parking lots, the absolute minimum that Federal lands should provide free of charge. Other visitors have no problem paying a small fee, especially if it covers the costs of these basic facilities (Watson and Herath, 1998). On the other hand,

[21] Visits are defined as the entry of one person upon a national forest to participate in recreation activities for an unspecified time period.

some users question the use of user fees to access recreation on public lands (Bowker, 2003). Federal lands are considered by many to be free and open spaces and object to any fee-based system that restricts these freedoms (Bowker 2003).

In summary, research suggests that lack of visitation by Hispanics is the result of social rather than economic constructs, with some evidence that fees do reduce participation by Hispanic populations. There is strong evidence that low-income visitors are disproportionately impacted by the implementation of user fees. While there is concern that Hispanic visitation to Fossil Creek dropped as a result of the reservation system (which includes a $10 service fee), it is more likely that visitation by low-income visitors, regardless of race and ethnicity, were impacted the most.

Environmental Justice and Reservation Systems

According to the American Community Survey[22] data for the U.S., households with lower incomes are much less likely to have computers and smartphones at home and less likely to have Internet, which could affect their ability to use a reservation system and therefore access to the Fossil Creek area. When household income was less than $25,000, only 51.3 percent of households had a computer and 55.4 percent had a smartphone, compared to 85.7 percent of households had a computer and 82.9 had a smartphone when household income was $50,000-99,999. Additionally, 58.8 percent of households had an Internet subscription when household income was less than $25,000, whereas 89.4 percent had Internet when income was $50,000-99,999 (Ryan 2018).

Race also affects ownership of computers, smartphones, and access to the Internet. For white householders, 80.9 percent of households had a computer, 74.9 percent had a smartphone, and 83.9 percent had an Internet connection. For black householders, 63.9 percent of households had a computer, 74.8 percent had a smartphone, and 72.6 percent had an Internet connection. For householders of Hispanic origin, 67.5 percent of households had a computer, 81.8 percent had a smartphone, and 77.3 percent had an Internet connection (Ryan 2018).

For low income and minority populations in the area, lack of Internet access and availability of a computer or smartphone in the household could impact their ability to use a reservation system. The households without internet or computers, which the data shows is often low income and minority populations, will face greater barriers to access if a reservation system is implemented. As the data suggests, reliance on smartphones for online access is especially common among minorities and they are either just as likely or more likely to have smartphones in the home than white householders. Therefore, access to a reservation system for these populations could be improved by ensuring the reservation system is compatible with mobile devices.

Quality of Life – Values, Beliefs, and Attitudes

Values are “relatively general, yet enduring, conceptions of what is good or bad, right or wrong, desirable or undesirable.”

Beliefs are “judgments about what is true or false – judgments about what attributes are linked to a given object. Beliefs can also link actions to effects.”

Attitudes are “tendencies to react favorably or unfavorably to a situation, individual, object, or concept. They arise in part from a person’s values and beliefs regarding the attitude object” (Allen et al 2009).

The public meetings that were held, as well as the submitted written comments, provide insight into the values, beliefs, and attitudes of the Fossil Creek area residents and surrounding communities. The major concerns from commenters were focused on economic impact and commercial opportunities, recreation development versus maintaining the area “wild and scenic,” recreation opportunities and access, user fees, and public safety.

Public safety was a particular concern for law enforcement, emergency responders, and local officials. These commenters described Fossil Creek as having significant public safety issues. Two major concerns were

[22] The American Community Survey (ACS) provides yearly estimates for geographies with populations of 65,000 people or more.

expressed. First was the ability for emergency responders to access visitors in a safe and timely manner. The closure of a four mile portion of FR 708 in 2011, and the dismantling of Irving Plant Flume and road increased the time from dispatch to rescue from 1.5 hours to 5-7 hours. Second, these commenters often found that visitors were unaware of the difficulty that Fossil Creek's trails and recreation spots pose (e.g. heat, altitude gains, hydration needs) and attempted activities that were beyond their capabilities. They recommended additional information about Fossil Creek and its challenges be provided during the permit process; a similar recommendation was echoed by environmental groups. These commenters did point out that after the permit system was implemented in May of 2016, the number of visitors needing emergency assistance dropped dramatically, however, it was still above reasonable levels. Additionally, the financial burden of these rescues to the local communities is a concern posited by area residents.

In addition to first responders' concerns with public safety and emergency access, there were several commenters for and against reopening the closed portion of FR 708. Those commenters who believe it should stay open argued that the road provides access for businesses, encourages additional tourism, and provides access to recreation. Several commenters believe that motorized access (Off-highway vehicles) should be allowed on the road and have discussed applying for a grant to do the necessary repairs and maintenance. However, other commenters were concerned that if the road is opened for motorized access, it will be a hazard to public safety.

There was strong support for the permit reservation system adopted in 2016. Support for the system was expressed for a variety of reasons. Some commenters supported the reduction in visitation, thereby, improving their recreation experience and reducing the negative impact to the environment. Recreation improvements mentioned include reduced garbage, better parking, and less noise. Commenters also expressed support for the system because they expect it to bring in revenue for the maintenance and enhancement of trails, roads and other uses. Additionally, the system could benefit the scenic qualities by limiting access to heavily used areas. In contrast, some commenters expressed general opposition to oversight of lands by the federal government.

People at the meetings and through written comments also showed concern for the management, preservation, and protection of Fossil Creek's Outstandingly Remarkable Values (ORVs). Commenters believe Fossil Creek is being, "loved to death," citing overcrowding as the key problem (per the Sierra Club letter). These commenters value the wild character and protection of ecosystem integrity and take issue with maximization of visitor numbers or experiences above these concerns. Commenters expressed their value in the natural amenities that Fossil Creek provides and would like to benefit from their sustained use and existence values they provide. Stewardship ethics and concerns for future generations, for example, were raised in the meetings. These commenters believe that the Fossil Creek area should be preserved for people in the future and that the current use should not inhibit future use. Specifically, sustaining healthy fisheries, wildlife and good water quality were values people commented on. While use levels affect the ability to sustain these conditions, the overall attitudes were supportive of maintaining the aesthetic beauty of the Fossil Creek area.

While many concerns focused on the conservation of the Fossil Creek area, many commenters acknowledged the importance of being able to use the site for recreation such as camping, fishing, hiking, swimming, kayaking, horseback riding, and water play. Of particular concern were visitors' ability to kayak in Fossil Creek and operate off-highway vehicles. Proponents of kayaking in Fossil Creek highlight the rare experience that Fossil Creek provides, their low environmental impact, and good stewardship, e.g. collecting trash. Commenters were both for and against motorized experiences. Those opposed find that visitors on OHVs are disrespectful to the environment and poor stewards of public lands. Additionally, commenters find OHVs to be noisy, smelly, and negatively impact visitors who prefer to have quiet and solitary experiences on public lands. In contrast, proponents of OHV use state they are responsible trail riders and desire access to public lands to enjoy their chosen form of recreation.

Economic opportunities and impacts were concerns raised by residents and county officials during public meetings and through scoping comments received. Local counties were concerned that any reduction in visitation would harm local businesses. Commercial opportunities from outfitters, guides, and concessionaires was discussed for its potential to increase local economic opportunity. However, allowing these activities may impact the wild and scenic character of the area and allow privileged access for those who are able to pay for it.

Environmental Consequences

Programmatic Analysis of the Effects of Management Direction of Social and Economic Resources

Implementation of the CRMP under the action alternatives, including Management Direction and Monitoring and Adaptive Management, will result in reduced effects to the social and economic resources compared to the no action alternative. Below is a summary of the effects of management direction for other program areas on the social and economic resources. This analysis summarizes all aspects of Management Direction regardless of alternative.

Implementing management direction to improve all ecological functioning (e.g. water quality, vegetation, soils, and wildlife) will have positive impacts on the social values for healthy ecosystems and the natural character within which people recreate. For example, intact terrestrial vegetation will reduce erosion potential and contribute to the quality of life, assuming this will improve areas for recreation. Reduced sedimentation and better water quality in Fossil Creek will also improve the quality of the recreation experience. People that have been recreating in the area for generations value the preservation of the natural character that they know and enjoy. Impacts to the quality of life from recreation experiences will be reduced when appropriate infrastructure is in place, visitor capacities are appropriately set to minimize or eliminate recreation use outside of recreation sites, entry is managed, and developed and dispersed camping is limited. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience. However, these use limitations that benefit the health of the ecosystem could have negative impacts to the social values for access and diversity of recreation experiences in the area.

Additionally, when the ecological functions are improved through the management plan, this will have long-term positive economic impacts as the recreation activities become more sustainable. By improving the quality of the recreation experience, people will want to continue visiting and therefore contribute to the local economy. However, the use limitations that benefit the health of the ecosystem could have negative economic impacts in the short-term as construction activities could temporarily affect the visitor experience and reduce associated economic activity.

The CRMP recommends expanding the Fossil Springs Botanical Area from 12 to 33 acres. This expansion would increase the area subject to management direction to protect and maintain the area's unique characteristics. The only specific limitation on use in this area would be to prohibit horse camping. The effects of this expansion would be minimal due to the size of the area and limitations on use, but the social values for healthy ecosystems would be positively impacted and values for horse camping and any associated economic activity resulting would be negatively impacted.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Alternative A – "no-action"

Economic Activity – Visitation

Under alternative A, a maximum of 148 vehicles and 740 people at one time would be permitted to visit Fossil Creek during the high-use season (April 1 – October 1). Recreation visitation to Fossil Creek in 2016 supported 2 jobs and $64,000 in labor income. If on a daily basis, the maximum number of vehicles (party trips)[23] is reached for the entire permit period (April 1 – October 1), then a total of 27,232 vehicles and 136,160 people would visit

[23] Number of vehicles = number of party trips. See methodology section for more details. In summary, NVUM party trip spending profiles were used to estimate employment and income.

Fossil Creek. Under alternative A, if the maximum number of vehicles (party trips) are to visit each day the permit period is open, 6 jobs and $149,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

Economic Activity: Spending on Project Activities

Under the no action alternative, various maintenance and monitoring activities would continue to occur, for example road maintenance and port-a-potty/vault toilet upkeep. Additionally, there would be various costs to the government to manage the area, including fleet maintenance and office supplies. Spending on these activities would support 4 jobs and $52,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, as well as commercial and industrial machinery repair and maintenance.

Economic and Commercial Opportunities

Under the no-action alternative outfitter/guides use would not be specifically authorized within the boundaries of Fossil Creek. Therefore, no economic impacts beyond those discussed above are anticipated.

Opportunities for partnerships, concessionaires, or other options to share operations and maintenance activities may be pursued. These opportunities have the potential to support employment and income in the area, however, data is not yet available to measure the impact. Because visitor capacities would remain the same, it is unlikely there would be a substantial economic impact from these activities. Non-local visitor spending would support the same employment and income described in Economic Activity – Visitation above, it may simply shift the location where visitors buy their sundries from the small towns surrounding Fossil Creek, to inside the Forest boundaries. However, these concessionaires may improve a visitor's recreation experience, allowing them a more convenient method to buy forgotten or needed necessities without leaving the area.

Financial Efficiency

Under the no-action alternative, total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(3,994,360). There are no monetary benefits associated with the project, therefore, the present net value is a cost.

Table 3-102. Alternative A Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$0	$0
Maintenance	$110,757	$(1,231,441)
Cost to the Government	$234,000	$(2,601,703)
Monitoring	$14,500	$(161,217)
Total Cost	**$ 359,257**	**$(3,994,360)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek, then somewhere between $13.19 and $16.49 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on the number of permits sold. See table 3-103.

Table 3-103. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years (alternative A)

Permits Sold	Maximum 27,232	95% 25,870	90% 24,509	85% 23,147	80% 21,786
Break Even	$13.19	$13.89	$14.66	$15.52	$16.49

Environmental Justice

Project management has the potential to disproportionately impact both low-income and minority populations. Under alternative A, the online permit reservation system would continue to be used. The fee to obtain a permit in

2017 and 2018 is $10, an increase in $4 from 2016. The permit fee provides no income to the Forest Service and covers only the administrative cost of the online permit system. The Environmental Justice and User Fees section provides detailed information regarding the impact of outdoor recreation fees on low-income and minority populations. In sum, fees reduce visitation among low-income populations. The impact of user fees on minority populations is mixed, but research suggests that lack of visitation by Hispanics is likely the result of social rather than economic constructs, with some evidence that fees do reduce participation by Hispanic populations.

With the continuation of the online permit reservation system, low income and minority populations in the area would continue to be negatively impacted since they lack access to the Internet and availability of computers in their home more so than white populations and those of higher income levels. The Environmental Justice and Reservation Systems section provides detailed information regarding access to Internet and computers by low-income and minority populations. The households without internet or computers, which the data shows is often low income and minority populations, will face greater barriers to access a reservation system.

During the temporal boundary of this analysis, the number of available weekend permits would not meet demand, and as a result, some visitors may have to travel further to find similar recreation opportunities. The additional travel cost would disproportionately impact low-income populations. In lieu of incurring additional travel costs, low-income visitors may elect to stay home.

Quality of Life: Access to recreation

Commenters were concerned that any limits on the number of available permits would restrict visitation and reduce the ability to visit Fossil Creek, in turn, reducing quality of life. Actual visitation in 2016 was significantly less than the maximum allowed. During the 2016 permit period (May 1 – October 1), 17,980 vehicles, which held 74,958 people, applied for a permit. Of these, only 11,681 vehicles and 47,927 people actually visited Fossil Creek. These values indicate, on a daily basis, 117 vehicles were permitted to visit Fossil Creek in 2016, and 76 actually did, which is well below the 148 vehicles allowed per day under alternative A. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day in 2016, indicating the daily demand for permits was 142, not 117 and actual visitation demand was 101. These data suggest that current management met the demand for recreation at Fossil Creek in 2016. However, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is still less than the maximum total people allowed during the permit period. It is difficult to say with certainty if the excess supply of permits available would be adequate to meet increasing demands for recreation as the population grows.

Weekend demand for permits (Saturday and Sunday) in 2016 was equal to supply under current management. The permit system was open for 154 days in 2016, 44 of these days fell on a weekend. Therefore a maximum of 6,512 vehicles and 32,560 people would have been able to visit Fossil Creek on the weekend. Applications for permits on the weekend in 2016 totaled 6,446 vehicles and 29,668 people, approximately 99 percent of the vehicle capacity and 91 percent of the people at one time capacity. As population increases, the demand for recreation will also increase, these data indicate that within the 15-year temporal boundaries of this analysis the demand for weekend permits would soon exceed the supply. The permit system has been open earlier in the season for an additional 30 days (month of April) from 2017 onward and may alleviate pressure on weekend demand later in the year.

Quality of Life: Diversity of Recreation Opportunities

Under alternative A, the same recreation opportunities currently available would remain available. Therefore, there would be no change to the existing quality of life for recreation visitors that rely on a diversity of recreation opportunities. As it relates to values for public safety, access to FR 708 would remain unchanged so there would be no change to emergency responder access relative to current conditions. Emergency responders can currently

drive the portion of FR 708 that is closed to the public at their own discretion. The Flume Trail (old Flume Road) would remain impassible for administrative OHV use.

Table 3-104. Resource indicators and measures for alternative A direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative A Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 6 jobs and $149,000 in labor income during the permit period. Spending on project activities would support a total of 4 jobs and $52,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($3,994,360)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees and reservation systems have the potential to disproportionately impact low-income populations and minority populations. The reduction in available weekend permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.
Quality of Life	Access to recreation	Number of recreation visits versus supply of permits available	Available permits would meet current demand for weekday visitation. It is difficult to say with certainty if future weekday demand will be met. Demand for weekend permits would not be met as the population grows. Reduction in quality of life for visitors who wish to recreate at Fossil Creek on the weekend, but aren't able to obtain a permit would be expected.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	No changes to opportunities for recreation such as camping, fishing, hiking, swimming, kayaking, horseback riding, and OHVs. Therefore no change to the existing quality of life for recreation visitors that rely on a diversity of recreation opportunities.

Cumulative Effects

Past, present or foreseeable projects in the surrounding area include decommissioning, obliteration, maintenance, resurfacing, and temporary closures to roads within and adjacent to Fossil Creek, including annual maintenance of FR708. Restoration, re-routing, seasonal limitations, and closures of trails within or near Fossil Creek have and would continue to occur. These changes may have both short and long-term impacts to desired recreation areas. Short-term impacts include temporary displacement as well as degraded recreation conditions, such as visual disturbance to scenic quality, noise, dust, etc. during project implementation. Long-term impacts may include permanent loss of access to desired routes and access points as well as preferred recreation sites and activities. However, in the long-run, trail and road improvements may increase access, improve recreation experiences, and provide greater recreation opportunities for visitors, further enhancing quality of life for visitors. Additionally, future implementation of the Travel Management Rule on the Tonto National Forest may limit vehicle access in certain areas, thereby further limiting access to water-based recreation activities in the central Arizona area.

If visitors are not able to find suitable recreation at Fossil Creek due to project activities or limited access (fees, unavailability of permits), and other ongoing road and trail projects in the surrounding area further limit the ability to find suitable recreation activities, then it is possible that visitors would have to travel farther. Subsequently, higher travel costs would disproportionately impact low-income populations.

Alternative B – Enhanced Protections

Alternative B would provide a more primitive visitor experience in Fossil Creek and emphasize protection of natural and cultural resources with minimal development of new facilities and infrastructure and a lower visitor capacity. Existing recreation sites, roads, and trails would be retained but not expanded, and a minimal amount facility and infrastructure improvement would support the sustainability of the recreation sites and transportation infrastructure. See Chapter 2 of the EIS for full alternative descriptions.

Economic Activity – Visitation

Visitation under alternative B would be lowered to a maximum of 112 vehicles (party trips) and 560 people at one time during the high-use season (April 1 – October 1). This represents a reduction in 36 vehicles and 180 people at one time relative to the "no-action" alternative. If on daily basis, the maximum number of vehicles and people at one time is reached for the entire permit period (April 1 – October 1), a total of 20,608 vehicles and 103,040 people would visit Fossil Creek. This is a 24 percent reduction in permitted visitation compared to the "no-action" alternative. Under alternative B, if the maximum number of vehicles are to visit each day the permit period is open, 4 jobs and $113,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

In addition to permitted vehicles, additional walk-ins, special groups, administrative, as well as tribal visitation would be allowed to enter Fossil Creek. These visits would increase recreation related employment and income estimates provided above, however, these visits will occur sporadically and are not presently quantifiable based on available data.

Economic Activity – Spending on Project Activities

In addition to annual spending on management of Fossil Creek, a variety of restoration and infrastructure construction would take place under alternative B. Including, a new Fossil Creek bridge, parking area resurfacing, trash cans, toilets, signage, and trail restoration. Spending on these activities would support 7 jobs and $117,000 in labor income annually. The cost of restoration and infrastructure construction are anticipated to be complete after 15 years. After this period, ongoing maintenance and management of Fossil Creek would support 5 jobs and $65,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including government, retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, commercial and industrial machinery repair and maintenance, maintenance and repair of highways and bridges, as well as landscape and horticultural services.

Economic and Commercial Opportunities

Under alternative B, a separate analysis to evaluate potential outfitter/guide opportunities and a prospectus would be prepared within approximately two years of CRMP approval. This process would evaluate the types, locations, and number of permitted uses that would be appropriate. At present, it is difficult to determine the employment and income that may be supported from these activities. However, because visitor capacity would remain the same regardless of commercial opportunities, it is unlikely that employment and income from recreation visitation would be considerably larger than the estimates provided above in Economic Activity – Visitation.

Opportunities for partnerships, concessionaires, or other options to share operations and maintenance activities may be pursued. These opportunities have the potential to support employment and income in the area, however, data is not yet available to measure the impact. Because visitor capacities would remain the same, it is unlikely there would be a substantial economic impact from these activities. Non-local visitor spending would support the same employment and income described in Economic Activity – Visitation above, it may simply shift the location where visitors buy their sundries from the small towns surrounding Fossil Creek, to inside the forest boundaries. However, these concessionaires may improve a visitor's recreation experience, allowing them a more convenient method to buy forgotten or needed necessities without leaving the area.

Financial Efficiency

Under alternative B, total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(7,739,205), including the cost of construction, maintenance, monitoring and costs to the government. Since no revenue for the government is generated in association with this project, the present net value is a large cost. While the benefits are not monetarily quantifiable, they still exist. For example, better recreation facilities, roads, trails, and signage may improve wildlife habitat, watersheds, vegetation, and visitor experience.

Table 3-105. Alternative B Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$242,789[24]	$(2,699,426)
Maintenance	$145,483	$(1,617,539)
Cost to the Government	$265,000	$(2,946,373)
Monitoring	$42,800	$(475,867)
Total Cost	**$696,072**	**$(7,739,205)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek for the next 15 years, as well as to cover the cost of adding facilities, road work, parking, etc., then between $33.78 and $42.22 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on the number of permits sold. See table 3-106.

Table 3-106. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years (alternative B)

Permits Sold	Maximum	95%	90%	85%	80%
	20,608	19,578	18,547	17,517	16,486
Break Even	$33.78	$35.55	$37.53	$39.74	$42.22

Environmental Justice

Project management has the potential to disproportionately impact both low-income and minority populations. Under alternative B, the online permit reservation system would be formally adopted. The fee to obtain a permit in 2017 and 2018 is $10, an increase in $4 from 2016. The permit fee provides no income to the Forest Service and covers only the administrative cost of the online permit system. The Environmental Justice and User Fees section provides detailed information regarding the impact of outdoor recreation fees on low-income and minority populations. In sum, fees reduce visitation among low-income populations. The impact of user fees on minority populations is mixed, research suggests that lack of visitation by Hispanics is likely the result of social rather than economic constructs, with some evidence that fees do reduce participation by Hispanic populations.

With the formal adoption of the online permit reservation system, low income and minority populations in the area would be negatively impacted since they lack access to the Internet and availability of computers in their home more so than white populations and those of higher income levels. The Environmental Justice and Reservation Systems section provides detailed information regarding access to Internet and computers by low-income and minority populations. The households without internet or computers, which the data shows is often low income and minority populations, will face greater barriers to access a reservation system.

The reduction in the number of permits available may require visitors to travel further to find similar recreation opportunities when permits are sold out. The additional travel cost would disproportionately impact low-income populations. In lieu of incurring additional travel costs, low-income visitors may elect to stay home.

[24] Annual construction costs are derived from total estimated construction cost averaged over 15 years.

Quality of Life: Access to Recreation

Permit sales in 2016 totaled 17,980, or 117 permits per day. 117 represents the average daily demand for permits to visit Fossil Creek under 2016 conditions. Under alternative B, 112 permits would be available per day, indicating the demand for permits is slightly greater than the supply. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day that would have liked to visit Fossil Creek in 2016, indicating the daily demand may have been as high as 142. It is likely that alternative B would reduce quality of life for users who wish to recreation at Fossil Creek, but are unable to obtain a permit. Additionally, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is more than the maximum total people that would be allowed during the permit period in alternative B.

Additionally, in 2016, 36 percent (6,446) of permits sold were for weekend visitation. If only 112 permits would have been available per day in 2016, then a maximum of 4,928 permits could have been sold on the weekend, which is well below the actual demand for weekend permits (6,446). The permit system will be open for an additional 30 days (month of April) from 2017 onward which may alleviate pressure on the demand for permits.

Population growth will increase demand for recreation within the 15-year temporal boundaries of this analysis. It is likely that the demand for permits would exceed the supply. Management activities may also impact demand. For example, people who value enhanced protections, including restoration may not have visited Fossil Creek under current management, but would if alternative B is implemented.

Quality of Life – Diversity of Recreation Opportunities

Under alternative B, visitor capacity is the lowest among the alternatives and infrastructure development is minimal. In addition, alternative B would restrict motorized use the most compared to the other alternatives (the number of vehicles at one time is reduced by approximately 36). Therefore, visitors and stakeholders who value Fossil Creek as an undeveloped and wild and scenic place would be positively impacted by alternative B compared to alternative A.

As detailed in the recreation report, there will likely be an overall reduction in swimming and boating opportunities due to decreased parking capacity at waterfall and springs trailhead, which would negatively impact those visitors that value these opportunities. However, there will be no restrictions on these activities so they can still occur and may benefit those that value the area as wild and scenic.

Alternative B proposes more designated camping areas (up to 10 designated campsites available in middle Fossil outside of permit season and dispersed camping in Fossil Springs areas for up to 3 groups of 5 people year-round) than alternatives C and D in Fossil Springs. This will positively impact those that value designated camping opportunities more so than under alternative A, which has no designated camping areas (dispersed camping available downstream of bridge and upstream of dam outside of permit season and camping available year-round in wild segments outside permit area).

Alternatives A, B, and C are the same in that motorized recreation access from SR260 is allowed with parking permit during reservation season and unlimited the rest of the year. Therefore, impacts to motorized recreation opportunities and people that value that use would be the same as under the existing condition.

In regards to public safety, access to FR 708 would remain unchanged and the Flume Trail (old Flume Road) would remain impassible for administrative OHV use, as such, there would be no change to emergency responder access relative to current conditions. Emergency responders can currently drive the portion of FR 708 that is closed to the public at their own discretion.

Table 3-107. Resource indicators and measures for alternative B direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative B Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 4 jobs and $112,000 in labor income during the permit period. Spending on project activities would support a total of 5 jobs and $65,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($7,739,205)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees and reservation systems have the potential to disproportionately impact low-income populations and minority populations. The reduction in available permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.
Quality of Life	Access to recreation	Number of recreation visits versus supply of permits available	Available permits are the lowest, which affects visitation. Alt B will likely have the greatest negative impact on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	People that value the area for its wild and scenic character will benefit from this alternative as visitor capacity is the lowest among the alternatives and infrastructure development is minimal. People that value swimming and boating may be negatively impacted more than under the existing condition as parking capacity is decreased.

