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Adapting to Wildfire: A Review of Ongoing Wildfire Planning and Mitigation Efforts Across 10 Landscapes in the Western United States

Robert M. Anderson, Kathryn Hixson, Kelly Johnston, Miranda H. Mockrin,
and Molly Mowery



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Wildfire impacts on communities and forests are a growing crisis in the United States. In 2022, the U.S. Department of Agriculture, Forest Service launched a major investment in landscape-level treatments to reduce hazardous fuels, which focused on 10 priority landscapes across eight states in the Western United States. Although these landscapes were designed to encompass communities facing high levels of wildfire risk, it is less clear how other community characteristics might vary, including sociodemographics, wildfire history, and past efforts to reduce wildfire risk. The goal of this report is to systematically describe the 10 landscapes initially prioritized by the Forest Service's Wildfire Crisis Strategy (WCS) to inform collaborative adaptation efforts between the agency and local communities. We collected information on landownership and economic and demographic trends at the county level; overviewed vegetation and recent wildfire history at the landscape level; and described two wildfire adaptation efforts: (1) the extent of fuel treatments conducted on National Forest System (NFS) lands in the past decade and (2) land-use planning, policy, and regulatory tools implemented at the county scale to address wildfire hazards. We found that although the areas included in the initial WCS landscapes share extensive housing in the wildland-urban interface, they span a range of social settings. Some landscapes are in largely rural, sparsely populated areas, while others are centered around metropolitan areas, many of which have seen substantial population growth, urbanization, and residential development in high wildfire hazard areas over recent years. Many residents of WCS landscapes have similar potential vulnerabilities, particularly in rural counties, including lower per capita income, older populations, and mobile homes representing a larger proportion of housing. Our analysis of fuel treatments conducted on NFS lands shows variation in the area treated, from less than 4 percent of NFS lands in some landscapes treated in the past decade to a high of 20 percent in others. We also found that counties across the WCS landscapes ranged substantially in their use of planning, policy, and regulatory tools, with some having comprehensive approaches in place, while others were beginning this process. There was no clear relationship between county-scale planning and regulatory adaptations and fuel treatment efforts, but counties with larger numbers of wildland-urban interface housing units typically had higher investment in one or both adaptations. This report lays the groundwork for more research to examine the human dimensions of implementation of the WCS, and more broadly, the processes of adaptation to growing wildfire risk in the Western United States.

KEYWORDS:

Hazard	Wildfire
Planning	Wildfire Crisis Strategy
Risk reduction	

Summary

The impacts of wildfire on communities and forests are a growing crisis in the United States, with rapid increases in the intensity, size, and frequency of wildfires posing substantial risks to both human communities and ecosystems. This crisis arises from a confluence of factors, including past forest management practices, altered fire regimes, a changing climate, and expanding human development in wildfire-prone areas. In response, in 2022, the U.S. Department of Agriculture, Forest Service launched a 10-year Wildfire Crisis Strategy (WCS), an investment in landscape-level treatments to reduce hazardous fuel buildups on forested landscapes. This effort aims simultaneously to restore forest conditions and reduce wildfire risk to communities, with treatments planned for both within and beyond National Forest System (NFS) lands. The WCS builds on existing collaborations with states, local governments, American Indian tribes, nongovernmental organizations, and other partners. It initially focused on 10 priority landscapes across eight states in the Western United States; 11 additional landscapes were added to the WCS in 2023, but they are not addressed in this report.

The goal of this report is to systematically describe each of these 10 initial WCS landscapes (hereafter, initial WCS landscapes), synthesizing county-level information on landownership, economic and demographic trends, and wildfire adaptation efforts with landscape-level information on wildfire history and fuel treatments. The WCS underscores the interconnectedness between NFS lands and surrounding human communities, and the need for collaborative efforts across jurisdictions and between diverse actors to achieve effective wildfire risk reduction. Understanding background conditions—social and ecological—in each of these landscapes can support collaboration between the Forest Service and local communities and reveal both shared dynamics and important differences between and within individual WCS landscapes.

We focus here on the county as a useful scale for gathering existing data as well as a key actor in planning for and regulating development and land use. We collected extant data for each of the counties associated with the initial WCS landscapes, including social data, such as demographic and socioeconomic information, landownership, and development patterns, as well as biophysical data, including forest types and conditions, wildfire history, and records of fuel treatments conducted on NFS lands. We also conducted an analysis and evaluation of planning, policy, and regulatory tools in use by each county, which allows for categorization of the counties in terms of the progress made in implementing planning and regulatory actions to address wildfire hazards.

We found that although all the areas included in the initial WCS landscapes share high levels of wildfire risk and extensive wildland-urban interface (WUI) development, they include a range of social settings and have made differing efforts to adapt via planning and regulatory mechanisms. The initial WCS landscapes span substantial portions of 40 counties across the Western United States, which vary considerably in population size, economic conditions, demographic trends, and other social dynamics, as well as spanning diverse ecosystem types and biophysical conditions.

As would be expected, the WCS counties generally represent areas with a high proportion of lands managed by the federal government and are places that have seen rapid growth in housing in the WUI. Demographically, counties in the initial WCS landscapes tend to be less racially and ethnically diverse than the United States, although some areas do have sizable Latino populations, American Indian populations, or both. We also found that the WCS landscapes have many shared vulnerabilities, with lower per capita income, older populations, and mobile homes representing a larger proportion of housing (with exceptions in highly urbanized areas, such as the Colorado Front Range).

In terms of social and economic trends, we note that the initial WCS landscapes can be divided into two distinct groups based on their placement on