Cumulative Effects

Past, present, or foreseeable projects in the surrounding area include decommissioning, obliteration, maintenance, resurfacing, and temporary closures to roads within and adjacent to Fossil Creek, including annual maintenance of FR708. Restoration, re-routing, seasonal limitations, and closures of trails within or near Fossil Creek have and would continue to occur. These changes may have both short and long-term impacts to desired recreation areas. Short-term impacts include temporary displacement as well as degraded recreation conditions, such as visual disturbance to scenic quality, noise, dust, etc. during project implementation. Long-term impacts may include permanent loss of access to desired routes and access points as well as preferred recreation sites and activities. However, in the long-run, trail and road improvements may increase access, improve recreation experiences, and provide greater recreation opportunities for visitors, further enhancing quality of life for visitors. Additionally, future implementation of the Travel Management Rule on the Tonto National Forest may limit vehicle access in certain areas, thereby further limiting access to water-based recreation activities in the central Arizona area.

By 2020, the Coconino National Forest is expected to experience 338,000 additional visitors annually, and the Tonto National Forest is expected to experience 986,000 additional visitors annually (English et al., 2014). This is expected to result in a cumulative increasing demand for access to recreation sites, especially those with water play opportunities. This would result in a cumulative increase in travel costs for those seeking a similar recreation experience.

If visitors are not able to find suitable recreation at Fossil Creek due to project activities (e.g. trail, road, or bridge maintenance) or because of its limited access (fees, unavailability of permits), and other ongoing road and trail projects in the surrounding area further limit the ability to find suitable recreation activities, then it is possible that visitors would have to travel farther, and subsequently incur greater travel costs to access recreation sites. Higher travels costs could reduce the ability of low-income populations to access recreation in the area.

Past and present actions have not reduced total public access below the 2009 baseline condition although the interim measures have spread out the timing of that use to reduce the amount of use on busy summer weekends. The quality of the visitor recreation experience has likely been improved due to past and present actions that have reduced potential crowding, trash, and sanitation issues. Therefore, social and economic cumulative impacts are expected to be positive but minimal.

Alternative C – Non-motorized experience

Alternative C would emphasize non-motorized recreation in Middle Fossil[25] by limiting motor vehicle use in portions of the river corridor during the busiest times and developing additional trails for hiking, bicycling, and equestrian use. A lower visitor capacity would support a quieter recreation experience. Trail access to the historic dam and Fossil Springs would be eliminated to minimize the effects of human presence in this area. Additional parking and visitor facilities would be developed at Cactus Flat and Homestead to serve as the primary entry point into the river corridor; from there visitors would access the corridor by foot, bicycle, or horseback during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park at a reduced number of parking spaces in existing parking lots. A moderate amount facility and infrastructure improvement would support the sustainability of recreation sites and transportation infrastructure in the corridor. See Chapter 2 of the EIS for full alternative descriptions.

Economic Activity - Visitation

Visitation under alternative C would be lowered to a maximum of 132 vehicles (party trips) and 660 people at one time during the high-use season (April 1 – October 1). This represents a reduction in 16 vehicles and 80 people at one time relative to the "no-action" alternative. If on daily basis, the maximum number of vehicles and people at one time is reached for the entire permit period (April 1 – October 1), a total of 24,288 vehicles and 121,440 people would visit Fossil Creek. This is an 11 percent reduction in visitation compared to the "no-action" alternative. If the maximum number of vehicles (party trips) visit Fossil Creek, 5 jobs and $133,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

Economic Activity: Spending on Project Activities

In addition to annual spending on management of Fossil Creek, a variety of restoration and infrastructure construction would take place under alternative C. This includes a new Fossil Creek bridge, parking area resurfacing, trash cans, toilets, signage, and trail restoration. Spending on these activities would support 9 jobs and $133,000 in labor income annually. The cost associated with restoration and infrastructure construction are anticipated to be complete after 15 years. After this period, ongoing maintenance and management of Fossil Creek would support 5 jobs and $74,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, commercial and industrial machinery repair and maintenance, maintenance and repair of highways and bridges, as well as landscape and horticultural services.

Economic and Commercial Opportunities

Same as alternative B.

Financial Efficiency

Under alternative C, the total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(8,793,048), including the cost of construction, maintenance, monitoring and costs to the government. Since no revenue for the government is generated in association with this project, the present net value is a large negative value. While the

[25] "Middle Fossil" includes the segment of Fossil Creek between the Mazatzal recreation site upstream to ¼ mile above the waterfall at the end of the Lewis Trail.

benefits are not monetarily quantifiable, they still exist. For example, better facilities, roads, and signage may improve wildlife habitat, watersheds, vegetation, and visitor experience.

Table 3-108. Alternative C Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$282,420[26]	$(3,140,055)
Maintenance	$140,136	$(1,558,091)
Cost to the Government	$325,500	$(3,619,035)
Monitoring	$42,800	$(475,867)
Total Cost	**$790,856**	**$(8,793,048)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek for the next 15 years, as well as to cover the cost of adding facilities, road work, parking, etc., then between $32.56 and $40.70 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on the number of permits sold. See table 3-109.

Table 3-109. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years

Permits Sold	Maximum	95%	90%	85%	80%
	24,288	23,074	21,859	20,645	19,430
Break Even	$32.56	$34.28	$36.18	$38.31	$40.70

Environmental Justice

The impact of user fees and a reservation system on environmental justice populations are the same as alternative B.

Under alternative C, the number of available weekend permits would not meet demand, as a result, some visitors may have to travel further to find similar recreation opportunities. The additional travel cost would disproportionately impact low-income populations. In lieu of incurring additional travel costs, low-income visitors may elect to stay home.

Quality of Life: Access to Recreation

Permit sales in 2016 totaled 17,980, or 117 permits per day. These values represent the demand for permits to visit Fossil Creek under 2016 conditions. Under alternative C, 132 permits would be available per day, indicating the supply of permits exceeds demand. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day that would have liked to visit Fossil Creek in 2016, indicating the daily demand may have been as high as 142. It is possible under alternative C that the demand for permits exceeds the supply as estimated from conditions in 2016, reducing the quality of life for users who prefer to recreate at Fossil Creek, but are unable to obtain a permit. Additionally, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is more than the maximum total people that would be allowed during the permit period in alternative C.

In 2016, 36 percent (6,446) of permits sold were for weekend visitation. If only 132 permits would have been available per day in 2016, then a maximum of 5,808 permits could have been sold on the weekend, well below the

[26] Annual construction costs are derived from total estimated construction cost averaged over 15 years.

actual demand for weekend permits (6,446). The permit system will be open earlier in the season for an additional 30 days (month of April) from 2017 onward which may alleviate pressure on weekend demand later in the year.

Population growth will increase demand for recreation within the 15-year temporal boundaries of this analysis. This will increase recreation demand for weekday trips and demand may not be met as population increases. The demand for weekend permits would continue to exceed supply. Management activities may also impact demand. For example, people who value quiet recreation experiences may not have visited Fossil Creek under current management, but would if alternative C is implemented.

Quality of Life: Diversity of Recreation Opportunities

Under alternative C, the non-motorized visitor experience is emphasized. As detailed in the recreation report, access to Fossil Springs is closed; Tonto Bench, Irving, and Waterfall are walk-in only, which would potentially reducing swimming and boating access, and there is limited year-round camping (camping limited to 7 designated campsites). People that value motorized access to the area for recreation opportunities will be negatively impacted and those that value the wild character and protection of ecosystem integrity will likely be positively impacted by alternative C compared to the other alternatives.

In regards to public safety, access to FR 708 would remain unchanged and the Flume Trail (old Flume Road) would remain impassible for administrative OHV use, as such, there would be no change to emergency responder access relative to current conditions. Emergency responders can currently drive the portion of FR 708 that is closed to the public at their own discretion. Additionally, portions of the Fossil Springs Trail that are common locations of emergency response but are currently difficult for first responders to reach would be closed to maximize restoration and maximize refugia for wildlife, fish, and vegetation in certain areas. This would likely reduce the need for emergency response.

Table 3-110. Resource indicators and measures for alternative C direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative C Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 5 jobs and $132,000 in labor income during the permit period. Spending on project activities would support a total of 9 jobs and $133,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($8,793,048)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees and reservation systems have the potential to disproportionately impact low-income populations and minority populations. The reduction in available weekend permits may require visitors to travel further to find similar recreation opportunities, the additional cost would disproportionately impact low-income populations.
Quality of Life	Access to recreation	Number of recreation visits	Available permits are the second lowest, which affects visitation. Alt C will likely have negative impacts on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	People that value the area for its wild and scenic character and ecosystem integrity will benefit from this alternative as access to Fossil Springs is closed. People that value motorized access to swimming, boating, and camping opportunities will be negatively impacted compared to the existing condition.

Cumulative Effects

Same as alternative B.

Alternative D – Motorized Use and Refugia

Alternative D would expand motorized access to Middle Fossil by increasing road connectivity and providing for scenic driving. Once hazard mitigations and repairs are completed, the currently closed portion of Forest Road (FR) 708 would be reopened to all motor vehicles. Recreational use would be focused at fewer sites in the river corridor. Some recreation sites would be closed and trail access to Fossil Springs and the Waterfall would be eliminated in order to maximize relatively undisturbed habitat (refugia) areas. New facility and infrastructure development would be focused on facilitating motorized access and supporting increased use at and sustainability of recreation sites. Increases in visitor capacity could be phased in over time. See Chapter 2 of the EIS for full alternative descriptions.

Economic Activity - Visitation

Visitation under alternative D would be increased to a maximum of 129 vehicles (party trips) and 645 people at one time during the high-use season (April 1 – October 1). Additionally, 40 permits would be available daily for scenic driving, (which assumes a maximum of 5 people per vehicle), for a daily maximum of 169 vehicle permits and 845 people at one time allowed to enter Fossil Creek under alternative D. This represents an increase in 21 vehicles and 105 people at one time relative to the "no-action" alternative. If on daily basis, the maximum number of vehicles, scenic driving vehicles, and people at one time was reached for the entire permit period (April 1 – October 1), a total of 31,096 vehicles and 155,480 people would visit Fossil Creek. This is a 14 percent increase in visitation compared to the "no-action" alternative. If the maximum number of vehicles (party trips) visit Fossil Creek, 6 jobs and $170,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

Economic Activity –Spending on Project Activities

In addition to annual spending on management of Fossil Creek, a variety of restoration and infrastructure construction would also take place under alternative D. Including, a new Fossil Creek bridge, parking area resurfacing, trash cans, toilets, signage, and trail restoration. Additionally, a new Irving Bridge would be built and FR 708 drainage repairs and hazard mitigation would be conducted. Spending on these activities would support 13 jobs and $234,000 in labor income annually. The cost of restoration and infrastructure construction are anticipated to be complete after 15 years. After this period, ongoing maintenance and management of Fossil Creek would support 7 jobs and $90,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, commercial and industrial machinery repair and maintenance, maintenance and repair of highways and bridges, as well as landscape and horticultural services.

Economic and Commercial Opportunities

Same as alternative B.

Financial Efficiency

Under alternative D, the total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(14,453,610), including the cost of construction, maintenance, monitoring and costs to the government. Since no revenue for the government is generated in association with this project, the present net value is a cost. While the benefits are not monetarily quantifiable, they still exist. For example, better facilities, roads, and signage may improve wildlife habitat, watersheds, vegetation, and visitor experience.

Table 3-111. Alternative D Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$661,172[27]	$(7,351,174)
Maintenance	$308,501	$(3,430,032)
Cost to the Government	$287,500	$(3,196,536)
Monitoring	$42,800	$(475,867)
Total Cost	**$1,299,973**	**$(14,453,610)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek for the next 15 years, as well as to cover the cost of adding facilities, road work, parking, etc., then between $41.81 and $52.26 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on visitor capacity. See table 3-112.

Table 3-112. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years

Permits Sold	Maximum	95%	90%	85%	80%
	31,096	29,541	27,986	26,432	24,877
Break Even	$41.81	$44.01	$46.45	$49.18	$52.26

Environmental Justice

The impact of user fees and a reservation system on environmental justice populations are the same as alternative B.

During the temporal boundaries of this analysis, the number of available permits for both weekend and weekdays would exceed the demand. Therefore, Alternative D is not likely to increase travel costs and disproportionately impact low-income populations.

Quality of Life: Access to Recreation

Permit sales in 2016 totaled 17,980, or 117 permits per day. These values represent the demand for permits to visit Fossil Creek under 2016 conditions. Under alternative D, 209 permits would be available per day, indicating the supply of permits exceeds demand. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day in 2016 so the daily demand may have been as high as 142. Based on these data, permit limits under alternative D still exceed demand under conditions in 2016 and is unlikely to impact quality of life for users who wish to recreate at Fossil Creek. However, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is still less than the maximum total people that would be allowed during the permit period in alternative D.

Additionally, the demand for weekend permits would be met under alternative D (using 2016 demand estimates). In 2016, 36 percent (6,446) of permits sold were for weekend visitation. If 209 permits would have been available per day in 2016, then a maximum of 9,196 permits could have been sold on the weekend, well above the actual demand for weekend permits (6,446). The permit system will be open earlier in the season for an additional 30 days (month of April) from 2017 onward which may alleviate pressure on weekend demand later in the year.

Population growth will increase demand for recreation within the 15-year temporal boundaries of this analysis. This increase in recreation demand for weekday and weekend trips should be met as population increases.

[27] Annual construction costs are derived from total estimated construction cost averaged over 15 years.

Management activities may also impact demand. For example, people who value motorized experiences may not have visited Fossil Creek under current management, but would if alternative D is implemented.

Quality of Life: Diversity of Recreation Opportunities

Under alternative D, the motorized visitor experience is emphasized. As detailed in the recreation report, Waterfall trail and Fossil Springs trail would be closed and restored, Tonto Bench would be closed, and parking expanded at Irving. In addition, there will be no camping available in middle Fossil or at Fossil Springs though dispersed camping will be available year-round in wild segments outside the permit area. The closures would limit access to boating, hiking, camping, and swimming spots and therefore negatively impact people that value these recreation opportunities. People that value the wild character and protection of ecosystem integrity will likely be positively impacted by alternative D due to these closures. However, alternative D includes scenic driving for up to 40 additional vehicles per day, which would negatively impact those that value the wild character of the area and positively impact (more than under alternatives A, B, and C) people that value access to the viewsheds. Short-term impacts of the construction include increased noise and possible access limitations for road repair.

In regards to public safety, access to the currently closed portion of FR708, as well as a new bridge at Irving, would be opened and maintained for vehicle travel. This will improve access for all visitors, including emergency responders. However, the Flume Trail (old Flume Road) would remain impassible for administrative OHV use. Additionally, portions of the Fossil Springs Trail that are common locations of emergency response but are currently difficult for first responders to reach would be closed to maximize restoration and maximize refugia for wildlife, fish, and vegetation in certain areas. This would likely reduce the need for emergency response.

Table 3-113. Resource indicators and measures for alternative D direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative D Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 6 jobs and $170,000 in labor income during the permit period. Spending on project activities would support a total of 13 jobs and $234,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($14,453,610)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees and reservation systems have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should meet demand, therefore, it is unlikely that travel costs would disproportionately impact low-income populations.
Quality of Life	Access to recreation	Number of recreation visits	The impact to quality of life due to permit availability/accessibility of Fossil Creek will be less than under Alternatives A, B, and C.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	People that value the area for its wild and scenic character will benefit from this alternative as hiking, camping, swimming, and boating opportunities are limited. People that value scenic driving will benefit more than under the existing condition as the alternative includes scenic driving for up to 40 additional vehicles per day.

Cumulative Effects

Same as alternative B.

Alternative E – Enhanced Recreation Opportunities with Phased Implementation

Alternative E would emphasize providing a variety of recreation opportunities throughout the Fossil Creek corridor. Phased development of additional parking and visitor facilities could occur at Cactus Flat, Heinrich, and Irving to support increased visitor capacity, and improvements at other recreation sites would be focused on supporting increased use at and sustainability of those sites. New trails for hiking, bicycling, and equestrian use would be constructed. Once hazard mitigations and repairs are completed, the currently closed portion of FR 708 would be reopened to motor vehicles less than 62 inches wide. See Chapter 2 of the EIS for full alternative descriptions.

Economic Activity - Visitation

Visitation under alternative E would be increased to a maximum of 270 vehicles (party trips) and 1,350 people at one time during the high-use season (April 1 – October 1). Additionally, 40 permits would be available daily for motorized trail vehicles. An occupancy of two people per motorized trail vehicle is assumed. This represents a total increase in 162 vehicles and 690 people at one time relative to the "no-action" alternative. If the maximum number of vehicles and people at one time was reached for the entire permit period (April 1 – October 1), then a total of 57,040 vehicles and 263,120 people would visit Fossil Creek. This is a 109 percent increase in vehicles permitted (including motorized trail vehicles), and a 93 percent increase in visitors compared to the "no-action" alternative. If the maximum number of vehicles (party trips) visit Fossil Creek, 12 jobs and $313,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

Economic Activity – Spending on Project Activities

In addition to annual spending on management of Fossil Creek, a variety of restoration and infrastructure construction would also take place under alternative E. This includes a new Fossil Creek bridge, parking area resurfacing, trash cans, toilets, signage, and trail restoration. Additionally, a new Irving Bridge would be built and FR 708 drainage repairs and hazard mitigation would be conducted. Spending on these activities would support 16 jobs and $269,000 in labor income annually. The cost of restoration and infrastructure construction are anticipated to be complete after 15 years. After this period, ongoing maintenance and management of Fossil Creek would support about 8 jobs and $106,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, commercial and industrial machinery repair and maintenance, maintenance and repair of highways and bridges, as well as landscape and horticultural services.

Economic and Commercial Opportunities

Same as alternative B.

Financial Efficiency

Under alternative E, the total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(16,802,522), including the cost of construction, maintenance, monitoring and costs to the government. Since no revenue for the government is generated in association with this project, the present net value is a cost. While the benefits are not monetarily quantifiable, they still exist. For example, better facilities, roads, and signage may improve wildlife habitat, watersheds, vegetation, and visitor experience.

Table 3-114. Alternative E Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$759,543[28]	$(8,444,897)
Maintenance	$343,394	$(3,817,988)
Cost to the Government	$365,500	$(4,063,771)
Monitoring	$42,800	$(475,867)
Total Cost	**$1,511,237**	**$(16,802,522)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek for the next 15 years, as well as cover the cost of adding facilities, road work, parking, etc., then between $26.49 and $33.12 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on visitor capacity. See 3-115.

Table 3-115. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years

Permits Sold	Maximum	95%	90%	85%	80%
	57,040	54,188	51,336	48,484	45,632
Break Even	$26.49	$27.89	$29.44	$31.17	$33.12

Environmental Justice

The impact of user fees and a reservation system on environmental justice populations are the same as alternative B.

During the temporal boundaries of this analysis, the number of available permits for both weekend and weekdays would exceed the demand from 2016. Therefore, Alternative E is not likely to increase travel costs and disproportionately impact low-income populations.

Quality of Life: Access to Recreation

Permit sales in 2016 totaled 17,980, or 117 permits per day. These values represent the demand for permits to visit Fossil Creek in 2016 when the reservation system was first implemented. Under alternative E, 310 permits (270 vehicles and 40 motorized trail vehicles) would be available per day, indicating the supply of permits exceeds demand. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day in 2016, indicating the daily demand may have been as high as 142. Based on these data, permit limits under alternative E exceed demand under conditions in 2016 and is unlikely to impact quality of life for users who wish to recreate at Fossil Creek. However, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is substantially less than the maximum total people that would be allowed during the permit period in alternative E.

Additionally, the demand for weekend permits would be met under alternative E (using 2016 demand estimates). In 2016, 36 percent (6,446) of permits sold were for weekend visitation. If 310 permits would have been available per day in 2016, then a maximum of 13,640 permits could have been sold on the weekend, well above the actual demand for weekend permits (6,446).

Population growth would increase demand for recreation, within the temporal boundaries of this analysis (15 years). This would increase recreation demand for weekday and weekend trips should be met as population increases. Management activities may also impact demand. For example, alternative E has a high visitor capacity

[28] Annual construction costs are derived from total estimated construction cost averaged over 15 years.

and enhanced recreation opportunities and people who value solitude and quiet experiences may find it more difficult to find these experiences under alternative E, therefore, not visit Fossil Creek.

Quality of life: Diversity of recreation opportunities

Under alternative E, there would be additional hiking and camping opportunities, as detailed in the recreation report (year-round limited camping at designated sites in Middle Fossil, Rim Trailhead, and Fossil Springs area, New Creek View and Rim Trails). However, the permits for Fossil Spring area would be reduced and there would be no dispersed camping. In addition, there is expected to be an overall increase in swimming and boating opportunities due to higher parking capacity. This would positively impact people that value designated camping areas, hiking, swimming, and boating opportunities. People that value the wild character and protection of ecosystem integrity will likely be less positively impacted by alternative E due to these increases in recreation opportunities, though since the permits for Fossil Springs area would be reduced, they will still be positively impacted compared to the existing condition. This alternative also includes scenic driving for up to 40 additional off-highway vehicles per day accessing Middle Fossil from Strawberry, which would negatively impact those that value the wild character of the area and positively impact (more than under alternatives A, B, and C) people that value access to the viewsheds. Short-term impacts of the construction include increased noise and possible access limitations.

In regards to public safety, the currently closed portion of FR708, as well as a new bridge at Irving, would be opened and maintained for motorized trail vehicle travel. This will improve access for all visitors, including emergency responders. However, the Flume Trail (old Flume Road) would remain impassible for administrative OHV use.

Table 3-116. Resource indicators and measures for alternative E direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative E Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 12 jobs and $313,000 in labor income during the permit period. Spending on project activities would support a total of 16 jobs and $269,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($16,802,522)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees and a reservation system have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should meet demand, therefore, it is unlikely that travel costs would disproportionately impact low-income populations.
Quality of Life	Access to recreation	Number of recreation visits	The impact to quality of life due to permit availability/accessibility of Fossil Creek is likely minimal since the number of permits is greater than the current visitation.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	People that value the area for its wild and scenic character will benefit from this alternative but less than under the other alternatives as permits for Fossil Spring area would be reduced. Since recreation opportunities will be increased for hiking, camping, boating, and swimming, people that value diverse recreation opportunities will be positively impacted more than under the other alternatives.

Cumulative Effects

Same as alternative B.

Alternative F – Demand-based Access

Alternative F would strive to meet recreation demand relatively quickly in order to achieve the goal of eliminating the need for a reservation system efficiently. This would be accomplished by establishing a large parking area at Cactus Flat, with additional parking at Homestead and several other recreation sites. New trails for hiking, bicycling, and equestrian use would be constructed. New facility and infrastructure development would support increased use at and sustainability of recreation sites. Cactus Flat and Homestead would serve as the primary entry point into the river corridor; private motor vehicle access to the remaining upstream recreation sites in Middle Fossil would be restricted during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots. See Chapter 2 of the EIS for full alternative descriptions.

Economic Activity - Visitation

Visitation under alternative F would be increased to a maximum of 500 vehicles (party trips) and 2,500 people at one time during the high-use season (April 1 – October 1). This represents an increase in 352 vehicles and 1,760 people at one time relative to the "no-action" alternative. If the maximum number of vehicles and people at one time was reached for the entire permit period (April 1 – October 1), then a total of 92,000 vehicles and 460,000 people would visit Fossil Creek. This is a 238 percent increase in vehicles permitted, and a 238 percent increase in visitors compared to the "no-action" alternative. If the maximum number of vehicles (party trips) visit Fossil Creek, 19 jobs and $490,000 in labor income would be supported annually from recreation visitation. These jobs would occur primarily in the retail and accommodation and food services sectors.

Economic Activity – Spending on Project Activities

In addition to annual spending on management of Fossil Creek, a variety of restoration and infrastructure construction would also take place under alternative F, including a new parking area and trails. Spending on these activities would support 12 jobs and $175,000 in labor income annually. The cost of restoration and infrastructure construction are anticipated to be complete after 15 years. After this period, ongoing maintenance and management of Fossil Creek would support 6 jobs and $91,000 in labor income annually.

These jobs would occur in a variety of industry sectors, including retail, hospitality, professional services (insurance, real estate, accounting, architecture and engineering), maintenance and repair of construction of non-residential structures, commercial and industrial machinery repair and maintenance, maintenance and repair of highways and bridges, as well as landscape and horticultural services.

Economic and Commercial Opportunities

Same as alternative B.

Financial Efficiency

Under alternative F, the total Present Net Value for 15 years of FS costs to manage Fossil Creek is $(11,547,691), including the cost of construction, maintenance, monitoring and costs to the government. Since no revenue for the government is generated in association with this project, the present net value is a cost. While the benefits are not monetarily quantifiable, they still exist. For example, better facilities, roads, and signage may improve wildlife habitat, watersheds, vegetation, and visitor experience.

Table 3-117. Alternative F Financial Efficiency Analysis

Activity	Annual Cost	Present Value
Construction	$411,165[29]	$(4,571,492)
Maintenance	$181,147	$(2,014,063)
Cost to the Government	$403,500	$(4,486,269)
Monitoring	$42,800	$(475,867)
Total Cost	**$1,038,612**	**$(11,547,691)**

If the Forest Service starts charging fees to cover the cost to manage Fossil Creek for the next 15 years, as well as cover the cost of adding facilities, road work, parking, etc., then between $11.29 and $14.11 (above the administrative fee charged by the permit system) for each permitted vehicle would need to be charged annually, depending on visitor capacity. See 3-118.

Table 3-118. Permit Fees to Cover the Costs to Manage Fossil Creek for 15 years

Permits Sold	Maximum	95%	90%	85%	80%
	92,000	87,400	82,800	78,200	73,600
Break Even	$11.29	$11.88	$12.54	$13.28	$14.11

Environmental Justice

The impact of user fees on environmental justice populations are the same as alternative B. Although there wouldn't be a reservation system, it is likely that user fees would be charged.

Since alternative F intends to eventually eliminate the need for a reservation system, low income and minority populations in the area would be limited less than under the other alternatives to access due to lack of Internet and computers. Alternative F incrementally increases visitor use and there is a period before the reservation system is eliminated, though it is expected to be eliminated sooner than under the other alternatives. The Environmental Justice and Reservation Systems section provides detailed information regarding access to Internet and computers by low-income and minority populations. The households without internet or computers, which the data shows is often low income and minority populations, will face greater barriers to access a reservation system so this alternative will have the least negative impacts to these populations once the reservation system is eliminated.

During the temporal boundaries of this analysis, the number of available permits for both weekend and weekdays would exceed the demand from 2016. Therefore, Alternative F is not likely to increase travel costs and disproportionately impact low-income populations.

Quality of Life: Access to Recreation

Permit sales in 2016 totaled 17,980, or 117 permits per day. These values represent the demand for permits to visit Fossil Creek in 2016 when the reservation system was first implemented. Under alternative F, 500 vehicle permits would be available per day, indicating the supply of permits far exceeds demand. The number of vehicles turned away from Fossil Creek for not having a permit should also be taken into account. According to the 2016 Visitor Use Summary report, 3,872 vehicles were turned away from Fossil Creek for not obtaining a permit. This represents an additional demand of 25 vehicles per day in 2016, indicating the daily demand may have been as high as 142. Based on these data, permit limits under alternative F still exceeds demand and is unlikely to impact quality of life for users who wish to recreate at Fossil Creek. However, 2016 was the first year the reservation system was implemented so it likely impacted the total visitation. A better proxy for demand is likely from 2015, prior to the implementation of the reservation system. In 2015, the total demand was about 130,000 people (turned away and permitted entry), which is substantially less than the maximum total people that would be accommodated during the permit period in alternative F.

[29] Annual construction costs are derived from total estimated construction cost averaged over 15 years.

Additionally, the demand for weekend permits would be met under alternative F (using 2016 demand estimates). In 2016, 36 percent (6,446) of permits sold were for weekend visitation. If 500 permits would have been available per day in 2016, then a maximum of 22,000 permits could have been sold on the weekend, well above the actual demand for weekend permits (6,446).

Population growth would increase demand for recreation within the temporal boundaries of this analysis (15 years). This increase in recreation demand for weekday and weekend trips should be met as population increases. Management activities may also impact demand. For example, alternative F has a high visitor capacity and enhanced recreation opportunities and people who value solitude and quiet experiences may find it more difficult to find these experiences under alternative F, therefore, not visit Fossil Creek.

Quality of life: Diversity of recreation opportunities

Under alternative F, there would be somewhat of a reduction in hiking opportunities, less boating opportunity (no boating restrictions but due to the closing of FR 708 to motor vehicles upstream from Homestead during high-use season that will make it harder to transport kayaks to the Waterfall), and limited camping, as detailed in the recreation report. Since the Fossil Springs trail will be closed under alternative F, this will negatively impact visitors who seek this hiking opportunity and it reduces recreation opportunities accessed from the town of Strawberry. However, access to the Fossil Springs area and historic dam would remain available along the Flume Trail. In addition, there are no swimming restrictions. This alternative would positively impact people that value expanded access to Fossil Creek, designated camping areas, and swimming opportunities. People that value the wild character, viewsheds and protection of ecosystem integrity will likely be less positively impacted by alternative F due to the increases in recreation use.

In regards to public safety, access to FR 708 would remain unchanged, as such, there would be no change to emergency responder access relative to current conditions. Emergency responders can currently drive the portion of FR 708 that is closed to the public at their own discretion. A new bridge would be installed where the Flume Trail crosses a side canyon to support limited administrative access by OHV. Additionally, portions of the Fossil Springs Trail that are common locations of emergency response but are currently difficult for first responders to reach would be closed to facilitate implementation of the alternative. This would likely reduce the need for emergency response. Maintaining the closure of FR708 will negatively impact access for all visitors; but access to the Fossil Springs area would be retained via the Flume Trail. Improving administrative access on the Flume Trail and closing the Fossil Springs trail would positively impact emergency response.

Table 3-119. Resource indicators and measures for alternative F direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative F Direct/Indirect Effects
Economic Impact	Economic Activity	Employment and labor income	Recreation visitation would support a maximum of 19 jobs and $490,000 in labor income during the permit period. Spending on project activities would support a total of 12 jobs and $175,000 in labor income annually.
Financial Efficiency	Financial Feasibility	Present Net Value	($11,547,691)
Environmental Justice	Disproportionate and adverse economic impacts to low-income and/or minority populations	Identification of low-income and minority populations in the study area	User fees have the potential to disproportionately impact low-income populations and minority populations. The number of available permits should exceed demand, therefore, it is unlikely that travel costs would disproportionately impact low-income populations. Without a reservation system, it is unlikely that internet and access to computers would impact these populations.

Resource Element	Resource Indicator	Measure	Alternative F Direct/Indirect Effects
Quality of Life	Access to recreation	Number of recreation visits	The impact to quality of life due to permit availability/accessibility of Fossil Creek is the least under Alt F since the number of permits is the greatest.
Quality of Life	Values, beliefs, attitudes for a diversity of recreation opportunities	Recreation opportunities	People that value the area for its wild and scenic character will be negatively affected by this alternative since this alternative has the greatest capacity for visitation. Since recreation opportunities will be increased for camping and not restricted for boating or swimming, people that value diverse recreation opportunities will be positively impacted more than under alternatives A, B, C, and D, though hikers for the Fossil Spring trail will be negatively impacted.

Cumulative Effects

Same as alternative B.

Adaptive Management Actions

Under all action alternatives, adaptive management actions will be applied to balance recreation access and experience quality with preservation of the other Fossil Creek ORVs, as indicated by monitoring. The actions may include increasing management presence, education efforts targeted at addressing observed impacts, temporary site closures, infrastructure development, restoration actions, or temporary or long-term reductions in the amount of visitor use. These actions are more likely to improve the visitor experience in the long-term, but could have effects detailed below.

Adaptive management actions for recreation opportunities could be temporary or long-term prohibitions of specific recreation activities. In the short-term, this could negatively impact the quality of life for people that value recreation opportunities affected by the prohibitions. This would also negatively impact the jobs and income resulting from recreation visitation in the short-term. However, these actions are intended to preserve the recreation quality of Fossil Creek and so will likely have positive long-term impacts on quality of life economic impacts.

Adaptive management actions for visitor capacity include reservation/permit system changes to adjust use patterns. In alternatives B-E, the timing and extent of the reservation system would be adjustable if needed to accommodate changes in use, administrative considerations, or river value protection. In Alternative F, a reservation system may be implemented at certain locations or corridor-wide if needed to protect river values or facilitate management activities. For people that value access to the area, their quality of life could be negatively impacted in the short-term. However, these actions are intended to preserve the recreation quality of Fossil Creek and so will likely have positive long-term impacts on quality of life.

Adaptive management actions for motor vehicle access into the Fossil Creek corridor may be temporarily restricted to protect public safety (such as during times of high fire danger or when construction activities are occurring) or to protect resources (such as in the event of wet weather). The effects will be the same as detailed above for recreation opportunities.

Adaptive management actions that include reservation system changes could have impacts on the environmental justice populations in the area. If the reservation system is implemented in more locations or corridor-wide, this will have greater negative impacts. However, if the use of the reservation system is reduced to specific times and locations, this will have less negative impacts on low-income and minority populations that do not have access to Internet and computers.

Summary

Degree to Which the Purpose and Need for Action is Met

The purpose and need identified the need for a long-term management plan and site-specific actions that protect river values and other biological, physical and social resources while managing recreational access, use, and amenities at levels that strive to meet demand but are consistent with the protection of river values. Table 3-120 summarizes the impact to socioeconomic resources by alternatives for recreation access and use.

Degree to Which the Alternatives Address the Issues

Table 3-120 summarizes the key issues by alternative. The economic impact from opportunities for outfitters/guides and concessionaires/partnerships are the same for alternatives A through F, with the exception of alternative A. Alternative A does not have an outfitter/guide option, therefore there are no impacts to address. In short, these activities have the potential to support employment and labor income for the surrounding communities. However, because visitor capacities would remain the same, it is unlikely that employment and income would be significantly greater than those described under the Economic Activity – Visitation sections for each alternative. Additionally, it may simply shift where visitors spend their money – from the local communities outside of Fossil Creek to within the Fossil Creek boundaries.

Alternatives A, B, C and D (a maximum of 148, 112, 132, and 169 vehicles permitted daily to visit Fossil Creek during the high-use season, respectively) would restrict user access significantly more than alternatives E and F (a maximum of 310 and 500 vehicles permitted daily to visit Fossil Creek during the high-use season, respectively). Alternative B is the most restrictive for access, reducing the number of permits available for weekday and weekend visitation by the greatest amount.

Alternative B would restrict motorized access the most amongst the alternatives, followed by alternatives C and A. Alternatives D and E would include up to 40 additional vehicles with scenic driving permits, increasing the motorized access. The greater the motorized access, the better the alternatives address key concerns for public safety and decreasing emergency response times, as well as increasing opportunities for motorized recreation.

Table 3-120. Summary comparison of how the alternatives address the key issues

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Economic and Commercial Opportunities	Employment and Income – Qualitative Analysis	No option for outfitter/ guides Partnerships/ concessionaires are possible in the future. These activities have the potential to support employment and labor income. Because visitor capacities would remain the same, it is unlikely that there would be substantial economic impact beyond what is described under Economic Activity – Visitation.	Future analysis would be conducted to determine outfitter/guide opportunities. Because visitor capacity would remain the same regardless of commercial opportunities, it is unlikely that employment and income from recreation visitation would be considerably larger than the estimates provided in Economic Activity – Visitation.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Same as alternative B.
Recreation Use and Visitor Capacities	Quality of life	Available permits would meet current demand for weekday visitation. It is difficult to say with certainty if future weekday demand will be met. Demand for weekend permits would not be met as the population grows. Reduction in quality of life for visitors who wish to recreate at Fossil Creek on the weekend, but aren't able to obtain a permit would be expected.	Available permits are the lowest, which affects visitation. Alt B will likely have the greatest negative impact on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.	Available permits are the second lowest, which affects visitation. Alt C will likely have negative impacts on quality of life for visitors who wish to recreate at Fossil Creek, but aren't able to obtain a permit.	The impact to quality of life due to permit availability/accessibility of Fossil Creek will be less than under Alternatives A, B, and C.	The impact to quality of life due to permit availability/accessibility of Fossil Creek is likely minimal since the number of permits is greater than the current visitation.	The impact to quality of life due to permit availability/accessibility of Fossil Creek is the least under Alt F since the number of permits is the greatest.

Issue	Indicator/ Measure	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Motorized Access	Quality of life	Motorized use limited to permitted vehicles driving to parking lots.	Number of vehicles at one time reduced by approximately 36. Motorized use limited to permitted vehicles driving to parking lots.	Number of vehicles at one time reduced by approximately 16. Motorized use limited to permitted vehicles driving to parking lots.	Up to 40 additional vehicles with scenic driving permits entering from Strawberry side per day.	Up to 40 additional OHVs with permit entering from Strawberry side per day.	Number of vehicles at one time increased by approximately 352. Motorized use limited to permitted vehicles driving to parking lots.

Summary of Environmental Effects

Table 2-5 summarizes the impact to socioeconomic resources across all alternatives.

Alternative E would support the most employment and labor income from project spending. Alternative F would support the most employment and labor income from recreation visitation. Alternative E also has the largest negative PNV, about $17 million, followed by alternatives D, F, C, B, and A.

Permits available per day under alternatives E and F are the highest and would likely meet the demand for recreation for both weekday and weekend visitation. Because the Fossil Creek permit period would be open an additional month moving forward, high demand on recreation later in the permit period may be alleviated. Due to the reduction in available permits, alternatives A, B, and C have the potential to increase travel costs and disproportionately impact low-income populations. Across all alternatives, the fee based permit system has the potential to negatively impact low-income and minority populations. Under alternatives A, B, C, D, and E, the reservation system has the potential to negatively impact low-income and minority populations.

Alternative E provides the greatest expected increase in recreation opportunities such as camping, hiking, boating, and swimming, and also includes increased access for scenic driving. This alternative will have the most positive impact to people that value these recreation opportunities and their quality of life. People that value the wild and scenic character of the area will be positively impacted the most by alternative B (reduces visitor capacity and infrastructure) and alternative C (emphasizes the non-motorized recreation experience).

Unavoidable Adverse Effects

The continued use of a fee based permit system would have an impact on low-income populations across all alternatives. The need for and benefits of the fee should be weighed and carefully monitored for impacts to low-income and minority populations.

Scenery

This section uses Fossil Creek data collected in user surveys, on-site inventories, and the scenery management system to analyze the landscape character, scenic attractiveness, and scenic integrity for the area. Two levels of analysis will be included, that of the Wild and Scenic River (WSR) corridor (the project area), and specific places where changes and improvements are proposed for inclusion in the comprehensive river management plan and the analysis area for scenic integrity objectives for the wider landscape. In addition, the relative value and importance of scenery in the WSR corridor will be considered as it relates to valued unique sense of place and aesthetic values of Fossil Creek. Additional background information for the scenery analysis can be found in the specialist report.

Methodology

This evaluation applies current National Forest Scenery Management methodology in conjunction with Forest Plan direction. This analysis relies on field studies and photography of analysis area, as well as coordination with project interdisciplinary team members, project GIS data related to development areas, restoration, and bare soil,

and consideration of public preferences for scenery. Cumulative scenic quality within the geographic scope of the project will consider scenic attributes, "seen area" from inventoried Concern Level 1 and 2 travelways/use areas based on GIS analysis, and the valued landscape character. Additionally, this report uses constituent information from visitor survey data collected by Northern Arizona University School of Forestry (Lee 2012, Anderson 2011, Hancock et al 2007), visitor use data (Roughan 2002; Rotert 2009-2013), and Coconino and Tonto National Visitor Use Monitoring (USDA FS 2015 and USDA FS 2016a, respectively) to indicate visitor numbers and characteristics, recreation uses and effects/ trends among these items, and the overall sense of place (Cross 2001) at Fossil Creek. Recreation and scenery research will be used to augment effects analysis for the alternatives. In addition, FS manual and handbook guidance will be used to assure adequacy of the scenery analysis for a wild and scenic river.

The scenery management system (USDA FS 2000) will be used to describe the following:

- landscape character types of the area including physical, biological and cultural attributes, disturbances, and land use patterns
- scenic attractiveness to measure the diversity of scenery within the landscape character types
- landscape visibility/constituent concern for scenery
- existing scenic integrity or intactness of the area
- scenic integrity objectives representing the desired condition of the area

Integration of this scenery analysis assures the CRMP is consistent with scenery-related CNF/Tonto Forest Plan direction, USFS policies, and applicable elements of USFS Visual Management and Scenery Management systems. This includes an amendment to the Tonto Forest Plan to update inventoried public concern for scenery. Refer to Appendix B of the SMS Handbook #701 for a complete list of references requiring Forest Service management of scenery and aesthetics (USDA FS 2000).

Project GIS data were used to compare acres of landscape disturbance to analyze changes to landscape character. Acreages are provided for developed recreation areas, roads, and trails within the project area only, though small areas of acreage layers may extend outside of the project area due to buffering in GIS. For alternatives B-F, these numbers reflect full implementation of the alternatives - e.g. all actions are implemented, and all restoration is complete. Any overlap in types of restoration (e.g. an unauthorized trail that crosses a bare area) has been eliminated.

For Alternative A disturbed areas, "developed rec areas" include all existing recreation sites. "Roads" includes all roads, including unauthorized. "Trails" includes system trails, creek access paths, and unauthorized trails. "Other disturbed areas" includes disturbed areas outside of rec sites, roads, and trails designated for restoration in the action alternatives. All overlap in disturbance (e.g. creek access paths that fall within rec sites) has been eliminated in the data.

For alternative B -F disturbed areas, acres are for developed recreation areas, parking lots, roads, trails, and creek access paths that would exist at full implementation of the alternatives. At full implementation, it is assumed all restoration of disturbed areas outside of rec sites and unauthorized roads and trails will be complete, so areas that would be restored are not included in the disturbed area calculations for alternatives B-F. All overlap in disturbance (e.g. creek access paths that fall within rec sites) has been eliminated in the data.

Visual Management System (VMS)

Currently the scenery resources of Tonto National Forest (TNF) are managed through the application of the VMS. The VMS was adopted by the Forest Service in 1974. The culmination of the VMS were Visual Quality Objectives (VQOs) prescribed in the Forest Plan for all lands within TNF. The VQO classifications range from Preservation, Retention, Partial Retention, Modification, to Maximum Modification. For a full synopsis of each VQO see *National Forest Landscape Management: Volume 2, Chapter 1, The Visual Management System* (Forest Service 1975). The VMS process has been updated in the Scenery Management System (SMS). Handbook direction outlining the inventory and transition process from VMS to SMS may be found in Landscape Aesthetics: A Handbook for Scenery Management (USDA FS 2000). Full adoption of the SMS is to occur as each National

Forest revises its Land and Resource Management Plans. The TNF Forest Plan is currently being revised and will be transitioning to Scenery Management System (see next section). For this project, the updated SMS inventory for the TNF will be incorporated and integrated at a project scale until Forest Plan Revision is completed. This action follows Forest Service direction to "*begin using the concepts and terms contained in this Handbook (Landscape Aesthetics, A Handbook for Scenery Management) as you work on new projects or initiate forest plan revisions"* (USDA FS 2000).

The Coconino updated the scenery resources inventory in 2011, and is part of the revised 2018 Forest Plan.

Scenery Management System (SMS)

Scenic Integrity Objectives (SIOs) are used in the SMS in much the same way as VQOs are used in VMS (table 3-121). The Scenic Integrity or "intactness" of national forest lands is the means by which proposed alterations to the land are evaluated. Scenic Integrity is produced from the combined inventory of scenic attractiveness, viewing distance from the observer, and concern level of forest visitors. Scenic Integrity Objectives (SIO) are established for the forest and can be applied at the forest, management area or treatment area (USDA FS 2000). SIOs range from Very High, meaning the landscape character is unaltered, to Very Low, meaning the landscape character is highly altered. Intermediate levels include High (landscape character appears unaltered), Moderate (landscape character is slightly altered), and Low (landscape character is moderately altered). Another basic premise of the SMS is landscape character, which defines a visual and cultural image for a geographic area. It consists of a combination of physical, biological and cultural attributes that make a landscape identifiable and unique. Landscape character embodies distinct landscape attributes that exist throughout an area (USDA FS 2000). Table 3-121 compares the Visual Management System rankings and terminology with the Scenery Management System.

Table 3-121. Scenic integrity, visual quality objective, and perception crosswalk (USDA FS 2000, 2-4)

Scenic Integrity (both Existing and Objective)	Visual Quality Objective	The Forest's Scenic Integrity as people perceive it
Very High	Preservation	Unaltered; landscape character is intact
High	Retention	Appears unaltered; deviations to landscape character are not evident
Moderate	Partial Retention	Slightly altered; deviations are subordinate to landscape character being viewed
Low	Modification	Moderately altered; deviations begin to dominate the valued landscape character being viewed
Very Low	Maximum Modification	Appears heavily altered; deviations may strongly dominate the valued landscape character.
Unacceptably Low	Unacceptable Modification	Appears extremely altered; this level is only used to inventory existing scenic integrity. It is never an objective on National Forest System lands.

Information Sources

To analyze potential impacts to Scenery in the CRMP analysis area from the proposed action, the best available science was used, including peer-reviewed literature, published reports from regulatory and land management agencies, existing resource inventories, field visits, GIS-generated models, and the professional judgment of specialist(s). Information used to support this analysis include:

- GIS generated viewshed models based most current SMS mapping protocol (10 meter Digital Elevation Models, with a default observer interval at 1/8 of a mile),
- the Coconino and Tonto forest plans,
- Forest's National Visitor Use Monitoring (NVUM) reports to determine the popularity of viewing scenery or driving for pleasure,
- *Forest Service Handbook 462 – The Visual Management System*,
- *Forest Service Handbook 701 - Landscape Aesthetics: A Handbook for Scenery Management*,
- *Landscape Character Types of the National Forests in Arizona and New Mexico,*

- Interviews with recreation technicians, interdisciplinary team members and other staff and publics familiar with the project area and

Analysis Questions, Indicators, and Measures

Analysis questions considered in this report are connected to the project's purpose and need, key issues, and forest plan guidance. Indicators and measures are developed to frame the analysis for each alternative.

Analysis Questions

The following questions are based on meeting Forest Plan direction and are the scenery indicators that identify and measure scenic quality (Scenery Management System, NFMA/Forest Plan):

1. Will the valued landscape character be sustained or changed?
2. Are opportunities for enhancement of the existing landscape character achieved?
3. Will areas of Pristine/Very High and Retention/High visual quality/scenic integrity be irreversibly altered?

This question relates to public preferences for the future of Fossil Creek:

4. Will the valued sense of place be enhanced or retained? This is a combination of the ORVs defining a natural state and valued landscape character.

The final questions relates to cumulative effects analysis:

5. Will there be cumulative effects to scenery? How do management actions affect Scenery? Will visual disturbances created by action alternatives detract from the natural appearance or provide for improved sense of place?

Indicators and Measures

The following indicators and measures will be addressed for each alternative to help answer the analysis questions.

Table 3-122. Analysis indicators and measures for the scenery analysis

Resource Element	Resource Indicator	Measure
Valued landscape character	Landscape disturbance	Acres of planned disturbance
Valued landscape character	Built environment	Description of built environment
Valued landscape character	Dispersed recreation	Acres of dispersed recreation area; persons at one time (PAOT)
Valued landscape character	Seen area	Qualitative description of seen area from travelways and recreation sites
Landscape character enhancement	Restoration of disturbed areas	Acres of restoration
Landscape character enhancement	Changes in management	Qualitative description of management changes
Visual quality/scenic integrity	Management changes impacting visual quality/scenic integrity	Narrative description of changes in visual quality/scenic integrity; trail construction; amount of dispersed recreation; amount of camping
Valued sense of place	Degree to which the river values would be protected and enhanced	Qualitative description
Valued sense of place	Degree to which facilities maintain or enhance scenic attractiveness	Qualitative description

Incomplete and Unavailable Information

Incomplete data at this time includes the completion of the SMS/GIS inventories on the Tonto National Forest Each alternative has some of the inventories completed, but the culmination of these (GIS visibility models of updated inventoried concern level 1 and 2 travelways and use areas) have not been combined with updated inventories of scenic attractiveness, scenic classes and overall scenic integrity objectives as a mapped product for the Tonto National Forest portion of the analysis area. The overall desired conditions of high and very high scenic integrity the management corridor is described in the narrative. Some of the alternatives include trails outside of the designated corridor- concern level of these trails have been inventoried in partnership with the Tonto National Forest recreation staff and preliminary maps visibility maps from these inventoried Concern level 1 and 2 travelways have been generated. The overall scenic integrity objectives have not been assigned in these locations.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect and Cumulative Effects Boundaries

The analysis area for this project is larger than the designated wild and scenic river corridor. It includes roads and trails that access the corridor as well as adjacent areas included in action alternatives. The spatial boundaries for analyzing the direct/indirect and cumulative effects to scenery are four Hydrological Unit Code 6 (HUC6) watersheds around the wild and scenic river corridor. This was chosen for consistency with other resources and because watershed boundaries are tied to topography, as are viewsheds. The scale of the HUC6 watershed boundaries encapsulates the majority of travelways used to access the Fossil Creek corridor and the setting/ sequential views of visitors to the corridor. The experience of driving or hiking into the corridor is part of the recreation setting and perceived sense of place.

The temporal boundaries for analyzing the direct and indirect effects is the time anticipated necessary to complete project implementation (up to 20 years) and achieve Forest Plan Scenery objectives within 5 years of project implementation. The timeline for cumulative effects analysis is 10-20 years because most long-term effects of the alternatives are assessed out to a 10-20 year timeframe (with the exception of large scale high severity wildfire which is more difficult to project). Ongoing activities are those that have signed decisions and are ready to implement or are being implemented. Ongoing activities also include those carried out by the public, agencies or the Forest Service such as recreation, hunting or road maintenance. Reasonably foreseeable future actions are those projects that are in the planning stages and have developed a proposed action or alternatives, but a decision has not been made.

Affected Environment – Baseline and Existing Condition

This section describes the baseline (time of designation of Fossil Creek as a Wild and Scenic River; 2009) and existing condition of scenery in Fossil Creek. More details about specific recreation sites can be found in the Scenery Specialist Report.

Baseline Condition time of designation of Fossil Creek as a Wild & Scenic river—2009

Background: At time of designation, the Fossil Creek corridor has a high level of scenic integrity due to the lack of urban development in the corridor and adjacent lands. Fossil Creek is a spring-fed perennial creek that was dammed for nearly a century for hydropower production, as shown in figure 3-56. The dam and diversion system diverted most of the creek flow out of the streambed. In 2005 the hydropower dam was decommissioned and flow was reestablished in the creek. Recreation use of the creek prior to the dam decommissioning was limited and knowledge of the area was localized. Once flows were re-established, the creek and creekside began to recover and recreation use began to increase with visitation from throughout the state.



Figure 3-56. Photo of historic Fossil Creek dam. (Courtesy Arizona Public Service Company)

Visitor Use, Activities and Preferences

Visitor use, activities, and preference are described in the *Affected Environment Common to All Resources* section at the beginning of this chapter.

Scenery Management

The Coconino NF completed new scenery management system mapping, landscape character descriptions, as well as new existing scenic integrity and scenic attractiveness maps. The Tonto NF has just started working on forest plan revision, but has not yet updated from the visual management system to the scenery management system. Since the Tonto forest plan revision is not completed, an inventory at the project level per management direction has been initiated (Forest Service 2000).

The landscape character descriptions used below include excerpts from the Coconino Landscape Character Analysis (USDA FS 2016b), as well as information from specialist reports for the Fossil Creek CRMP Project.

Sense of Place

Visitors to special places like Fossil Creek have a relationship with/to the place that may include a mix of natural and cultural features in the landscape as well as what they bring to it and how they interact with the environment (Cross 2001). The relationship may include ties that are biological (historical or familial, developing over time), spiritual (emotional, sense of belonging or feeling), ideological (moral or ethical, responsibility to place, religious) and narrative (learning about a place through stories, families histories). Cross (2001) finds that when something is taken from or given to the environment, the actions may alter the environment's influence on people and their relationship to it. People have an impact through how they care for, create new social bonds, and design new physical features for settings. This can be positive or negative, short-term or long-term.

Public feedback during the CRMP planning process has indicated that people coming to the WSR river corridor care about the physical and cultural features there. They want to retain the uniqueness of the place and protect the resources that they enjoy using. Some users feel that fewer people, addition of some facilities would enhance their experience.

The draw to the majority of area users is the scenery and vibrant blue waters of Fossil Creek. However, the natural landscape shows evidence of impacts by the visitation to these natural features such as bare ground disturbance and compacted soils from informal creek access points, dispersed camps and use areas. What is seen from the viewpoint of the road are the many recreation use areas along Forest Roads 502/708 adjacent to Fossil Creek. There is visible evidence of deterioration of the natural environment by repeated use in dispersed recreation sites

lining the roads. Broken branches, litter, feces, and barren ground occurs in varying degrees in the dispersed campsites in the area. At the time of designation, there is only one sign in the river corridor- the site identification marking the forest boundary.

The most noticeable deviation from the desired landscape character is the presence of the overhead powerlines and notable change in vegetation resulting from periodic vegetation clearing around power poles and under the powerlines within the utility corridor.

Landscape Character

Valued Landscape Attributes (USDA FS 2016)

The Verde Valley Landscape Character Zone is located in the southwest portion of the Coconino National Forest. This character zone is characterized as the large Verde River Valley and semi-desert grasslands and desert communities. Broad valleys with lonely rounded hills are common in the north and western portion of the character zone and steep drainages characterize the eastern portion of the character zone. The Wild and Scenic Verde River runs along the southern end of the Forest. Fossil Creek, also a designated Wild and Scenic River, emerges from deep cottonwood and mixed broadleaf lined canyons cut into the Mogollon Rim and continues a ribbons of riparian vegetation across the pinyon juniper and semi-desert grasslands before merging with the Verde River.

Escarpments, rocky outcrops, and mesas provide a diversity of landforms and leads to unexpected changes in vegetation. This area is valued for its heritage resources, steep drainages offering quiet and solitude, lush riparian areas offering an escape from the desert heat, and many expansive, panoramic views. Fossil Creek Wild and Scenic River is known for its diverse native fish, plants, and animals, beautiful clear, blue waters and magnificent fossil-like rock deposits called travertine formation which gives the stream its unique color and is of international significance.

Water Resources



A wide variety of water features in the zone include water bubbling out of the ground from perennial springs; still, deep pools that provide swimming holes; waterfalls, and whitewater as the channel varies. The chemicals that form the travertine formations under the water cause brilliant, bright blue-green colors.

Climate

Precipitation ranges from 10 to 25 in (250 to 635 mm) annually, with more than half of the precipitation falling during the winter. Temperature ranges from 40 to 70 ºF (4 to 20 ºC); winters are mild below about 6,800 feet (2,075 m) and cold at higher elevations. The growing season lasts 70 to 170 days (McNab and Avers 1994a).

Existing Vegetation



Vegetation is described in detail in the *Wildlife and Vegetation* section above. Along Fossil Creek's riparian corridor today, vegetation ranges from an Arizona sycamore (*Platanus wrightii*) dominated overstory above Fossil Springs, to a diverse, broadleaf riparian forest at and below the springs. The riparian forest is patchy in some areas because of large bedrock outcroppings and restricted channel width. Reduced water flows while the creek was dammed affected the age and size classes present in the riparian forest. Many seedlings have been established since decommissioning. Dominant tree species include sycamore, ash (*Fraxinus velutina*), alder (*Alnus oblongifolia*), Fremont cottonwood (*Populus fremontii*), walnut (*Juglans major*), and willows (*Salix spp.*). Understory shrubby and herbaceous vegetation is most diverse in the reach associated with Fossil Springs (see vegetation report for more information).

The presence of introduced plants and weeds from historic and ongoing human disturbance in Fossil Creek is evident in most sections of the creek from the springs down to the confluence of Fossil Creek with the Verde River. Native plant species diversity is being compromised in some areas around the springs by the spreading presence of non-native plant species. A total of forty-eight species of invasive exotic plants were identified in the uplands and riparian corridor associated with Fossil Creek, and sixteen target species were further identified. Species include tamarisk (*Tamarix ramosissima*), tree of heaven (*Ailanthus altissima*), Siberian elm (*Ulmus pumila*) giant reed (*Arundo donax*), Himalayan blackberry, and yellow star-thistle (*Centaurea solstitialis*) (see vegetation report for more details).

Cultural Landscape






The area has a rich history of prehistoric cultures inhabiting the landscape. "The most significant influences on cultural change were the intermingling of Apache and Yavapai groups, Euroamerican settlement in the area, forced relocation of native groups by the U. S. military, and the return of many Apache and Yavapai as workers involved in the construction of the hydroelectric system" (Neal and Martin 2003, p. 8). This landscape is important to many tribes and particularly sacred to the Apache mythology. Contemporary western Apache continue to recognize and value the cultural importance of this landscape.

The Cultural Landscape, modification of the natural occurring landscape by human changes and modification for land uses, includes transmission lines, roads, and recreation impacts. There are notable elements of human modification of the natural landscape for differing land uses. Evidence of the suite of power-generating features remains evident today, with preserved sections of the flume and other attributes of historic energy generation in place for historical reference and onsite interpretation.

Additionally, there is evidence of historic roads and trails tied to the ranching history that continue to be of value to champions of heritage tourism. The existing views off Forest Roads 502/708 include open range ranching, transmission lines, roads, and recreation impacts. Some of the constructed features are assets to recreation such as Stehr Lake and Flume Trail #154 and the Mail trail #84. These features are considered enrichment to the area experience for those that value history. Ranching has existed for over 100 years and is a recognized component of the landscape.

The draw to the majority of area users is the scenery- views of crystal-clear blue travertine water of Fossil Creek with shaded creekside dispersed day use and camping opportunities.

Scenic Attractiveness

Scenic attractiveness is the primary indicator of the scenic beauty of a landscape. Fossil Creek Wild and Scenic River (FCWSR) area contains a unique scenic landscape. The combination of riparian vegetation, sedimentary formations, basaltic lava flows, travertine formations and the blue-green waters make this a dramatic, diverse landscape as shown in the photographs below.



Under SMS, scenic attractiveness is inventoried and mapped in the following classifications:

Class A (distinctive/unique) features usually exhibits a great deal of variety in form, line, color, and texture. Landform, rock, water and vegetation stand out as being unusual and/or outstanding in scenic quality compared to those found in the general area.

Class B (common/typical) includes features such as land-forms, water forms, rock formation, and vegetative patterns commonly found in the general area.

Class C (Indistinctive) areas where landform, vegetation patterns, water characteristics and cultural land use have low scenic quality.

Figure 3-57 provides the scenic attractiveness mapping for the Coconino portion of the analysis area.

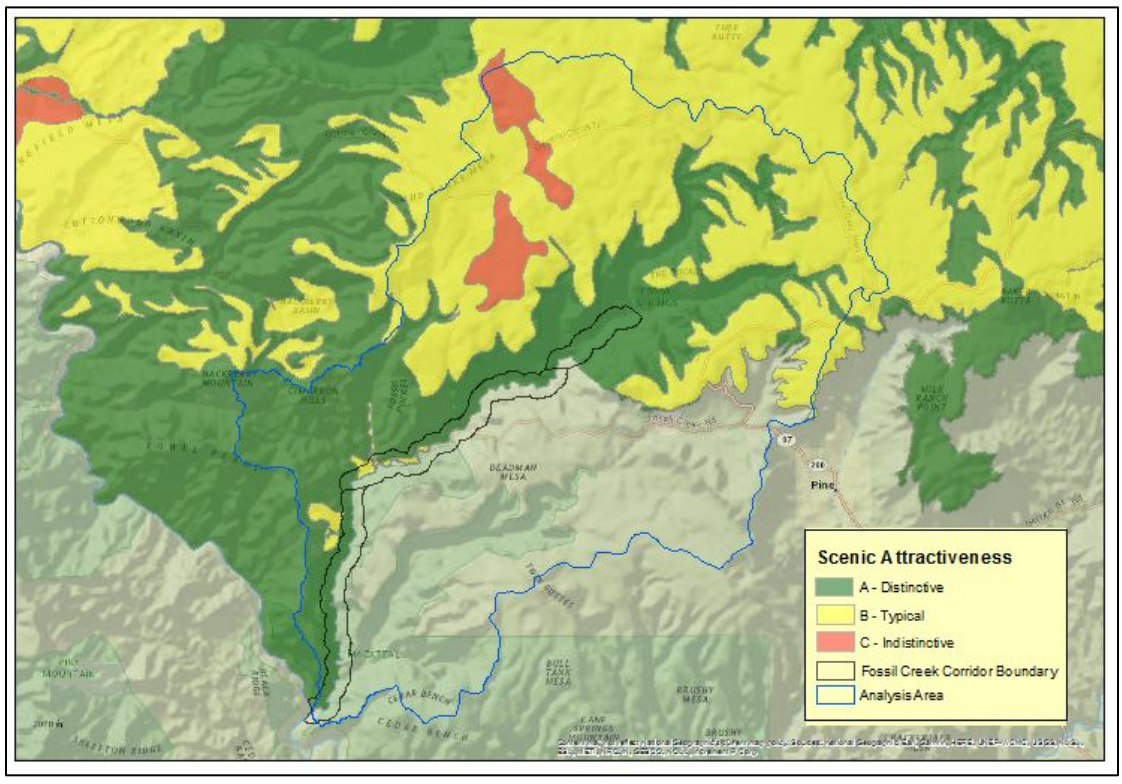


Figure 3-57. Scenic attractiveness for the Coconino NF in the Fossil Creek CRMP analysis area.

Areas classified as Class A or distinctive are seen mostly in the river corridor. These are places where the landform, water, vegetation and cultural features combine to provide outstanding scenic quality. Areas outside of

these are more common, and are Class B or typical. These landscapes have positive characteristics, but not as extraordinary as those in Class A. Several areas further removed from the corridor are inventoried as indistinctive.

While scenic attractiveness/ uniqueness values are usually considered a long term and stable characteristic, Fossil Creek is undergoing changes as it recovers from the dam decommissioning. There are both improvements in the riparian areas, and impacts occurring from concentrated recreation use.

The 1980s Tonto VMS (Visual Management Objective) mapping was field reviewed to determine if the classification were appropriate in today's context. The following updates were made: Hackberry quad map, south of Hackberry Mountain, west of FR 708 to the Verde River and North of Road 502 moved from Scenic Attractiveness B – Common and upgraded to Scenic Attractiveness A. The classification description better describes the majority of landscape in the area. This is to be updated in the GIS inventory when the Tonto completes their SMS inventories.

Deviations from desired Landscape Character

Other considerations for mapping scenic attractiveness are those areas that take away rather than add to the unique landscape character and sense of place. The most notable deviation from the valued landscape character within the designated WSR corridor is the presence of the twin 345 kV transmission lines and to a lesser extent the NW-1 transmission lines. The kV lines are a dominant feature on the landscape noticeable from many vantage points. The marked contrast of the cleared kV powerline corridor can be seen from a distance, as can the powerline structures.






Other features that detract from the overall valued natural character of the area are those instances of impacts by visitors drawn to the natural features in the corridor. Many recreation use areas lining FR 502/708 adjacent to Fossil Creek show visible evidence of deterioration of the natural environment by repeated use. Broken branches, carved and hacked trees, exposed roots, litter, feces, graffiti, and bare ground occurs in varying degrees along the creek and in/near recreation sites in the area.






Landscape Visibility and Concern Level

Another key component of the SMS is landscape visibility, which is typically extrapolated from inventoried travelways and use areas, constituent concern for scenery and associated distance zones. Travelways include linear viewing platforms such as waterways, highways, roads and trails. Use areas are locations that have concentrated public viewing use such as trailheads, campgrounds, day use areas, subdivisions, and commercial areas. Concern levels are classified as 1, 2 or 3, and represent the degree of concern for scenery from specific viewing platforms. Concern level 1 viewing platforms are those areas where observers have a primary concern for scenery, concern level 2 routes are assigned to those areas where there is a secondary concern for scenery, and the remaining routes are considered concern level 3. This is typically done as part of a Forest scale inventory process,

and meant to be refined at the project scale. Distance zones are broken down into the following categories: immediate foreground (to 300 feet), foreground (300 feet to 0.5 mile), middleground (0.5 to 4.0 miles), and background (greater than 4.0 miles). Distance zones are applied to locations for which Concern Levels are assigned. Concern levels measure expectations, desires, and preferences of viewers. The Fossil Creek area has a high level of visitor concern for scenery. High concern levels combined with landscape visibility make management of Fossil Creek a challenge- requiring sensitive and intentional planning/ design.

The steep canyon landform and lush vegetation combine to often obscure middleground and distant views from most viewer platforms. The predominance of deciduous trees along the canyon bottom create a dramatic difference in landscape visibility between winter and summer in the canyon. As directed by Forest Service policy, this analysis focuses on “leaf off” condition, when visibility is maximized.

Another consideration under SMS recognizes the concept of duration of view. Viewer platforms such as roads, have the shortest duration and campers/picnickers have the longest duration of view. Fossil Creek is a year round destination for visitors and the setting is conducive to a variety of recreational uses and settings. The primary use season is from April through October; use noticeably drops off during the winter. Fossil Creek has numerous viewing platforms including trails, the creek and banks as well as roads in the project area.

Updated inventory of viewing platforms and concern levels for the Fossil Creek project area:

Concern Level 1 Travelways and Use Areas: Fossil Creek Road FR708, FR502, Twin Buttes Road FR154, Stehr Lake, Fossil Springs area**,** Fossil Creek – stream & bank, Powerline Trail #540/collocated with Arizona National Scenic Trail #14, Mail Trail #84, Flume Road Trail #154, FR784 (spur road access to Fossil Springs TH), FR9139B and FR9139G (access to Purple Mountain), FR708E and 708D (Access to Homestead), Mazatzal, Purple Mountain, Sally May, Junction, Cactus Flat, Homestead, Heinrich, Fossil Creek Bridge, Tonto Bench, Irving, Lewis Trailhead and Trail, Bear/Rim Trailheads, Historic Dam, and East Welcome Station.

Concern Level 2 Travelways and Use Areas: Deadman Mesa Trail#17, FR591 (access to Deadman Mesa TH).

Slope

Figure 3-58 provides a visual interpretation of the landform distribution in terms of percent slope for the project area. Elements of the action alternatives would be seen for varying lengths of time depending on the context of the viewer. As previously mentioned, someone driving may view the areas affected by the proposal for several seconds or catch glimpses of the affected areas several times along their drive. Someone sitting in an open area with a direct view of elements of the alternative versus someone biking on one of the trails would be able to perceive differing levels of detail. Generally, the steep areas of the landscape are comprised of the canyons and stream inner gorges. The more discreet and smaller the scale of proposed changes highlighted in action alternatives, the less it would be noticeable to the casual viewer. Much of the project area is vegetated, which would limit the extent to which the project area is visible.

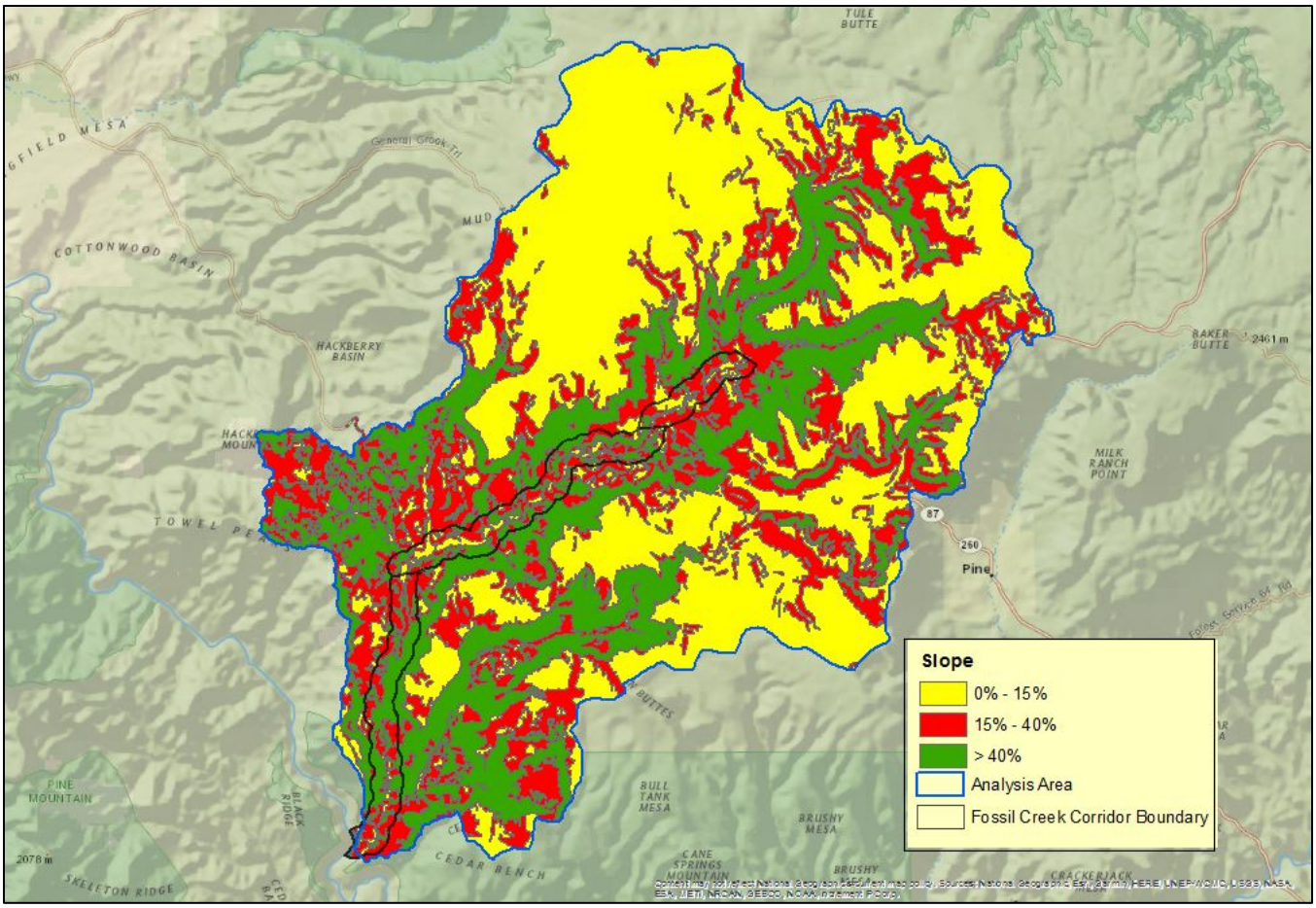


Figure 3-58. Percent slope in the Fossil Creek project area

Scenic Integrity

Scenic integrity is the "intactness of the landscape" and "wholeness of the ecosystem." It includes assessment of deviations from the existing landscape character that is valued for its aesthetic appeal.

The baseline for measuring Scenic Integrity Objectives (SIOs) are the valued attributes of existing landscape character being viewed. The wild and scenic river corridor, as well as most of the project area is a natural appearing landscape. The narrow, wild and scenic river corridor makes the presence of deviations more visible since they are viewed in the foreground (within ½ mile). Figure 3-59 shows the visual quality and scenic integrity objectives for the project area – focused on the Coconino National Forest, as the Tonto mapping in currently underway. There are human alterations in the existing landscape some of which have become acceptable and even celebrated over time- such as presence of old wooden corrals, or old foundations, and others that are not acceptable. The latter includes bare and denuded ground where concentrated recreation is causing noticeable contrasts to the surrounding natural landscape- such as damaged, trampled, or cut dead vegetation; compacted bare mineral soil devoid of living vegetation; eroding creek banks resulting from social trailing; and other evidence of human degradation – including human and dog waste, and carelessly discarded trash.

In the broader analysis area, the landscape is seen as foreground (within 1/2 mile), middleground (1/2 mile to 4 miles) and background (4 miles to horizon) views (Forest Service 2000). In this context, human alterations can be less visible. At this scale, the landscape character is natural-appearing, and direct human alterations are less noticeable, with the exception of the kV transmission line utility corridors that create striking contrasts to the valued landscape character.

Scenic Integrity, as defined in the Scenery Management Handbook, is "...measure of the degree to which a landscape is visually perceived to be complete. The highest scenery integrity ratings are given to those landscapes

which have little or no deviation from the character valued by constituents for its aesthetic appeal." The Levels are further defined as follows.

- **VERY HIGH (VH)** Scenic integrity refers to landscapes where the valued landscape character is intact with only minute, if any, deviations.
- **HIGH** (H) Scenic Integrity refers to Landscapes where the valued landscape character appears intact with deviations that repeat form, line, color, texture, and pattern common to the landscape character so completely that they are not evident.
- **MODERATE (M)** Scenic Integrity refers to landscape where the valued landscape character "appears slightly altered but noticeable deviations remain visually subordinate to the landscape character being viewed.
- **LOW (L)** Scenic Integrity refers to landscape where the valued landscape character "appears slightly altered" but borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed.
- **VERY LOW (VL)** Scenic Integrity refers to landscapes where the valued landscape character "appears heavily altered" and deviations may strongly dominate the valued landscape character.
- **UNACCEPTABLY LOW (UL)** Scenic Integrity refers to landscapes where the valued landscape character being viewed appears extremely altered and deviations are extremely dominant.

Existing Scenic Integrity

The existing scenic integrity in the Coconino portion of the analysis area is shown below in figure 3-59. This map acknowledges cultural elements that have negative impacts on the intactness of the scenery in the analysis area. For example, the cleared utility corridors create linear features across the landscape that are out of scale with the existing landscape character. They also introduce colors, shapes and textures that would not normally be found in this landscape. This map will help form the baseline to compare the effects of action alternatives, as well as comparison with scenic integrity objectives

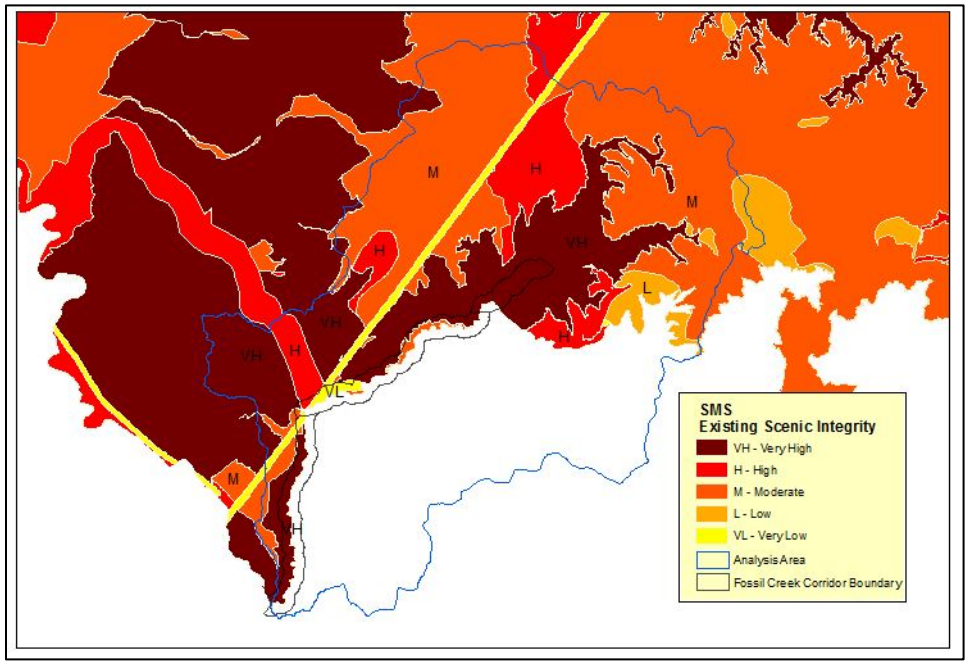


Figure 3-59. Existing scenic integrity in the Coconino NF portion of the analysis area

Affected Environment – Existing Condition, 2012 to present

Existing kinds and amounts of visitor use; existing roads, trails, and facilities; and disturbance such as bare soil are described in the *Affected Environment Common to All Resources* section at the beginning of this chapter.

Scenic Integrity Objectives

Figure 3-60 displays Scenic Integrity Objectives for the Coconino National Forest portion of the project area. Scenic Integrity Objectives for the Tonto National Forest are currently being updated through the plan revision process.

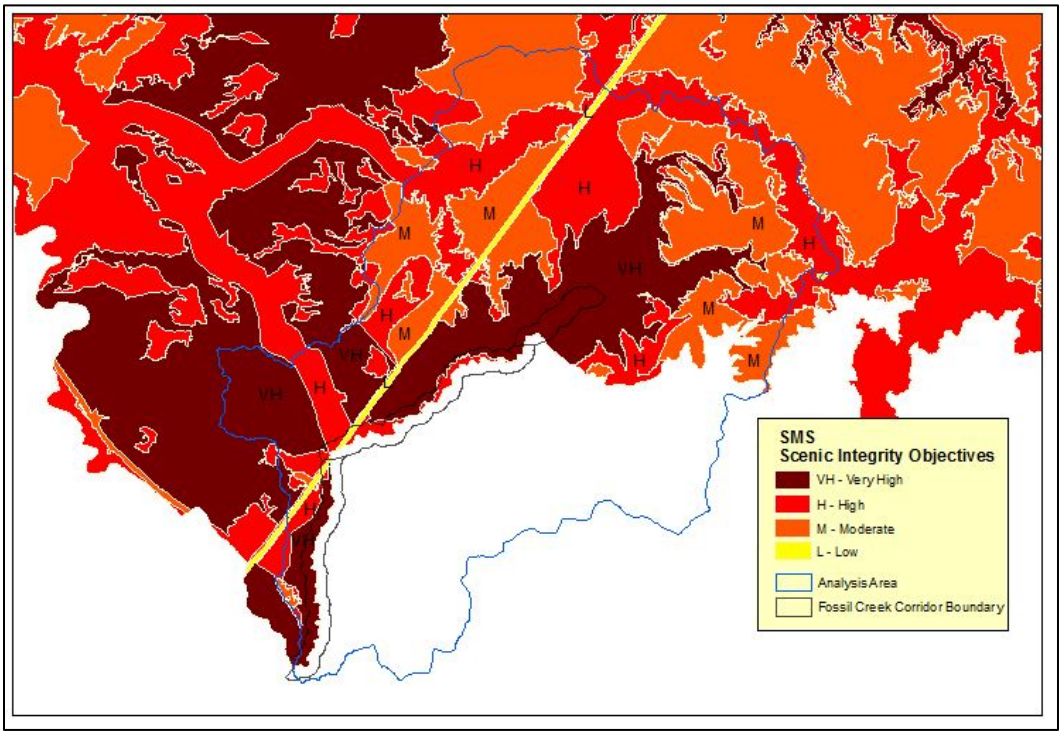


Figure 3-60. Scenic Integrity Objectives for the Coconino portion of the project area. Tonto objectives currently being updated.

Environmental Consequences

The Fossil Creek CRMP will result in various effects to scenery in the Fossil Creek WSR corridor. While many of these effects are common to all action alternatives, some vary by alternative in nature and intensity. Effects may result from both programmatic components of the CRMP and site-specific management actions. This section will address the direct, indirect, and cumulative effects of programmatic and site-specific components of the CRMP for the action alternatives and compare those to the effects of not establishing a CRMP (Alternative A, No Action).

Effects of Programmatic Actions

Programmatic components of the CRMP consist of formally establishing boundaries of the Fossil Creek WSR corridor and ORVs, providing management direction (desired conditions, standards, guidelines, and objectives) to guide future management of Fossil Creek, and establishing a monitoring and adaptive management plan.

Alternative A – No Action

Under alternative A, no programmatic actions would be taken and activities impacting scenery in Fossil Creek would continue to be subject to general guidance provided in the forest plans. While interim management of Fossil Creek would continue to have the objective of protecting the identified river values, no management direction would provide comprehensive guidance for river value protection and no formal monitoring and adaptive management plan would be in place. Without specific management direction, landscape character may continue to be negatively affected by infrastructure or continuing use not guided by coherent design themes or clear management plans. Without a monitoring and adaptive management plan, river value monitoring would continue on an ad hoc basis and management actions needed to protect river values may be delayed as separate environmental analysis is completed, possibly taking several years. This would reduce the likelihood of impacts

that may adversely impact scenery being detected through monitoring and addressed through reactive management, potentially negatively impacting valued landscape character and sense of place.

Alternatives B-F

Programmatic components of the CRMP are largely common to all action alternatives. Formally establishing boundaries for the Fossil Creek WSR corridor and designating the ORVs would support better articulation of the components of the WSR corridor that contribute to its outstandingly remarkable character. Developing specific management direction, including for scenery, would better protect river values and other resources (such as riparian communities) and provide more coherent guidance for infrastructure development in Fossil Creek. Establishing a monitoring and adaptive management plan would more effectively allow adverse impacts to be detected and quickly addressed through adaptive management actions. Together, these programmatic components of the CRMP would, compared to the no action alternative, better provide for protection of the river values and other components of the WSR corridor that contribute to valued landscape character and sense of place.

Protection and/or enhancement of river values will result in protection of valued landscape character and scenic integrity. Though scenery is not an ORV, the river values comprise the unique and valued landscape character and sense of place attributes (landform, water, vegetation, wildlife, and cultural features). Incorporation of specific desired conditions, standards, guidelines, and objectives provided in the CRMP's management direction into land and resource management plans for the Coconino and Tonto national forests is beneficial to the management of scenery in the corridor. This additional direction provides Fossil Creek-specific details about how to protect and enhance river values and promote desired landscape character and scenic integrity, as does the monitoring and adaptive management plan.

CRMP management direction provides guidance and focus for education, interpretation, and research activities. Education, interpretation, and research would be designed to facilitate successful implementation of each alternative and protection and enhancement of river values. Incorporation of design guidelines for developing amenities in each alternative would ensure a comprehensive vision and define a palette of materials and design attributes that pay tribute to the overall valued sense of place and enhance scenery through built works and interpretive displays rather than detract from or take away from this unique setting, as may be the case without such guidelines.

Relatively undisturbed habitat (refugia) for wildlife, fish, and plants that is supported by the alternatives would provide an undeveloped scenic backdrop for the WSR corridor and improve visitors' opportunity to view wildlife, which is recognized as a positive component of setting management and a positive contributing factor toward scenic integrity.

CRMP management direction for pursuing withdrawal of the recreational segment of the WSR corridor from locatable mineral entry and for obtaining water rights for streamflows necessary to protect Fossil Creek's river values would have positive impacts on scenery over the next several decades, as mineral extraction and structures associated with diverting water for water rights detract from scenic integrity and streamflow reductions would likely negatively impact river values and thus Fossil Creek's valued sense of place.

Providing a range of recreation opportunities year-round is a balancing act with regard to scenery management. Providing opportunities for viewing and experiencing the unique character of the WSR corridor is an objective for scenery management. However, impacts from recreation can degrade the setting if not carefully managed, as described in more detail below.

Expanding the Fossil Springs Botanical Area would increase the area in which the protection and maintenance of physical and biological processes unique to the Fossil Springs area is emphasized. This would benefit scenery by supporting protection of the area around the spring source, which would help protect the scenic integrity of this area.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and

Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Direct and Indirect Effects of Management Actions Common to All Alternatives

Analysis and resource protection measures specific to the gabion and Fossil Creek/Irving bridges can be found in Appendix B of the *Scenery Specialist Report*.

Valued Landscape Character

The amount of disturbed area resulting from the presence and use of recreation sites, roads, and trails (referred to as "planned disturbance") is used as a measure of changes to landscape character because disturbed landscapes detract from the desired landscape setting and are notable to the causal viewer. The amount of disturbed area varies by alternative, and specifics for each alternative are addressed in the Effects Unique to the Alternatives sections below. Planned disturbance diminishes the valued natural-appearing landscape character, particularly when it is seen from other viewpoints or from travelways or use areas. Cut and fill associated with development, particularly roads and parking lots, have a high potential to have long-lasting impacts on scenery. The location within the WSR corridor, size and scale, and amount of vegetative screening of roads and parking areas dictate how visible these features are on the landscape. Trails tend to be notable to a lesser extent as the amount of earth work associated with trails is lower than that associated with roads and parking lots. In Fossil Creek, recreation sites, including creek access points and trailheads within the corridor, are and would continue to be highly visible from the access roads. These developments create notable changes in the line, form, color and texture of the landscape, and a marked contrast with the desired landscape character.

Amenities such as parking, signage, kiosks, and toilets that are constructed with temporary materials or installed without comprehensive design considerations detract from the naturally appearing landscape, though they can provide for both user comfort and resource protection. The amount and distribution of amenities varies by alternative, but a comprehensive design process would be completed prior to future development. Well-designed landscape features, including built works such as kiosks, signs, and even toilets, can complement landscape character and contribute to a unique sense of place through the use of repetitive features and natural materials.

Roads and trails provide the main access to Fossil Creek and in conjunction with the developed recreation sites provide the major viewing platforms of the project area. Vegetation or terrain may limit visibility depending on the perspective of the viewer. Visibility models from inventoried travelways and recreation sites were created for each alternative to provide a visual aid for what is seen from these areas and to assist with updating the Tonto National Forest to the SMS and the future establishment of SIOs. The results of this modeling are described by alternative below. Activities or development occurring within the areas seen from travelways and recreation sites present in each alternative have the potential to impact the line, form, color and texture of the landscape. Poorly designed development in these areas has the potential to negatively impact the desired landscape character. Conversely, well-designed development that would be supported by the alternatives through a design process would result in less impact to the landscape character in seen areas and therefore less—and potentially positive—impact to the landscape character.

Poorly designed or user-developed trails and use areas are notable deviations from the desired vegetated, relatively natural-appearing landscape. The presence of trash, human waste, and trampled or hacked vegetation does not convey a sense of care or management. In many ways these impacts provide the greatest threat to scenery as they are likely to impact the river values that cumulatively make up the unique landscape valued by visitors.

Dispersed recreational use often results in trampling that disturbs vegetation and ground cover (such as leaf litter) and compacts soils, especially in riparian areas (Manning 1979). Trash and human waste may also correspond with dispersed use. Overnight camping often results in increased impacts in respect to trash and bare ground. Impacts such as these, particularly in the highly valued riparian corridor, negatively impact scenic integrity and landscape character because they are unsightly, create a sense of neglect, and may adversely impact the river values. These impacts are more pronounced when recreational use is unmanaged, and application of management

principles such as recreation ecology (Marion 2016) that take use levels, locations of use, resource conditions, and visitor behavior into account can reduce these impacts and thus protect scenic integrity and landscape character. Recreational use in Fossil Creek prior to 2011 was fairly unmanaged, and increases in the amount of denuded area were observed (Rotert 2014). Human waste (Anderson 2011) and trash (Smith 2016) were also notable observations in Fossil Creek. Interim management measures implemented beginning around 2011 (capacity management, restroom facility improvements, parking delineation, and restoration) appear to have reduced issues associated with dispersed recreational use (Rotert 2014, Smith 2016). It is anticipated that the more managed recreation environment that would be created under the CRMP action alternatives would further support protection of scenic integrity and landscape character from the impacts of dispersed recreation. However, dispersed recreation will continue to occur under all alternatives, and some amount of associated impact is expected. Areas where dispersed recreation is anticipated to occur in association with developed recreation sites differ by alternative and are described in the alternative-specific sections below.

Landscape Character Enhancement

The amount of rehabilitation of denuded areas (referred to as "unplanned bare areas") is used as a measure of enhancement of the existing landscape character because this work makes progress toward the desired conditions of high or very high scenic integrity and towards a more natural-appearing landscape. Denuded landscapes deviate from the valued landscape character because of notable changes in form, line, color, and texture. Casual observers can easily discern the change in color with exposed mineral soils and the marked contrast with vegetated landscape. For example, a compacted light brown exposed soil noticeably contrasts with a lush, green, vegetated natural-appearing landscape. Some short-term notable features like straw or wattles may be associated with restoration actions, but over time these elements become less visible. Soil, watershed, and vegetation improvements realized through restoration would result in long term improvements in the scenic integrity of the analysis area.

Relatively unmanaged recreational use in the past has resulted in vegetation and soil disturbance in the most heavily visited areas of Fossil Creek. Through interim management, some active restoration projects have been implemented throughout Middle Fossil Creek where trails were blocked, straw wattles placed, and areas reseeded with native species. In other areas, passive restoration by blocking trails and denuded areas has resulted in natural recovery. These activities have enhanced Fossil Creek's landscape character.

Changes to Visual Quality/Scenic Integrity

Development and human use associated with the CRMP may result in alteration of visual quality/scenic integrity in ways described above. Of particular concern are irreversible alterations of areas with Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. Under all alternatives, there may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would likely not exceed 15%, and is thus anticipated to meet Coconino and Tonto Forest Plan direction for scenery. CRMP management direction for scenery, coupled with comprehensive design of amenity development, would facilitate protection of areas with Preservation/Very High and Retention/High visual quality/scenic integrity in the WSR corridor.

Use of interim measures appears to be slowing the growth of denuded areas, and the more managed environment the CRMP would provide would likely further limit recreation impacts in areas outside of recreation sites. In locations where sanitary facilities do not exist or are infeasible, the presence of human and pet waste and trash would decrease the overall scenic attractiveness within the WSR corridor.

Presence of invasive species such as Himalayan blackberry and giant reed detracts from the overall scenic beauty by displacing native species and disrupting natural processes. Vehicles, humans, and pets represent vectors that could spread invasive species. Treatment of invasive species is not a specific component of the CRMP, but under all alternatives invasive species would continue to be identified and treated under existing authorities. Where they are present and untreated they would continue to negatively impact visual quality/scenic integrity. Treatment may result in short term impacts to scenery when dead or dying vegetation is seen.

Valued Sense of Place

The combination of Fossil Creek's river values defines the natural state, valued landscape character, and overall scenic integrity, all of which combine to create a unique sense of place in Fossil Creek. For example, the vegetated slope combined with the unique travertine geology combine with the clear, clean, blue water of Fossil Creek to form habitat for fish and wildlife, many of which have special status. The scenic integrity, or overall intactness of the landscape, is tethered to these elements. A visitor's experience, from the perspective of scenery, is tied to what is seen. For the visitor, having views of the river values, without deviations, would be well received. The sight of wildlife or fish would further enhance the visitor experience. Management actions that protect or enhance the river values also protect or enhance the contributions these river values make to creating Fossil Creek's valued sense of place. Conversely, adverse impacts to the river values would adversely impact the valued sense of place by compromising the integrity of those components that visitors encounter that contribute to their enjoyment of Fossil Creek.

As described in the "Valued Landscape Character" section above, amenities such as parking, signage, kiosks, and toilets that are constructed with temporary materials or installed without comprehensive design considerations detract from the natural-appearing landscape and thus the valued sense of place. Well-designed landscape features can contribute to a unique sense of place through the use of repetitive features and natural materials.

Direct and Indirect Effects of Management Actions Unique to Alternative A (No Action)

As the "no action" alternative, Alternative A serves as the basis of comparison for analyzing the environmental impacts of implementing the action alternatives. Alternative A represents a continuation of current management of the Fossil Creek and the surrounding area. No CRMP would be developed; thus, management of Fossil Creek would not comply with the Wild and Scenic Rivers Act. Interim management such as capacity control and restoration activities would continue as needed, but would not be guided by plan direction specific to the Fossil Creek area.

From the baseline condition of 2009 (time of designation) to today, interim management measures have been implemented as a stop-gap process without fully integrating goals for scenery. These actions have been framed as a short-term solution until the CRMP is completed and provides a wider vision. The results of this from the standpoint of the built environment are that infrastructure such as kiosks, toilets, and parking layouts were quickly put into place with the understanding that the CRMP may change the vision of those locations and the infrastructure may be changed or removed. These interim measures were implemented to manage people and access during the planning process and are often not aligned with long term desired conditions for scenery. Other interim actions restored denuded areas, which promotes long-term improvement to scenic quality.

Valued Landscape Character

Currently, approximately 126.3 acres of disturbed area is present in the project area (table 3-123). These disturbed areas consist of developed recreation sites (primarily parking lots), roads, trails, and other areas disturbed by unplanned use outside of recreation sites, roads, and trails. Because of the presence of 36.3 acres of "other disturbed areas," Alternative A represents the greatest amount of disturbed area of all alternatives and would therefore result in the greatest negative impact to valued landscape character. The "other disturbed areas" would be restored under all action alternatives. Effects of disturbance are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Table 3-123. Alternative A capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	148
Total persons at one time (PAOT)[1]	740
Dispersed recreation areas (acres)	
Dispersed recreation areas	26.0
Disturbance (acres)	

Developed recreation	10.8
Roads	72.1
Trails & creek access[2]	7.1
Other disturbed areas[3]	36.3
Disturbed acres TOTAL	**126.3**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle.

[2]Alternative A trails & creek access includes unauthorized trails.

[3]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration

Interim measures including signage, kiosks, and toilets, including portable toilets, currently present in Fossil Creek detract from the natural-appearing landscape because their development has lacked a comprehensive set of design principles. These features do, however, provide for both user comfort and resource protection.

Approximately 26.0 acres of dispersed recreation areas would be available under Alternative A. This is slightly less than alternatives E and F, the same as Alternative B, and more than alternatives C and D. Most of these areas are connected to recreation sites, though some occur along the Lewis Trail and in the Fossil Springs area. Alternative A would provide for a visitor capacity of 740 PAOT, which is more than alternatives B and C and less than alternatives D, E, and F. Recent management observations indicate a reduction in the amount of trash removed from the WSR corridor since 2015 (Nichols 2017); however, numerous unauthorized trails are currently present in Middle Fossil. Effects of dispersed recreation are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Figure 3-61 displays locations within the analysis area that are modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative A. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be limited opportunities to screen views with vegetation in the foreground. Alternative A would contain 11 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than alternatives B, E, and F; the same as Alternative C; and more than alternative D. However, the chance of adverse impacts to foreground areas and their contribution to landscape character is greatest in Alternative A because no comprehensive design guidance would be provided by the CRMP.

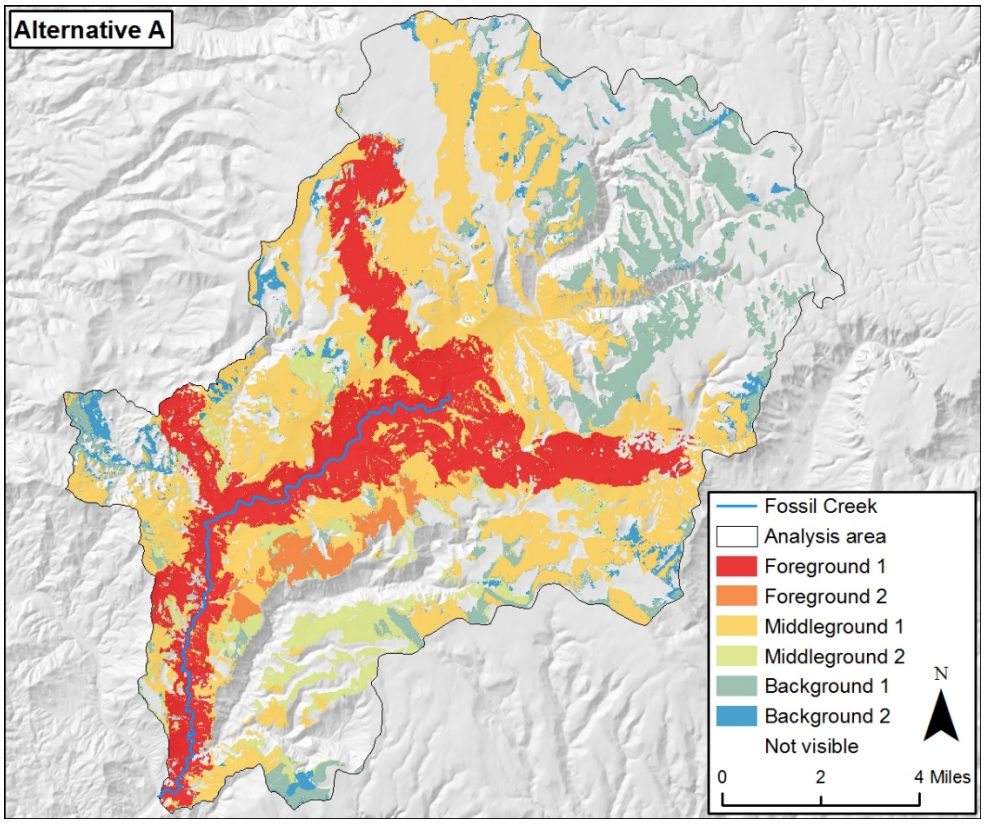


Figure 3-61. Areas visible as foreground, middle ground, and background in Alternative A[30]

Landscape Character Enhancement

As described in the *Affected Environment Common to All Resources* section at the beginning of this chapter, relatively unmanaged recreational use in the past has resulted in vegetation and soil disturbance in the most heavily visited areas of Fossil Creek. Through interim management, some active restoration projects have been implemented throughout Middle Fossil Creek where trails were blocked, straw wattles placed, and areas reseeded with native species. In other areas, passive restoration by blocking trails and denuded areas has resulted in natural recovery. The amount of recovery varies by site, and 2012 was the first year in which the total denuded area decreased. Natural recovery has been influenced by the success of minimizing use of recovery areas, weather fluctuations, and rate of vegetation recovery.

In Alternative A, no specific additional restoration actions are planned, and restoration of disturbed areas would be completed on an as-needed basis and be subject to separate NEPA analysis, likely delaying or slowing restoration activities by one or more years. The 36.3 acres of "other disturbed areas" identified in Fossil Creek would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. As a result, Alternative A has the lowest potential of any alternative to enhance valued landscape character.

If new permanent facilities are constructed under Alternative A, they would be analyzed under a separate NEPA process, which could take several years. The opportunity to improve existing infrastructure and facilities exists, but would not be propelled forward by the CRMP process. Without the additional guidance identified in the CRMP, development of additional facilities in Fossil Creek may continue to be perceived as a hodge-podge with no coherent guiding design themes.

[30] Foreground areas are those 0-0.5 miles from viewing areas (recreation sites, roads, or trails), middle ground areas are 0.5-4 miles from viewing areas, and background areas are 4-15 miles from viewing areas. Designations of 1 or 2 are based on whether a viewing area is concern level 1 or 2.

Changes to Visual Quality/Scenic Integrity

In Alternative A, it is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15% and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery.

In Alternative A, dispersed camping in the off season would continue to be allowed upstream of the historic dam and downstream of Fossil Creek Bridge. Dispersed camping in the past has resulted in impacts such as vegetation and soil disturbance, trash, and human waste, which negatively impact visual quality/scenic integrity. Although the locations of camping are limited in Alternative A, negative impacts are expected to continue to occur.

Valued Sense of Place

The effects of Alternative A on Fossil Creek's river values and the socioeconomic environment are described in the other resource analyses above. Overall, it is anticipated that Alternative A would do the least of the alternatives to protect river values because no CRMP would be in place to provide resource-specific management direction or a comprehensive strategy for management of Fossil Creek. Alternative A therefore has lower potential to promote Fossil Creek's valued sense of place. However, because Fossil Creek is still a designated wild and scenic river, interim actions would continue to be taken to support river value protection as required by the Wild and Scenic Rivers Act. If actions requiring additional NEPA analysis become necessary to protect river values, there may be a delay in implementation of one or more years and river values—and thus sense of place—may experience short-term adverse effects as a result.

Facilities put in place during interim management do not enhance the valued sense of place, but rather provide for key visitor needs at a minimal level. Additional facilities determined to be necessary would likely continue to be installed in this fashion and therefore not enhance the sense of place.

Direct and Indirect Effects of Management Actions Unique to Alternative B

Alternative B would provide a more primitive visitor experience in Fossil Creek and emphasize protection of natural and cultural resources with minimal development of new facilities and infrastructure and a lower visitor capacity. Existing recreation sites, roads, and trails would be retained but not expanded, and a minimal amount facility and infrastructure improvement would support the sustainability of the recreation sites and transportation infrastructure.

Valued Landscape Character

In Alternative B, approximately 94.1 acres of planned disturbed area would be present in the project area (table 3-124), which is the smallest amount of total disturbed area of all alternatives. These disturbed areas consist of developed recreation sites (parking lots and other amenities such as picnic tables, bike racks, and group shelters), roads, and trails. Effects of this disturbance are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Because Alternative B had the smallest amount of disturbed area, it would result in the fewest negative effects to landscape character caused by planned disturbance.

Table 3-124. Alternative B capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	112
Total persons at one time (PAOT)[1]	560
Dispersed recreation areas (acres)	
Dispersed recreation areas	26.0
Disturbance (acres)	
Developed recreation areas	16.4
Roads	72.0

Trails & creek access	5.7
Other disturbed areas[2]	**
Disturbed acres TOTAL	**94.1**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle.

[2]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete, so no acreage is reported for other disturbed areas.

Alternative B would present opportunities to improve accessibility and upgrade elements of the built environment such as by properly designing parking lots; screening unsightly features such as portable toilets; signing accessible parking; installing features such as picnic tables, bike racks, and trash receptacles; and improving visitor information and access and wayfinding features. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort.

Approximately 26.0 acres of dispersed recreation areas would be present under Alternative B. This is slightly less than alternatives E and F, the same as Alternative A, and more than alternatives C and D. Most of these areas are connected to recreation sites, though some occur along the Lewis Trail and in the Fossil Springs area. Alternative B would provide for a visitor capacity of 560 PAOT, which is the lowest of any alternative. This would result in the lowest potential for impacts from dispersed recreation, and a recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation. Effects of dispersed recreation are described in the “Direct and Indirect Effects of Management Actions Common to All Alternatives” section above.

Figure 3-62 displays locations within the analysis area that are modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative B. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be limited opportunities to screen views with vegetation in the foreground. Alternative B would contain 12 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than Alternative E; the same as Alternative F; and more than alternatives A, C, or D.

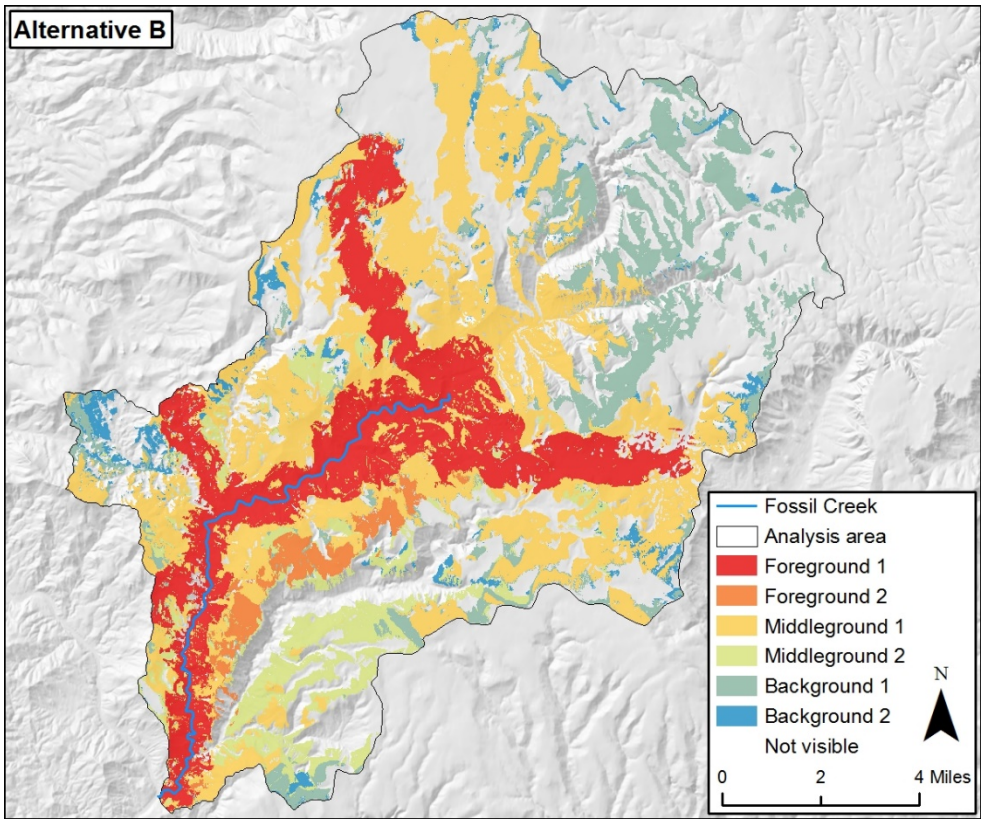


Figure 3-62. Areas visible as foreground, middle ground, and background in Alternative B

Landscape Character Enhancement

Numerous unplanned bare areas (unauthorized trails and other disturbed areas) continue to be present in the WSR corridor, and in Alternative B, approximately 41.2 acres of restoration actions are planned (table 3-125). These actions would restore these unplanned bare areas. Until restoration is completed, these areas would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Alternative B proposes less restoration than alternatives C, D, and F and more restoration than alternatives A and E.

Table 3-125. Alternative B restoration

Restoration (acres)	
Bare soil restoration	35.6
Road restoration	3.7
Trail restoration	1.9
Restoration acres TOTAL	**41.2**

New development possible under Alternative B is fairly limited in order to provide a more primitive visitor experience in Fossil Creek. This would likely enhance landscape character as perceived by those seeking a more primitive experience; however, those seeking a more developed environment may be negatively affected. New development that does occur would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.

Changes to Visual Quality/Scenic Integrity

In Alternative B, it is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15%

and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery. Further, because Alternative B emphasizes fairly limited development, associated decreases in visual quality/scenic integrity should be lessened as compared to alternatives that propose more development.

Dispersed recreation has the potential to negatively impact visual quality/scenic integrity as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. However, because Alternative B would have relatively low visitor numbers, the potential for these impacts would be lessened compared to the other alternatives. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity.

In Alternative B, up to 10 designated campsites would be established in Middle Fossil and up to three dispersed campsites would be established in the Fossil Springs area. Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past (such as vegetation and soil disturbance, trash, and human waste) and corresponding impacts to visual quality/scenic integrity. The designated campsites themselves would be a notable development in the corridor and may detract from the overall scenic integrity when viewed- particularly for those who are not actively using the campsites.

Valued Sense of Place

The effects of Alternative B on Fossil Creek's river values and the socioeconomic environment are described in the other resource reports completed for this project. With a CRMP in place, it is anticipated that Alternative B would protect river values. However, because Alternative B would provide access to Fossil Creek to the fewest people of any alternative, a relatively low number of people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alternative B would promote Fossil Creek's valued sense of place. Those whose sense of place of Fossil Creek is enhanced by encountering few people may be positively impacted.

Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Direct and Indirect Effects of Management Actions Unique to Alternative C

Alternative C would emphasize non-motorized recreation in Middle Fossil by limiting motor vehicle use in portions of the river corridor during the busiest times and developing additional trails for hiking, bicycling, and equestrian use. A lower visitor capacity would support a quieter recreation experience. Trail access to the historic dam and Fossil Springs would be eliminated to minimize the effects of human presence in this area. Additional parking and visitor facilities would be developed at Cactus Flat and Homestead to serve as the primary entry point into the river corridor; from there visitors would access the corridor by foot, bicycle, or horseback during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park at a reduced number of parking spaces in existing parking lots. A moderate amount facility and infrastructure improvement would support the sustainability of recreation sites and transportation infrastructure in the corridor.

Valued Landscape Character

In Alternative C, approximately 97.2 acres of planned disturbed area would be present in the project area (table 3-126), which is less disturbed area than alternatives A, E, and F and more than alternatives B and D. These disturbed areas consist of developed recreation sites (parking lots and other amenities such as picnic tables, bike racks, and group shelters), roads, and trails. Effects of this disturbance are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Table 3-126. Alternative C capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	132
Total persons at one time (PAOT)[1]	660
Dispersed recreation areas (acres)	

Dispersed recreation areas	10.1
Disturbance (acres)	
Developed recreation areas	18.3
Roads	71.7
Trails & creek access	7.2
Other disturbed areas[2]	**
Disturbed acres TOTAL	**97.2**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle.
[2]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete, so no acreage is reported for other disturbed areas.

Alternative C would present opportunities to upgrade elements of the built environment such as by properly designing parking lots; screening unsightly features such as portable toilets; signing accessible parking; installing features such as picnic tables, bike racks, and trash receptacles; and improving visitor information and access and wayfinding features. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be lessened during the high-use season, as visitors would be unable to drive past Homestead.

Approximately 10.1 acres of dispersed recreation areas would be present under Alternative C. This is substantially less than alternatives A, B, E, and F and more than Alternative D. The reduction in dispersed recreation area from that available in alternatives A, B, E, and F is due mostly to a large area in the vicinity of Fossil Springs being inaccessible. Most of the dispersed recreation areas are connected to recreation sites, though some occur along the Lewis Trail. Alternative C would provide for a visitor capacity of 660 PAOT, which is the second lowest of any alternative, including current management. This would result in a relatively low potential for impacts from dispersed recreation, and a recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation. Effects of dispersed recreation are described in the “Direct and Indirect Effects of Management Actions Common to All Alternatives” section above.

Figure 3-63 displays locations within the analysis area that are modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative C. Two new trails (Creek View in Middle Fossil and Rim near the Fossil Springs Trailhead) would be established in Alternative C. These would represent new travelways providing views into the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be limited opportunities to screen views with vegetation in the foreground. Alternative C would contain 11 developed sites (parking areas, visitor contact stations, and administrative sites), which is fewer than alternatives B and E, the same as Alternative A, and more than Alternative D.

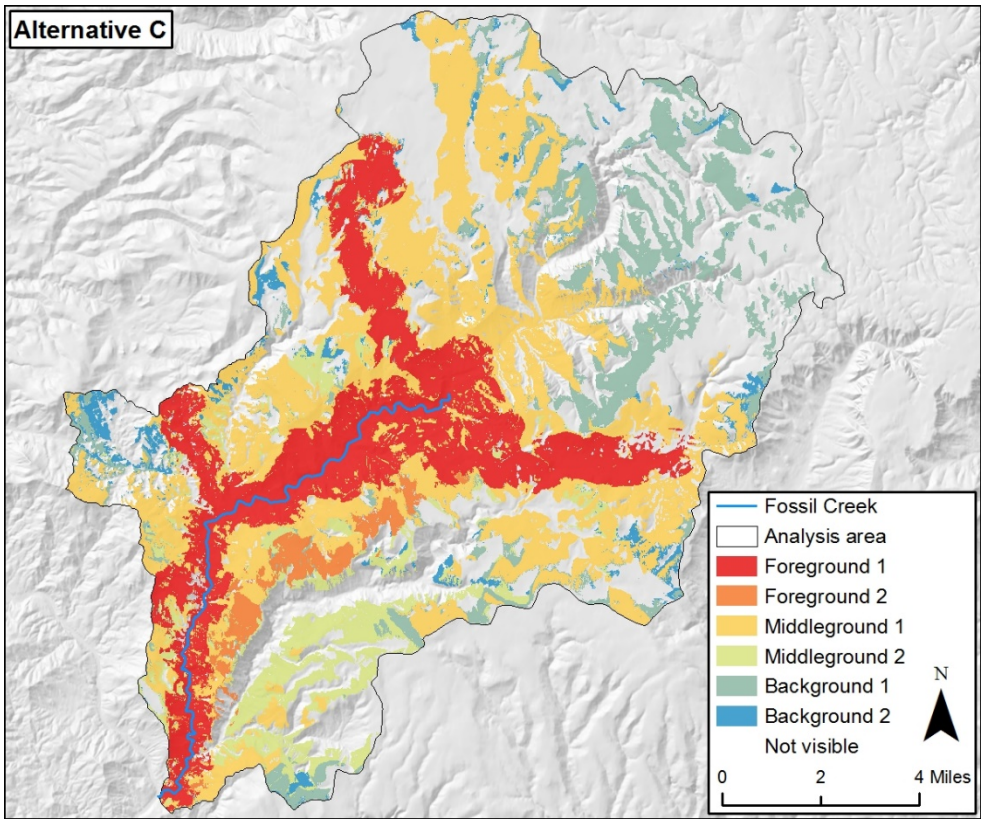


Figure 3-63. Areas visible as foreground, middle ground, and background in Alternative C

Landscape Character Enhancement

Numerous unplanned bare areas (unauthorized trails and other disturbed areas) continue to be present in the WSR corridor, and in Alternative C, approximately 43.7 acres of restoration actions are planned (table 3-127). These actions would restore unplanned bare areas, recreation sites and associated roads that would be closed (Purple Mountain and Sally May recreation sites), and a portion of the Flume Trail in the vicinity of Fossil Springs. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Restoring existing recreation sites and portions of the Flume Trail would reduce the overall impact of bare areas on visual quality/scenic integrity. Alternative C proposes less restoration than Alternative D and more restoration than alternatives A, B, E, and F.

Table 3-127. Alternative C restoration

Restoration (acres)	
Bare soil restoration	37.2
Road restoration	3.8
Trail restoration	2.7
Restoration acres TOTAL	**43.7**

New development possible under Alternative C is intended to support a generally non-motorized visitor experience in Fossil Creek. This would likely enhance landscape character as perceived by those seeking a quieter recreation experience; however, those seeking a motorized experience may be negatively affected. New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.

Changes to Visual Quality/Scenic Integrity

In Alternative C, it is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15% and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery. Further, because Alternative C would have fairly limited development and restore several recreation sites and a portion of the Flume Trail, impacts to visual quality/scenic integrity would be lessened as compared to alternatives that propose more development.

Two new trails (Creek View in Middle Fossil and Rim near the Fossil Springs Trailhead) would be established in Alternative C. While cut and fill associated with these trails may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor and the trails would be designed to minimize scenery impacts.

Dispersed recreation has the potential to negatively impact visual quality/scenic integrity as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. However, because Alternative C would have relatively low visitor numbers, the potential for these impacts would be lessened compared to the other alternatives. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity.

In Alternative C, up to three designated campsites would be established at Cactus Flat and up to four designated campsites would be established at the Rim Trailhead. No camping would be available in the Fossil Springs area. Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past (such as vegetation and soil disturbance, trash, and human waste) and corresponding impacts to visual quality/scenic integrity.

Valued Sense of Place

The effects of Alternative C on Fossil Creek's river values and the socioeconomic environment are described in the other resource reports completed for this project. With a CRMP in place, it is anticipated that Alternative C would protect river values. However, because Alternative C would provide access to Fossil Creek to relatively few people, a relatively low number of people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alternative C would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by motorized access or visiting the Fossil Springs and historic dam area may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a non-motorized recreation experience or being in the presence of fewer people may be positively impacted.

Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Direct and Indirect Effects of Management Actions Unique to Alternative D

Alternative D would expand motorized access to Middle Fossil by increasing road connectivity and providing for scenic driving. Once hazard mitigations and repairs are completed, the currently closed portion of Forest Road (FR) 708 would be reopened to all motor vehicles. Recreational use would be focused at fewer sites in the river corridor. Some recreation sites would be closed and trail access to Fossil Springs and the Waterfall would be eliminated in order to maximize relatively undisturbed habitat (refugia) areas. New facility and infrastructure development would be focused on facilitating motorized access and supporting increased use at and sustainability of recreation sites. Increases in visitor capacity could be phased in over time.

Valued Landscape Character

In Alternative D, approximately 95.9 acres of planned disturbed area would be present in the project area (table 3-128), which is less disturbed area than alternatives A, C, E, and F and more than Alternative B. These disturbed areas consist of developed recreation sites (parking lots and other amenities such as picnic tables, bike racks, and

group shelters), roads, and trails. Effects of this disturbance are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Table 3-128. Alternative D capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	129
Total number of scenic driving vehicles[1]	40
Total persons at one time (PAOT)[1]	845
Dispersed recreation areas (acres)	
Dispersed recreation areas	6.6
Disturbance (acres)	
Developed recreation areas	21.5
Roads	71.6
Trails & creek access	2.8
Other disturbed areas[2]	**
Disturbed acres TOTAL	**95.9**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle.

[2]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete, so no acreage is reported for other disturbed areas.

Alternative D would present opportunities to upgrade elements of the built environment such as by properly designing parking lots; screening unsightly features such as portable toilets; signing accessible parking; installing features such as picnic tables, bike racks, and trash receptacles; and improving visitor information and access and wayfinding features. Facilities at the Irving site would be expanded substantially to help support greater visitor numbers. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be increased year-round, as FR 708 would be repaired and reopened for public motorized use.

Approximately 6.6 acres of dispersed recreation areas would be present under Alternative D. This is substantially less than all other alternatives. The reduction in dispersed recreation area is due mostly to a large area in the vicinity of Fossil Springs being inaccessible and to the closure of the Purple Mountain, Sally May, Tonto Bench, and Lewis Trailhead recreation sites. Alternative D would provide for a total visitor capacity of 845 PAOT, approximately 200 PAOT of which would be for scenic driving (no extended stops in the WSR corridor). This total capacity is higher than alternatives A, B, or C and lower than alternatives E and F. The increased number of visitors would increase the potential for impacts from dispersed recreation; however, a substantial portion of this capacity would be from visitors who are driving through the corridor and only stopping for short periods of time, which has a lower likelihood of impacts. Additionally, a recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation. Effects of dispersed recreation are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Figure 3-64 displays locations within the analysis area modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative D. Although the new Rim Trail would be constructed, the Bear Trail and portions of the Flume Trail would be closed, reducing the overall seen area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be limited opportunities to screen views with vegetation in the foreground. Alternative D would contain 10 developed sites (parking areas, visitor contact stations, and administrative sites), which is the fewest of all alternatives.

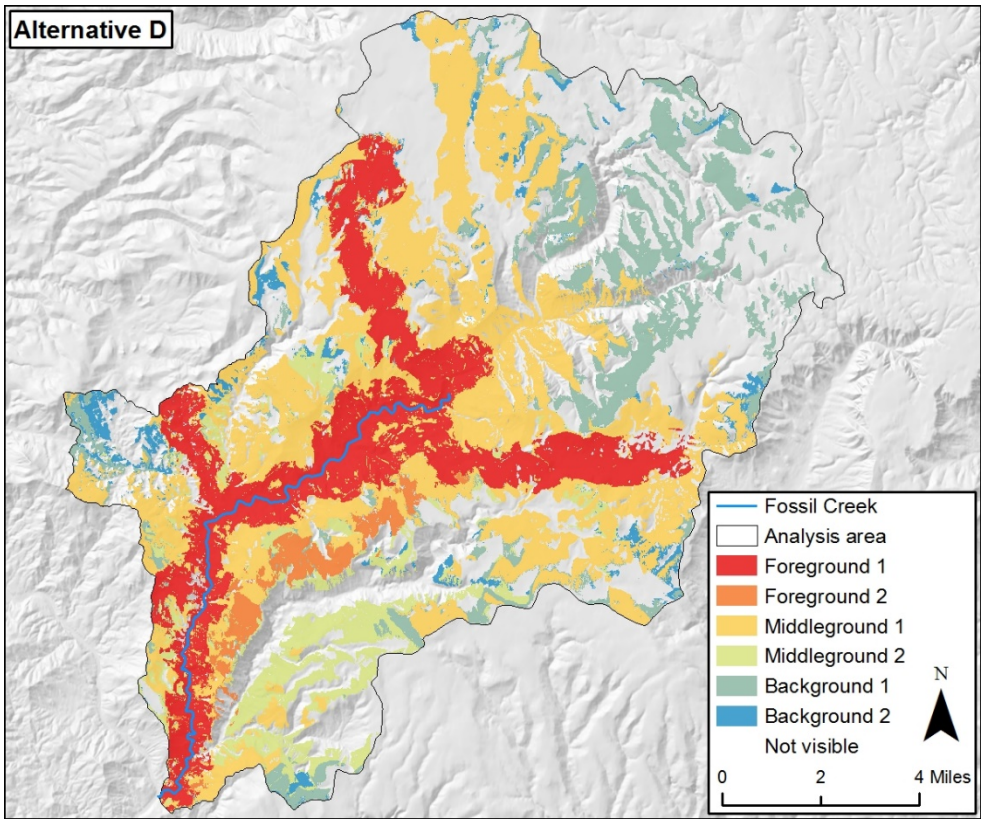


Figure 3-64. Areas visible as foreground, middle ground, and background in Alternative D

Landscape Character Enhancement

Numerous unplanned bare areas (unauthorized trails and other disturbed areas) continue to be present in the WSR corridor, and in Alternative D, approximately 46.4 acres of restoration actions are planned (table 3-129). These actions would restore unplanned bare areas, recreation sites and associated roads that would be closed (Purple Mountain, Sally May, Tonto Bench, and Lewis Trailhead recreation sites), the Bear Trail, and a portion of the Flume Trail in the vicinity of Fossil Springs. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Restoring existing recreation sites, the Bear Trail, and portions of the Flume Trail would reduce the overall impact of bare areas on visual quality/scenic integrity. Because of the number of recreation sites proposed to be closed, Alternative D would provide the most restoration—and thus the most potential for landscape character enhancement through restoration—of all alternatives.

Table 3-129. Alternative D restoration

Restoration (acres)	
Bare soil restoration	38.1
Road restoration	3.8
Trail restoration	4.5
Restoration acres TOTAL	**46.4**

New development possible under Alternative D is intended to support increased motorized access and scenic driving in Fossil Creek. This would likely enhance landscape character as perceived by those seeking increased access and a motorized recreation experience; however, those seeking a quieter or non-motorized experience may be negatively affected by the sight and sounds of more motor vehicles. New development would be subject to a

comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.

Changes to Visual Quality/Scenic Integrity

In Alternative D, it is not anticipated that there would be irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15% and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery. Further, because Alternative D would have fairly limited development and restore several recreation sites, the Bear Trail, and a portion of the Flume Trail, impacts to visual quality/scenic integrity would be lessened compared to alternatives that propose more development.

The new Rim Trail would be established in Alternative D. While cut and fill associated with this trail may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor because the trail is outside of the WSR corridor and the trail would be designed to minimize scenery impacts.

Dispersed recreation has the potential to negatively impact visual quality/scenic integrity as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. The higher total number of visitors in Alternative D increases the potential for dispersed recreation impacts; however, a portion of the total visitors would be in the WSR corridor for a short duration as they engage in scenic driving. Additionally, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity.

In Alternative D, no camping would be available in the WSR corridor. This should eliminate impacts that have been associated with dispersed camping in the past (such as vegetation and soil disturbance, trash, and human waste) and corresponding impacts to visual quality/scenic integrity.

Valued Sense of Place

The effects of Alternative D on Fossil Creek's river values and the socioeconomic environment are described in the other resource reports completed for this project. With a CRMP in place, it is anticipated that Alternative D would protect river values. Additionally, because Alternative D would provide access to Fossil Creek to more people, more people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alternative D would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by non-motorized recreation or visiting the Fossil Springs and historic dam area may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a motorized recreation may be positively impacted.

Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Direct and Indirect Effects of Management Actions Unique to Alternative E (Proposed Action)

Alternative E would emphasize providing a variety of recreation opportunities throughout the Fossil Creek corridor. Phased development of additional parking and visitor facilities could occur at Cactus Flat, Heinrich, and Irving to support increased visitor capacity, and improvements at other recreation sites would be focused on supporting increased use at and sustainability of those sites. New trails for hiking, bicycling, and equestrian use would be constructed. Once hazard mitigations and repairs are completed, the currently closed portion of FR 708 would be reopened to motor vehicles less than 62 inches wide.

Valued Landscape Character

In Alternative E, approximately 114.4 acres of planned disturbed area would be present in the project area (table 3-130), which is the most disturbed area of all action alternatives but less than the no action (Alternative A). These disturbed areas consist of developed recreation sites (parking lots and other amenities such as picnic tables,

bike racks, and group shelters), roads, and trails. Effects of this disturbance are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Table 3-130. Alternative E capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	270
Total number of motorized trail vehicles[1]	40
Total persons at one time (PAOT)[1]	1,430
Dispersed recreation areas (acres)	
Dispersed recreation areas	26.3
Disturbance (acres)	
Developed recreation areas	35.2
Roads	71.4
Trails & creek access	7.8
Other disturbed areas[2]	**
Disturbed acres TOTAL	**114.4**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle, except for motorized trail vehicles, which assume 2 people per vehicle.
[2]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete, so no acreage is reported for other disturbed areas.

Alternative E would present opportunities to upgrade elements of the built environment such as by properly designing parking lots; screening unsightly features such as portable toilets; signing accessible parking; installing features such as picnic tables, bike racks, and trash receptacles; and improving visitor information and access and wayfinding features. Facilities at the Irving site would be expanded substantially to help support greater visitor numbers. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. Accessibility of the WSR corridor would be increased year-round, as FR 708 would be repaired and reopened for limited public use as a motorized trail.

Approximately 26.3 acres of dispersed recreation areas would be present under Alternative E. This is the same as Alternative F and more than alternatives A, B, C, and D. Most of these areas are connected to recreation sites, though some occur along the Lewis Trail and in the Fossil Springs area. Alternative E would provide for a total maximum visitor capacity of 1,430 PAOT, approximately 80 PAOT of which would be for motorized trail use (no extended stops in the WSR corridor). This total capacity is lower than Alternative F and substantially higher than alternatives A, B, C, and D. The increased number of visitors would increase the potential for impacts from dispersed recreation; however, visitor numbers would be increased incrementally if monitoring indicates river values are protected and adaptive management actions would be taken to prevent dispersed recreation impacts from "creeping" outside of recreation sites. Additionally, a portion of this capacity would be from visitors who are driving through the corridor on motorized trail vehicles and only stopping for short periods of time, which has a lower likelihood of impacts. Further, a recreation environment that is more managed overall would further reduce the potential for impacts of dispersed recreation. Effects of dispersed recreation are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Figure 3-65 displays locations within the analysis area modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative E. The new Rim and Creek View trails would be constructed, increasing the overall seen area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be

limited opportunities to screen views with vegetation in the foreground. Alternative E would contain 13 developed sites (parking areas, visitor contact stations, and administrative sites), which is the most of all alternatives.

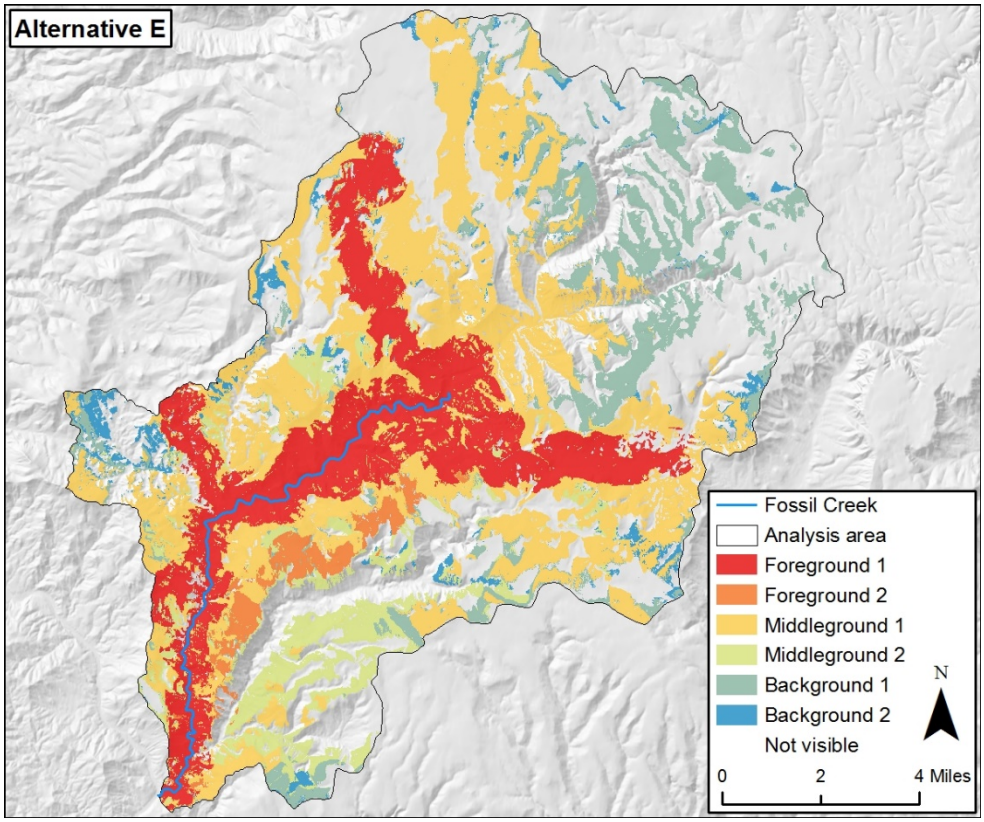


Figure 3-65. Areas visible as foreground, middle ground, and background in Alternative E

Landscape Character Enhancement

Numerous unplanned bare areas (unauthorized trails and other disturbed areas) continue to be present in the WSR corridor, and in Alternative E, approximately 40.6 acres of restoration actions are planned (table 3-131). These actions would restore unplanned bare areas. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Because Alternative E contains the highest number of recreation sites of all alternatives and no recreation sites or trails would be closed, the amount of restoration is lowest of all alternatives.

Table 3-131. Alternative E restoration

Restoration (acres)	
Bare soil restoration	34.8
Road restoration	3.7
Trail restoration	2.1
Restoration acres TOTAL	**40.6**

New development possible under Alternative E is intended to support increased visitor use and motorized access in Fossil Creek. This would likely enhance landscape character as perceived by those seeking increased access and a motorized trail recreation experience; however, those seeking a quieter or non-motorized experience without relatively high numbers of visitors may be negatively affected by a relatively high number of visitors and the sight and sound of motorized trail vehicles (ATVs and UTVs). New development would be subject to a comprehensive

set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.

Changes to Visual Quality/Scenic Integrity

Alternative E would contain the most recreation site development in the WSR corridor of all alternatives. Although this represents the most potential for decreasing visual quality/scenic integrity of the alternatives, this should be mitigated by management direction for scenery provided by the CRMP and comprehensive design guidelines. As a result, Alternative E is not anticipated to cause irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15% and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery.

The new Rim and Creek View trails would be established in Alternative E. While cut and fill associated with these trails may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor and the trails would be designed to minimize scenery impacts.

Dispersed recreation has the potential to negatively impact visual quality/scenic integrity as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. The higher total number of visitors in Alternative E increases the potential for dispersed recreation impacts; however, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity. Additionally, visitor numbers would be increased incrementally if monitoring indicates river values are protected and adaptive management actions would be taken to prevent dispersed recreation impacts from "creeping" outside of recreation sites.

In Alternative E, up 10 designated campsites would be established in Middle Fossil, three administrative campsites would be established at Cactus Flat, four designated campsites would be established at the Rim Trailhead, and three designated campsites would be established in the Fossil Springs area. Identifying specific camping locations would help reduce impacts that have been associated with dispersed camping in the past (such as vegetation and soil disturbance, trash, and human waste) and corresponding impacts to visual quality/scenic integrity.

Valued Sense of Place

The effects of Alternative E on Fossil Creek's river values and the socioeconomic environment are described in the other resource reports completed for this project. With a CRMP in place, it is anticipated that Alternative E would protect river values. Additionally, because Alternative E would provide access to Fossil Creek to more people, more people would be able to experience Fossil Creek as a unique place. Overall, it is anticipated that Alternative E would promote Fossil Creek's valued sense of place. However, those whose sense of place of Fossil Creek is enhanced by a quieter recreation experience with fewer people may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by a motorized recreation or proximity to other visitors may be positively impacted.

Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Direct and Indirect Effects of Management Actions Unique to Alternative F

Alternative F would meet anticipated demand for recreational use in Fossil Creek through 2030 in order to prevent the need for a reservation system. This would be accomplished by establishing a large parking area at Cactus Flat, with additional parking at Homestead and several other recreation sites. New trails for hiking, bicycling, and equestrian use would be constructed. New facility and infrastructure development would support increased use at and sustainability of recreation sites. Cactus Flat and Homestead would serve as the primary entry point into the river corridor; private motor vehicle access to the remaining upstream recreation sites in Middle Fossil would be restricted during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots.

Valued Landscape Character

In Alternative F, approximately 108.7 acres of planned disturbed area would be present in the project area (table 3-132), which is less disturbed area than alternatives A and E and more than alternatives B, C, and D. These disturbed areas consist of developed recreation sites (parking lots and other amenities such as picnic tables, bike racks, and group shelters), roads, and trails. Effects of this disturbance is described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Table 3-132. Alternative F capacities and disturbance area

Recreation capacities	
Total number of parking spaces/vehicles[1]	500
Total persons at one time (PAOT)[1]	2,500
Dispersed recreation areas (acres)	
Dispersed recreation areas	26.3
Disturbance (acres)	
Developed recreation areas	31.4
Roads	70.6
Trails & creek access	6.7
Other disturbed areas[2]	**
Disturbed acres TOTAL	**108.7**

[1]Total parking spaces/vehicles and PAOT are for visitor use only (does not include administrative use). PAOT is derived by assuming 5 people per vehicle.

[2]Other disturbed areas = existing areas (not including unauthorized roads/trails) identified for restoration. Alternatives B-F assume restoration is complete, so no acreage is reported for other disturbed areas.

Alternative F would present opportunities to upgrade elements of the built environment such as by properly designing parking lots; screening unsightly features such as portable toilets; signing accessible parking; installing features such as picnic tables, bike racks, and trash receptacles; and improving visitor information and access and wayfinding features. Facilities at the Irving site would be expanded to help support greater visitor numbers, and a large parking lot would be constructed at Cactus Flat. These features would be guided by a comprehensive design process and thus promote overall aesthetic appeal of the built environment and support landscape character. These features would also support resource protection and visitor comfort. However, the size of the parking lot at Cactus Flat and the overall high number of vehicles in the WSR corridor would detract from landscape character by representing a marked departure from the relatively remote and natural Fossil Creek setting. Accessibility of the WSR corridor would be decreased in the high use season, as FR 708 would be closed to public motorized travel beyond the Homestead site to reduce traffic congestion in the corridor.

Approximately 26.3 acres of dispersed recreation areas would be present under Alternative F. This is the same as Alternative E and more than alternatives A, B, C, and D. Most of these areas are connected to recreation sites, though some occur along the Lewis Trail and in the Fossil Springs area. Alternative F would provide for a total maximum visitor capacity of 2,580 PAOT. This total capacity is substantially higher than all other alternatives. The increased number of visitors would increase the potential for impacts from dispersed recreation through "creep" of dispersed recreation and associated impacts outside of recreation sites. This effect may be exacerbated by the Cactus Flat parking lot, where most parking would occur, being relatively removed from creekside access points and visitors needing to seek access to the creek on foot or bike. However, adaptive management actions would be taken to address these effects within a year or more if they are found to occur. Further, a recreation environment that is more managed overall would reduce the potential for impacts of dispersed recreation. Effects of dispersed recreation are described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above.

Figure 3-66 displays locations within the analysis area modeled visible as foreground, middle ground, and background from travelways and recreation sites in Alternative F. The new Rim and Creek View trails, as well as

a connector trail between Cactus Flat and Homestead, would be constructed, and the Bear Trail would be closed and decommissioned. These trail system changes would increase the overall trail mileage and therefore increase the overall seen area in the WSR corridor. All management activities and most recreational use would occur in foreground areas where disruptions to landscape character would be most noticeable. As a result, the landscape character of foreground areas has the highest potential to experience impacts from management and use. Additionally, a higher level of detail is discernable in the foreground and there may be limited opportunities to screen views with vegetation in the foreground. Alternative F would contain 12 developed sites (parking areas, visitor contact stations, and administrative sites), which is less than Alternative E, the same as Alternative B, and more than alternatives A, C, and D.

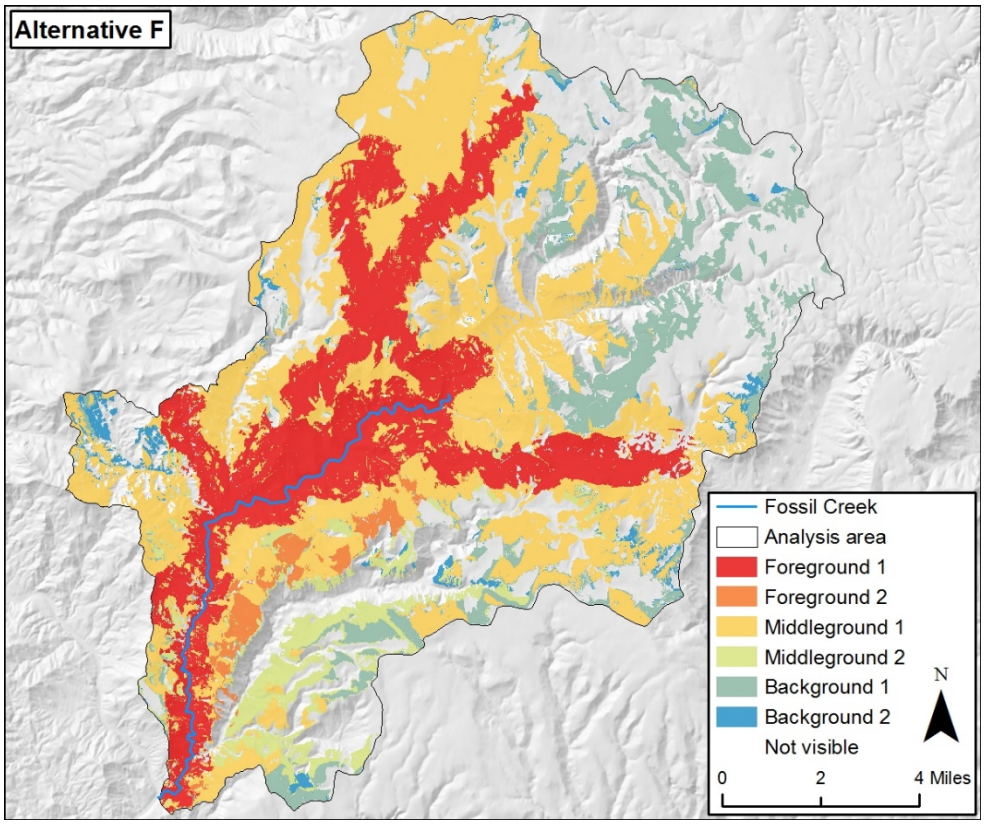


Figure 3-66. Areas visible as foreground, middle ground, and background in Alternative F

Landscape Character Enhancement

Numerous unplanned bare areas (unauthorized trails and other disturbed areas) continue to be present in the WSR corridor, and in Alternative F, approximately 40.5 acres of restoration actions are planned (table 3-133). These actions would restore unplanned bare areas and the Bear Trail. Until restoration is completed, unplanned bare areas would continue to cause deviations from the landscape character as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. Alternative F proposes less restoration than alternatives C and D and more than alternatives A, B, and E.

Table 3-133. Alternative F restoration

Restoration (acres)	
Bare soil restoration	34.7
Road restoration	3.9
Trail restoration	3.4
Restoration acres TOTAL	**42.0**

New development possible under Alternative F is intended to support increased visitor use in Fossil Creek. This would likely enhance landscape character as perceived by those seeking increased access to Fossil Creek; however, those seeking a quieter or non-motorized experience without relatively high numbers of visitors may be negatively affected by a high number of visitors. New development would be subject to a comprehensive set of design guidelines, which would improve the contribution the built environment makes to the overall character of Fossil Creek.

Changes to Visual Quality/Scenic Integrity

Alternative F would contain less total acreage of recreation site development than Alternative E, and more than alternatives A, B, C, and D. This represents relatively high potential for decreasing visual quality/scenic integrity compared to most alternatives, but this should be mitigated by management direction for scenery provided by the CRMP and comprehensive design guidelines. However, the size of the parking lot at Cactus Flat and the overall high number of vehicles in the WSR corridor may detract from visual quality/scenic integrity by representing a marked departure from the relatively remote and natural Fossil Creek setting. Overall, Alternative F is not anticipated to cause irreversible alterations to areas of Preservation/Very High and Retention/High visual quality/scenic integrity in the analysis area. There may be a gradual decrease in visual quality/scenic integrity in the long term (20 years plus) in the project area, but this would not exceed 15% and is anticipated to meet Coconino and Tonto Forest Plan direction for scenery.

The new Rim and Creek View trails and a connector trail between Cactus Flat and Homestead would be established in Alternative F, and the Bear Trail would be closed and decommissioned. While cut and fill associated with new trails may result in slight reductions in visual quality/scenic integrity, this impact is anticipated to be fairly minor and the trails would be designed to minimize scenery impacts.

Dispersed recreation has the potential to negatively impact visual quality/scenic integrity as described in the "Direct and Indirect Effects of Management Actions Common to All Alternatives" section above. The high total number of visitors in Alternative F increases the potential for dispersed recreation impacts, and it is anticipated that the unprecedented number of visitors that could be accommodated may result in "creep" of dispersed recreation and associated impacts outside of recreation sites. However, a more managed recreation environment would reduce the chances that dispersed recreation negatively impacts visual quality/scenic integrity, and adaptive management actions would be taken to address these impacts.

In Alternative F, up to 10 designated campsites would be established at Homestead. Dispersed camping would be allowed upstream of the historic dam in the Fossil Springs area outside of the high-use season only. Identifying specific camping locations in Middle Fossil would help reduce impacts that have been associated with dispersed camping in the past (such as vegetation and soil disturbance, trash, and human waste) and corresponding impacts to visual quality/scenic integrity. Although dispersed camping in the Fossil Springs area may continue to impact visual quality/scenic integrity in this area, this use is anticipated to be relatively low because it would occur outside of the high-use season.

Valued Sense of Place

The effects of Alternative F on Fossil Creek's river values and the socioeconomic environment are described in the other resource analyses in this EIS. As described in these analyses, it is possible that the implementation strategy of Alternative F, and, in some case, the high number of people, may adversely impact components of the river values. However, the Wild and Scenic Rivers Act requires the Forest Service to protect Fossil Creek's river values. If adverse impacts are found to be occurring, adaptive management actions must be taken to address these impacts. As a result, though Alternative F may result in adverse impacts to Fossil Creek's river values and thus its valued sense of place, it is anticipated these effects would be relatively short-term and would be reversed by the application of adaptive management. Alternative F would provide access to Fossil Creek to substantially more people, so more people would be able to experience Fossil Creek as a unique place. However, those whose sense of place of Fossil Creek is enhanced by a quieter recreation experience with fewer people may be negatively impacted. Conversely, those whose sense of place of Fossil Creek is enhanced by expanded access or proximity to other visitors may be positively impacted.

Development of new facilities would be guided by a comprehensive design process. This would promote enhancement of sense of place.

Cumulative Effects of All Alternatives

The cumulative effects area for this report is the analysis area and the time period is 20 years. It is anticipated that the alternatives would be similar in the cumulative effect to scenery that would result from their implementation in the context of other past, present, and reasonably foreseeable future actions, so these effects are addressed together.

Motor vehicle use and routine maintenance on Forest Service system roads, utility corridor maintenance, livestock grazing, personal use fuelwood collection, vegetation and fire management, and mineral quarrying are anticipated activities of the past, present and reasonably foreseeable future.

Livestock grazing is authorized on allotments within and adjacent to the Fossil Creek WSR corridor. However, most pastures that overlap with the WSR corridor are not currently grazed. A limited amount of mineral quarrying occurs in the vicinity of the Fossil Creek WSR corridor to provide materials for road surfacing. The limited nature of this activity and distance from the WSR corridor make it unlikely that it would substantially interfere with Fossil Creek's scenic integrity or valued landscape character. As a result, livestock grazing and mineral quarrying occurring in conjunction with continued management of Fossil Creek under Alternative A or management under the action alternatives are anticipated to have negligible cumulative effect on scenic integrity or valued landscape character.

Past projects include installation of the utility corridors, wildland-urban interface (WUI) treatments near Strawberry on the Tonto NF, and road maintenance and improvements. Present and future activities include routine powerline corridor maintenance clearing, travel management and concentrated recreation use.

Past vegetation management activities and proposed WUI treatments have resulted in short term (up to 5 year) decreases in visual quality/scenic integrity. The WUI treatments near Strawberry have resulted in obvious deviations from the landscape character due to the thinning technique used. These changes to landscape character will be more enduring, lasting until the trees grow sufficiently to look more natural or new pinyon-juniper and shrubby vegetation is established. If this occurs, there should not be a further long-term decline in landscape character. Planned vegetation and fire management are routine activities completed by the Forest Service. Conversely, wildfires would likely result in the greatest cumulative impact to scenic resources. Though wildfires may be a natural part of the Southwestern forest ecosystem, high-severity large-scale wildfires that remove the majority of vegetative cover from entire viewsheds would have a cumulative negative impact by removing the vegetative screening from unnatural linear features such as roads, trails, powerlines, etc.

The utility corridors and continuing powerline clearing result in lowered scenic integrity objectives. These result in long term decreases in visual quality/scenic integrity.

Management measures related to recreation use and travel management will have positive and long term effects. Closure and/or decommissioning of roads would improve the naturalness of the analysis area over time. Managing for recreational use within established capacities and prohibition of cross country motorized travel will both result in decreases in denuded areas and bare ground.

In some instances, the sequential viewing of management activities from designated travelways and use areas combined with disturbance resulting from new restoration areas or development proposed under the CRMP alternatives can cumulatively degrade scenery and perceptions of landscape character. As an example, views of dispersed camping impacts along a roadway like FR708, combined with impacts from a vegetation management associated with the clearing of the kV utility corridor and the developed parking at designated areas in the river corridor, can cumulatively degrade scenic quality as perceived by travelers. While this effect will be slightly more pronounced for alternatives that propose more recreational development, overall, however, the cumulative effect of this sequential viewing should not have a lasting impact on valued landscape character or sense of place

because this sequential viewing is a fluid experience and a visitor's view of altered landscapes will likely be of short duration.

Summary

This section summarizes the findings of the effects implementation of the CRMP alternatives would have on scenery in the Fossil Creek WSR corridor.

Degree to Which the Purpose and Need for Action is Met

The purpose of this project is to develop a CRMP that provides for public use and enjoyment of the Fossil Creek WSR and protection and enhancement of its river values. Although scenery is not a river value itself, it indirectly influences the condition of the recreation ORV as it shapes the landscape character valued by Fossil Creek's visitors. Although negative impacts to scenery may result from implementing alternatives B-F, it is not anticipated that these impacts would occur to the degree that the recreation ORV is adversely affected. In fact, programmatic management direction and actions proposed under the CRMP alternatives are intended to support protection of scenic integrity/visual quality in addition to protecting and enhancing river values.

Degree to Which the Alternatives Address the Issues

The issue most directly related to scenery is "additional infrastructure development may reduce the wild character and scenic integrity of Fossil Creek." Alternatives C and D include the fewest recreation sites and thus the lowest potential that infrastructure reduces the scenic integrity/visual quality of Fossil Creek. Alternative E has the most recreation sites and thus the highest potential that infrastructure reduces scenic integrity/visual quality. However, development of infrastructure in all alternatives would be guided by a comprehensive design process intended to enhance the ability of Fossil Creek's infrastructure to compliment landscape character and enhance sense of place.

Summary of Environmental Effects

Table 2-5 summarizes the effects implementing the no action and action alternatives would have on scenery.

Short-term Uses and Long-term Productivity

Recreation sites, roads, and trails represent long-term deviations from landscape character. However, with design considerations that would be supported by the CRMP, the impact these deviations have on the overall scenic integrity/visual quality of Fossil Creek should be minimized.

Impacts to scenic integrity/visual quality will likely occur during construction and restoration actions. However, these impacts would be short-lived and, in the case of restoration actions, support enhancement of overall scenic integrity/visual quality.

Vegetation and ground cover disturbance, soil compaction, and trash and human waste associated with dispersed recreation would impact landscape character and scenic integrity/visual quality. If allowed to persist, these impacts may be long-term. However, a more managed recreation environment would reduce these impacts. Further, detection of impacts through monitoring and correction through adaptive management would help limit these impacts to the short term.

Unavoidable Adverse Effects

Although adverse effects to scenery may result from activities associated with the CRMP, management direction the CRMP provides and monitoring and adaptive management that would detect and address unanticipated effects would help alleviate adverse effects.

Irreversible and Irretrievable Commitments of Resources

Although the presence of recreation sites, roads, and trails may represent an irretrievable reduction in scenic integrity/visual quality, the reduction is not irreversible because these features can be removed and the landscape restored to a natural state.

Chapter 4. Consultation, Coordination, and List of Preparers

Introduction

This chapter lists agencies consulted during development of the Fossil Creek CRMP and EIS, summarizes tribal consultation, and lists persons who contributed to development of the CRMP and EIS. All agencies and tribes described in this chapter were provided a link to access the EIS and CRMP, and the project record contains full lists of individuals who received information about this project. Arizona Game and Fish Department is a cooperating agency. More detail on the public involvement process can be found in the "Collaboration and Public Involvement" section of Chapter 1 and the "Alternative Development Process" section of Chapter 2.

Tribal Consultation

Tribal concerns regarding the presence of areas of traditional cultural importance and potential effects to those places were gathered directly from the tribes through consultation. Tribal consultation is best carried out through direct face-to-face meetings between federally recognized tribes and the Federal government. Other components of tribal consultation may include sharing of information through letter carried mail, email, and follow-up telephone calls, which supplement the face-to-face meetings.

American Indian Law requires consultation between the U.S. Forest Service and federally recognized American Indian tribes; however, acknowledging that we share a common interest in maintaining the health of Fossil Creek, consultation has been extended beyond the legal requirements. Numerous informal discussions have occurred with tribal representatives regarding the planning process and the ongoing interim management of the corridor. With the knowledge that American Indian people have inhabited the Fossil Creek area for centuries, traditional knowledge has been considered in the ongoing effort to restore and maintain a healthy riparian ecosystem.

The following tribes were informed of the project:

Ak-chin, Ft. McDowell Yavapai, Gila River, Havasupai, Hopi, Hualapai, Kaibab Band of Paiute, Navajo Nation, Salt River Maricopa, San Carlos Apache, Tonto Apache, White Mountain Apache, Yavapai–Apache, Yavapai–Prescott, and Pueblo of Zuni. Tribes that do not actively participate in tribal consultation will continue to receive information via email and hand delivered mail. Information will be shared unless a tribe asks specifically to not be informed.

Table 4-1 is an up-to-date complete listing of information sharing and consultations with federally recognized tribes regarding the Fossil Creek Wild and Scenic River. Tribal consultation will be ongoing throughout the Fossil Creek project. Due to the Yavapai-Apache Nation's ongoing use of the area, tribal consultation will continue to inform on the management of the corridor after the Record of Decision is issued.

Table 4-1. Summary of Tribal Consultation

Date and type of Meeting	Tribe
December 17, 2009/ Fossil Creek Consultation/Field Trip	Yavapai-Apache Nation
May 20-12, 2010/ Fossil Creek Consultation/Field Trip	Yavapai-Apache Nation
June 8, 2010/ Fossil Creek Field Trip	Yavapai-Apache Nation
March 30, 2011/ Fossil Creek Consultation	Yavapai-Apache Nation*
May, 2011/SOPA Consultation	Hopi Tribe
June 7, 2011/ Fossil Creek Consultation/Field Trip	Yavapai-Apache Nation
July, 2011/SOPA Consultation	Hopi Tribe
October, 2011/SOPA Consultation	Hopi Tribe
November 29, 2011/ Fossil Creek Consultation	Tonto Apache Tribe
January, 2012/ SOPA Consultation	Navajo Nation
February, 2012/ SOPA Consultation	Hopi Tribe

Date and type of Meeting	Tribe
April, 2012/ SOPA Consultation	Hopi Tribe
November, 2012/ SOPA Consultation	Hopi Tribe
January 28, 2013/ Fossil Creek Consultation	Yavapai-Apache Nation & Tonto Apache Tribe
February 25, 2013/ Fossil Creek Consultation	Yavapai-Apache Nation
March 14, 2013/ Fossil Creek Consultation	Yavapai-Apache Nation
April 30, 2013/ Fossil Creek Consultation/Field Trip	Yavapai-Apache Nation & Tonto Apache Tribe
June 3, 2014/ Fossil Creek Consultation	Yavapai-Apache Nation
October 8, 2014/ Fossil Creek Consultation	Yavapai-Apache Nation
November 21, 2014/ Letter	Yavapai-Apache Nation
January 6, 2015/ Fossil Creek Consultation	Yavapai-Apache Nation
June 2, 2015/ Fossil Creek Consultation/Field Trip	Yavapai-Apache Nation
February 9, 2017/Discuss Proposed Vault Toilet Installation	
March 6, 2017/Discuss Preliminary Alt. Concepts	Yavapai-Apache Nation
March 15, 2017/ Field Trip and Fossil Creek Consultation	Yavapai-Apache Nation
June 26, 2017/Arch. Contractor Prelim. Report, CRMP Alts., Bear (Fossil Springs) Trail	Yavapai-Apache Nation
July 21, 2017/Bear (Fossil Springs) Trail Consultation	Yavapai-Apache Nation
August 28, 2017/ Field Trip and Fossil Creek Consultation	Yavapai-Apache Nation
September 20, 2017/ Letter	Yavapai-Apache Nation
September 20, 2017/ Letter	Tonto Apache Tribe
September 27, 2017/ Letter	Tonto Apache Tribe
September 27, 2017/ Letter	White Mountain Apache Tribe
November 8, 2017/Fossil Creek Consultation Regarding Likelihood of New Alternative	Yavapai-Apache Nation
May 2, 2018/ Fossil Creek Consultation Regarding New Alternative (F)	Yavapai-Apache Nation
May 21, 2018/Letter	Yavapai-Apache Nation
June 13, 2018/ Fossil Creek Consultation Regarding Bear (Fossil Springs) Trail	Yavapai-Apache Nation

*Following this meeting the Yavapai-Apache Nation issued a Fossil Creek Resolution, No. 81-11 (see Heritage Resources Specialist Report).

Federal, State, and Local Agencies Consulted

Federal, State, and Local Agency Consultation

U.S. Fish and Wildlife Service (USFWS): The Forest Service partners with the USFWS to protect endangered species, manage migratory birds, restore nationally significant fisheries, and conserve and restore wildlife habitat. The USFWS participates with AGFD in reintroduction, surveys, and monitoring of listed species. To meet Endangered Species Act requirements, the Forest Service enters into informal and/or formal consultation on the effects of implementation of proposed actions on federally-listed or proposed species and critical habitat.

Bureau of Reclamation (BOR): The BOR assisted the Forest Service with permanent fish barrier installations. The BOR oversees annual inspections of fish barriers but is transferring operation and maintenance responsibilities to the Central Arizona Water Conservation District.

Arizona State Historic Preservation Office (SHPO): SHPO is a state office with a federal mandate. Under Section 106 of the National Historic Preservation Act of 1966 and its implementing regulations at 36 CFR 800, federal agencies are required to consult with SHPOs regarding the eligibility of historic and cultural properties for nomination to the National Register of Historic Places and on determinations of effect from federal undertakings and management decisions.

Arizona Game and Fish Department: AGFD, as the agency responsible for managing and protecting Arizona's fish and wildlife resources, is a cooperating agency in developing the CRMP. AGFD leads the reintroduction, surveys, and monitoring of wildlife and native fish species within the Fossil Creek WSR.

Arizona Department of Environmental Quality (ADEQ): ADEQ sets guidance to prevent, control, and abate pollution of air, water and land resources; provides critical information on water-quality conditions; establishes water quality standards, and develops water-quality management plans. If water quality within Fossil Creek were to be placed on the list of streams not meeting water quality standards (303(d) list), then ADEQ would place the reach(es) not meeting standards on their schedule of streams for developing water-quality management plans.

Arizona Department of Water Resources (ADWR): ADWR ensures dependable long-term water supplies for Arizona communities. It administers state water laws (except those related to water quality), explores methods of augmenting water supplies to meet future demands, and works to develop public policies that promote conservation and distribution of water. It oversees the use of surface and ground water resources under state jurisdiction.

Gila and Yavapai Counties: Forest Road 708 from Highway 260 to Fossil Creek is maintained in part by Yavapai County under a road maintenance agreement. In terms of emergency response, sheriff's offices for both Gila and Yavapai counties assist within the Fossil Creek WSR corridor. Local and county governments possess the authority to regulate and control land use and development activities.

Gateway Communities: The communities of Camp Verde and Strawberry/Pine have been involved through the iterative phases of planning and public outreach for the Fossil Creek Wild and Scenic River Plan. The Forest Service has presented project updates at town commission meetings and to various interested community organizations. The Verde Front regional collaborative, made up of central Arizona community stakeholders, created the Fossil Creek Working Group that has provided input to the Forest Service on the project's planning, management, and monitoring. The working group contains roughly 30 participants, including state entities like Arizona State Parks; local government entities like the Town of Camp Verde and the Pine-Strawberry Fire Department; Gila, Yavapai, and Coconino counties; congressional offices and other political entities; academic institutions like Northern Arizona University; environmental groups like the Center for Biological Diversity and the Sierra Club; and tribal groups like the Yavapai-Apache Nation.

Agencies and Individuals Notified in the Past

Since 2010, public and partner involvement has played a critical role in helping the Forest Service assess management needs within the Fossil Creek Wild and Scenic River corridor and develop components of the draft CRMP and DEIS. The Forest Service has sent notification letters to the agencies consulted (above) as well as to others including Governor Doug Ducey's Office as well as U.S. Government Offices of former Sen. John McCain, Sen. Jeff Flake, and Rep. Paul Gosar.

The project's mailing list contains approximately 1,700 organizations and individuals, which were notified of the Nov. 29, 2016, release of the Notice of Intent in the *Federal Register*. The full list of people notified is contained in the Fossil Creek Wild and Scenic River's project record.

Agencies and Individuals to Be Notified Now

Agencies, organizations, businesses, and individuals to receive the Fossil Creek draft CRMP/DEIS include the U.S. Environmental Protection Agency and those on the 1,700 mailing list. Several thousand more individuals, who applied for a seasonal reservation permit to enter the Fossil Creek Wild and Scenic River Corridor in 2016 and 2017, will also be included.

List of Preparers

Table 4-2 lists Forest Service individuals who contributed to development of the Fossil Creek CRMP and EIS.

Table 4-2. List of Preparers

Name	Affiliation	EIS Contribution	Education	Years of Experience
Marcos Roybal	Coconino NF, Red Rock RD	Project leadership; document development; GIS	M., Water Resources Management/Community & Regional Planning, University of New Mexico, 2012 B.S. Natural Resources Management, Colorado State University, 2009.	7 FS 3 Other
Elizabeth Munding	Coconino NF, Red Rock RD	Planning expertise; document development	M.S., Forestry—Parks, Recreation and Tourism, University of Maine-Orono, 2006 B.A. Journalism and B.A. Spanish, University of Missouri-Columbia, 1989	4 FS 6 Other
Tom Runyon	Coconino NF	Watershed condition, free flow, water quality, water quantity, riparian function, soil condition, and air quality	M.S., Environmental Engineering, University of Arizona, 1989 B.S., Geology, Northern Arizona University, 1985	7 FS 23 Other
Janie Agyagos	Coconino NF, Red Rock RD	Wildlife, vegetation, and rare plants	B.S. Fisheries and Wildlife Management Arizona State University, 1993	25 FS
Matt O'Neill	Coconino NF, Supervisor's Office	Fish and aquatics	Ph.D. Biology, Northern Arizona University, 2013 M.S. Biology, Northern Arizona University, 2005 B.S. Biology, Florida Institute of Technology, 1999	2 FS 6 Other
Ted Neff	Coconino NF, Red Rock RD	Cultural and heritage resources; tribal consultation	Ph.D. Anthropology, University of Pennsylvania, 2008 M.A. Anthropology, Rutgers University, 1993 B.A. Anthropology and History, Marquette University, 1987	3 FS 27 Other
Adam Barnett	Coconino NF, Red Rock RD	Recreation	M.S., Resource Recreation and Tourism, University of Idaho, 2004 B.A. Political Science, Vassar College, 1992	15 FS 9 Other
Steve Overby	Forest Service Rocky Mountain Research Station	Geology	Ph.D. Forest Ecology, Northern Arizona University, 2009 M.S. Environmental Sciences Arizona State University, 1994 B.S. Range Ecology, Colorado State University, 1983	34 FS
Sarah Belcher	Coconino NF, Red Rock RD	Scenery	MLA, Landscape Architecture, Virginia Polytechnic Institute 2003 B.A. Human Studies, Warren Wilson College, 1995	15 FS
Kristen Waltz	Forest Service Enterprise Program	Socioeconomics	M.S. Resource Economics, University of Delaware, 2008 B.S. Natural Resource Management, University of Delaware, 2006	5 FS 4 Other
Nicole Branton	Coconino NF, Red Rock RD	Project leadership	Ph.D. Anthropology, University of Arizona, 2004 M.A. Anthropology, University of Arizona, 2000	FS 20 Other 2

Name	Affiliation	EIS Contribution	Education	Years of Experience
			B.A. Anthropology, Southern Illinois University, 1998	
Debbie Hom	Coconino NF, Red Rock RD	GIS	B.A. Biological Sciences, California State University, 1987	29 FS
Bjorn Fredrickson	Forest Service Region 3 Regional Office	Wild and scenic rivers, recreation	M., Environmental Science, Yale School of Forestry and Environmental Studies, 2009 B.A., Environmental Studies, Yale University, 2007	9 FS 2 Other
Kyung Koh	Forest Service Region 3 Regional Office	Recreation	M., Environmental Science and Management, Bren School, University of California, Santa Barbara, 2010 B.A., English and B.A., Environmental Studies, University of California, Santa Barbara, 1999	8 FS 9 Other
Patrick McGervey	Coconino NF	Recreation (former)	B.S. Parks and Recreation Management, California State University Chico, 2006	12 FS
Charlotte Minor	Coconino NF	Project leadership; recreation; scenery (former)	MLA, Landscape Architecture, University of Arizona, 1990 B.S. Forestry, Northern Arizona University, 1981	27 FS 5 Other
Jennifer Burns	Coconino NF, Red Rock RD	Recreation (former)	MLA, Landscape Architecture, University of Arizona B.S. Renewable Natural Resource Management, University of Arizona	32 FS and Other
Larry Vogel	Tonto NF, Payson RD	Recreation, special uses (former)	B.S. in Forestry Utah State University, 1997	6 FS
Travis Bone	Coconino NF, Red Rock RD	Cultural and heritage resources (former)	M.A., Anthroplogy, Northern Arizona University, 2002 B.S.B.A. Finance, Business Administration, Northern Arizona University, 1993	16 FS
Amina Sena	Coconino NF, Red Rock RD	Watershed condition, free flow, water quality, water quantity, riparian function, soil condition, and air quality (former)	B.S. Watershed Management, New Mexico Highlands University, 2006 M. Life Science Natural Resources Management, New Mexico Highlands University, 2008	14 FS
Judy Adams	Coconino NF, Red Rock RD	Lands (former)	B.S. Forestry, Michigan Technological University, 1984	32 FS
Grant Loomis	Tonto NF	Water (former)	M.S. (All but thesis) University of.Arizona, 1979 B.A. Economics, University of California-Davis, 1976	32 FS 8 Other
Rory Steinke	Coconino NF	Soils; hydrology (former)	B.S. Soil Science, University of Wisconsin Stevens Point, 1981	35 FS and Other
Mike Childs	Coconino NF, Red Rock RD	Fish and aquatics (former)	M.S. Fisheries and Wildlife Management, Oklahoma State University, 1993 B.S. Fisheries and Wildlife Management, Arizona State University, 1990	6 FS 15 Other
Laura Moser	Coconino NF	Vegetation, rare plants, and riparian restoration (former)	M.S. Forest Health and Restoration at Northern Arizona University, 1999	17 FS 3 Other

Name	Affiliation	EIS Contribution	Education	Years of Experience
			B.S. Plant Genetics at University of California Davis, 1990	
Debbie Cress	Tonto NF	Riparian and botany (former)	*	*
Polly Haessig	Coconino NF, Mogollon Rim RD	Geology (former)	M.S. Geology, Oregon State University, 1988 B.A. Anthropology, Occidental College, 1979	28 FS 2 Other
Mark Schwab	Forest Service Region 3 Regional Office	Geology (former)	B.A. Geological Sciences, University of California, Santa Barbara, 1983	20 FS 10 Other

* Biographical information unavailable

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List of Acronyms

ADEQ – Arizona Department of Environmental Quality
ADWR – Arizona Department of Water Resources
AGFD – Arizona Game and Fish Department
AMZ – Aquatic Management Zone
APS – Arizona Public Service Company
AZCC – Arizona Conservation Corps
BCE – Before Common Era
BMP – Best Management Practice
BOR – Bureau of Reclamation
CE – Common Era
CFR – Code of Federal Regulations
CFS – Cubic Feet per Second
COBH – Common Black-hawk
CPUE – Catch per Unit Effort
CRMP – Comprehensive River Management Plan
DEIS – Draft Environmental Impact Statement
EA – Environmental Assessment
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency
ESA – Endangered Species Act
FERC – Federal Energy Regulatory Commission
FR – Forest Road
FS – Forest Service
FSH – Forest Service Handbook
FSM – Forest Service Manual
IBI – Index of Biological Integrity
IMPROVE – Interagency Monitoring of Protected Visual Environments
IWSRCC – Interagency Wild and Scenic Rivers Coordinating Council
LRMP – Land and Resource Management Plan
MA – Management Area
MIS – Management Indicator Species
mL – Milliliter
NAU – Northern Arizona University
NEPA – National Environmental Policy Act
NFMA – National Forest Management Act
NFS – National Forest System
NOI – Notice of Intent
NRHP – National Register of Historic Places
NVUM – National Visitor User Monitoring
OAW – Outstanding Arizona Waters
PAC – Protected Activity Center
PAOT – Persons at One Time
OCWC – Oak Creek Watershed Council
OHV – Off-highway Vehicle
ORV – Outstandingly Remarkable Value
SHPO – State Historic Preservation Office
TCP – Traditional Cultural Property
US – United States
USC – United States Code
USDA – United States Department of Agriculture
USFS – United States Forest Service
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
VES – Visual Encounter Survey
VWRC – Verde Watershed Restoration Coalition
WAPA – Western Area Power Administration
WSR – Wild and Scenic River
WSRA – Wild and Scenic Rivers Act

Glossary

Adaptive Management: A "rigorous approach for learning through deliberately designing and applying management actions as experiments" (Murray and Marmorek 2003). The CRMP includes monitoring indicators and metrics associated with specific objectives. As the CRMP is implemented, monitoring provides the data that informs the adaptive management process and is the critical link in determining when action is needed. Adaptive management is an important component of this CRMP and is described in Chapter 6.

Adverse Impact: A substantial reduction in the condition of a river value in relation to baseline conditions as a result of public use, development, and/or administrative use. An adverse impact is a condition that requires immediate management attention. It may be detected by periodic monitoring or by other means. When more than one indicator is monitored for any river value, an adverse impact associated with any one of the indicators constitutes an adverse impact on the value as a whole. This definition is specific to the WSRA and is not the same as the definition used in NEPA. General definitions of adverse impact with respect to the river values are provided in Chapter 2 of the CRMP.

Aquatic Management Zone (AMZ): An established area that generally follows the shape of the streamcourse and consists of vegetation and vegetative litter within a specified distance from the edge of the stream. The purpose of the AMZ is to buffer against detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that may seriously and adversely affect water conditions or fish habitat, similar to the "riparian management zone" described at 36 CFR 219.8(a)(3)(ii). In Fossil Creek, the AMZ is established 100 feet from either edge of the perennial portion of Fossil Creek and 50 feet or encompassing the entire riparian area on each side of intermittent streams, whichever is wider.

Baseline Condition: The condition of river values at the time of designation of a wild and scenic river. Fossil Creek's baseline year is 2009. Baseline conditions are described in Chapter 2 of the CRMP.

Best Management Practices (BMPs): Methods, measures, or practices selected by an agency to meet its nonpoint source pollution control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

Degradation: The state in which a river value has been fundamentally altered by public use or development to the point that its condition is reduced below the baseline documented at time of designation. Degradation is a long-term, segmentwide condition. A river value has been degraded when recovery would only be possible through a sustained change in management and a significant investment of financial capital. Degradation may be detected by periodic monitoring or by other means. Degradation of river values is prohibited by the Wild and Scenic Rivers Act. General definitions of degradation with respect to the river values are provided in Chapter 2 of the CRMP.

Desired Conditions: Plan components that set forth the desired social, economic, and ecological goals of Fossil Creek. They attempt to paint a picture of what we (the public and the Forest Service) desire the WSR corridor to look like or the goods and services we desire it to provide. Desired conditions are generally expressed in broad, general terms; however, more specificity may be added to clarify the intent. Desired conditions are timeless in that there is no specific date by which they are to be completed. They are aspirations and not commitments or final decisions that approve projects or activities, and they may only be achievable over a long timeframe. Projects and site-specific activities must be consistent with desired conditions. Projects that conflict with desired conditions would require a plan amendment. Desired conditions for Fossil Creek are described in Chapter 3 of the CRMP. Forest-wide desired conditions are described in the land and resource management plans for the Coconino and Tonto national forests.

Enhancement: Actions taken to improve the condition of a river value. Such actions improve the conditions of a river value to the point where the river value's condition meets or exceeds the desired condition. Where possible, these actions correct past and present degradation. The state of enhancement is the best possible condition for a river value.

Free-flowing: The condition of a river, or section of a river, moving in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. A river must be in a free-flowing state to be eligible for inclusion in the National Wild and Scenic Rivers System.

Guidelines: Plan components that are sideboards that guide management activities and provide specifications that a project or activity would adopt unless there is a compelling or defensible reason to vary from the guideline. A guideline is applied only after it has been analyzed in project-level planning and included in a project decision. Unlike a standard, deviation from the explicit provisions of the guideline is permitted without a plan amendment, as long as the intent of a guideline is met. Deviation from the explicit provisions of a guideline, if it is meeting the intent of the guideline, must be documented in the project record. Projects that deviate from a guideline's intent must be accompanied by a plan amendment that would allow for the deviation. Guidelines for projects and activities in Fossil Creek are described in Chapter 3 of the CRMP. Forest-wide guidelines are described in the land and resource management plans for the Coconino and Tonto national forests.

Heritage Resource: Heritage resources consist of both the Fossil Creek Cultural Outstanding Remarkable Value and National Register of Historic Places-eligible historic properties. Historic properties are also referred to as archaeological sites.

Indicator: A factor assessed through monitoring to determine the condition of river values. Indicators are selected based their relationship to river values, their ease of measurement, precision, sensitivity to changes over time, and, if possible, their ability to satisfy multiple objectives of the monitoring process. Indicators are provided in Chapter 6 of the CRMP.

Interim Management Measures: Management actions taken to ensure a wild and scenic river's values are protected while development of the comprehensive river management plan is ongoing.

Management Approaches: Statements that help clarify how plan direction may be applied and identify probable management actions that are designed to maintain or make progress toward desired conditions and objectives. Management approaches are strongly influenced by recent trends, past experiences, anticipated staffing levels, and short-term budgets. Management approaches for projects and activities in Fossil Creek are described in Chapter 3 of the CRMP. Forest-wide management approaches are described in the land and resource management plans for the Coconino and Tonto national forests.

Middle Fossil: The reach of Fossil Creek between the Mazatzal recreation site upstream to ¼ mile above the waterfall at the end of the Lewis (Waterfall) Trail.

Mitigation: A component of resource protection measures. Mitigation includes: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or (e) compensating for the impact by replacing or providing substitute resources or environments.

Monitoring: Evaluation of the condition of river value-related indicators to determine if they are protected and enhanced or to detect adverse impacts and to inform the need for adaptive management actions. Monitoring is described in Chapter 6 of the CRMP.

National Register of Historic Places-Eligible Historic Property: A historic property that is National Register-Eligible (as per the National Historic Preservation act of 1966, as amended, and through promulgated regulations).

Objectives: Concise, time-specific statements of measurable, anticipated results that help achieve or move toward desired conditions over the life of the plan. Objectives are projections based on recent trends, current and anticipated staffing levels, and anticipated budgets. Activities specified in objectives are intended to help make

progress toward achieving desired conditions and represent just some of the outcomes or actions expected to accomplish movement toward desired conditions. Objectives for projects and activities in Fossil Creek are described in Chapter 3 of the CRMP. Forest-wide objectives are described in the land and resource management plans for the Coconino and Tonto national forests.

Ordinary High Water Mark: The U.S. Army Corps of Engineers defines the ordinary high water mark as "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."

Other Use: Use within a WSR corridor other than public use (defined below), such as federally authorized mining, forestry, grazing, subsistence hunting and fishing, road use and management, administrative use for other than WSR purposes, and use on non-federal lands in a WSR corridor that have a potential to affect river values. Other use also includes any use on federal or non-federal lands that border upon or are adjacent to a WSR corridor that may substantially interfere with public use and enjoyment of river values.

Outstandingly Remarkable Value (ORV): A scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar river-related value that is unique, rare, or exemplary feature and is significant when compared with similar values from other rivers at a regional or national scale. Fossil Creek's ORVs are geology, biological, recreation, and Western Apache and Yavapai traditional and contemporary cultural values. ORVs are described in detail in Chapter 2 of the CRMP.

Plan Components: Desired conditions, objectives, standards and guidelines. Once plan components are approved, any substantive changes to them will require a plan amendment. Plan components are described in Chapter 3 of the CRMP. Forest-wide plan components are described in the land and resource management plans for the Coconino and Tonto national forests.

Protection: Documenting and eliminating adverse impacts on river values, including activities that were occurring on the date of designation. Protection of river values is mandated by the Wild and Scenic Rivers Act.

Public Use: Visitor use and WSR-specific administrative use within a WSR corridor.

Recreation Sites: Recreation sites include both developed recreation footprints and recreation dispersal footprints. Developed recreation footprints are areas within the Fossil Creek WSR corridor in which disturbance from machinery, the building of infrastructure, the presence of vehicles, and use by visitors may occur. Recreation dispersal footprints are areas within the Fossil Creek WSR corridor where effects from visitor use may occur, but no major machinery or infrastructure will be used or built in these areas. Minor allowed infrastructure or actions could include signage, hardened trails and armored creek access, and restoration activities.

Refugia: Upland and riparian areas outside of recreation sites, roads, and trails where the effects of visitor use are so minor as to be negligible and use of heavy machinery or development of infrastructure will not occur.

Resource Protection Measures: Actions taken to ensure management activities do not adversely impact river values. Resource protection measures include mitigation and best management practices (defined above).

River Corridor: Also referred to as the WSR corridor. The geographic area generally encompassed within one-quarter mile on either side of Fossil Creek that contains the river and its outstandingly remarkable values. Fossil Creek's river corridor is described in Chapter 1 of the CRMP.

River-related or river-dependent: The state of being located in the river or on its immediate shorelands (generally within 0.25 mile on either side of the river); contributing substantially to the functioning of the river ecosystem; and/or owing its location or existence to the presence of the river.

River Segment Classifications: The Wild and Scenic Rivers Act creates Wild, Scenic, and Recreational segment classifications:

- ***Wild:*** Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- ***Scenic:*** Rivers or sections that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- ***Recreational:*** Those rivers or sections that are readily accessible by road or railroad, may have some development along their shorelines, and may have undergone some impoundment or diversion in the past.

River Values: The characteristics that contributed to designation as a wild and scenic river. Fossil Creek's river values are a combination of its outstandingly remarkable values (defined above) and its water. Fossil Creek's river values are described in detail in Chapter 2 of the CRMP.

Section 7 Analysis: An analysis undertaken to determine whether a proposed water resources project (defined below) within Fossil Creek would have a "direct and adverse" effect on Fossil Creek or whether a proposed water resource project below, above, or on a stream tributary would "invade" Fossil Creek or "unreasonably diminish" its river values.

Standards: Plan components that are constraints upon project and activity design. A standard is an absolute requirement to be met in the design of projects and activities. A standard is applied only after it has been analyzed in project-level planning and included in a project decision. A project or activity is consistent with a standard when its design is in accord with the explicit provisions of the standard; variance from a standard is not allowed except by plan amendment. Standards for projects and activities in Fossil Creek are described in Chapter 3 of the CRMP. Forest-wide guidelines are described in the land and resource management plans for the Coconino and Tonto national forests.

Thresholds: Thresholds signify degrees of movement toward degradation of river values. Soft and hard thresholds are pre-defined decision points that indicate, barring mitigating circumstances, an adaptive management action is warranted to ensure protection or prevent degradation of river values. Soft thresholds indicate the point at which adverse impacts may be at risk of occurring. Hard thresholds indicate the point at which the risk of degradation is threatened.

Traditional Cultural (uses/values/importance): Associated with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.

Traditional Cultural Property: A cultural (heritage) resource that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. The entity evaluated for eligibility for inclusion in the National Register of Historic Places must be a tangible property; that is, a district, site, building, structure, or object as defined in 36 CFR 64.4 (Forest Service Manual, Chapter 2360). Currently, a draft Fossil Creek Traditional Cultural Property nomination is under review at the USFS Washington Office.

Travertine: Biotically and/or abiotically precipitated calcium carbonate (predominately calcite and aragonite) from spring-fed, heated and/or ambient-temperature waters. Travertine is chemically identical to the mineral calcite.

User Capacity: The maximum amounts and kinds of public use that a WSR collectively or by analysis area can accommodate without degrading river values.

Visitor Use: Human presence within a WSR corridor for recreational purposes, including education, interpretation, inspiration, and physical and mental health.

Water Resources Projects: Water resources projects are projects proposed in the bed or banks of a designated river or congressionally authorized study river and that are proposed by a federal agency or require some type of federal assistance such as a permit, license, grant, or loan. Water resources projects include any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the Federal Power Act, or other construction of developments which would affect the free-flowing characteristics of a wild and scenic or congressionally authorized study river. In addition to projects licensed by the Federal Energy Regulatory Commission, water resources projects may also include: dams; water diversion projects; fisheries habitat and watershed restoration/enhancement projects; bridges and other roadway construction/ reconstruction projects; bank stabilization projects; channelization projects; levee construction; recreation facilities such as boat ramps and fishing piers; and activities that require a 404 permit from the Army Corps of Engineers.

"Bed or banks" is limited to the area within the ordinary high water mark of the river. The ordinary high water mark is defined in 33 CFR Part 328.3(c)(6) as "…that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."

Wild and Scenic River: A river that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values that, by inclusion in the national wild and scenic rivers system created by the Wild and Scenic Rivers Act, is preserved in free-flowing condition, and that is protected for the benefit and enjoyment of present and future generations.

Wild and Scenic River-Dependent Activities: Those activities that happen specifically in a WSR setting, and that may not necessarily occur in other areas with similar features. WSR-dependent activities are also those activities that allow visitors to appreciate and value the river values that make the area special. For example, water play in this unique environment, where the water is a clear turquoise blue, is unique to Fossil Creek Wild and Scenic River corridor.

WSR-specific Administrative Use: Use within a WSR corridor by the river manager, including ranger patrols, maintenance activities, field research, staff visits to administer contracts or facilities, search and rescue, and interpretative programs for the purpose of protection or enhancement of river values.

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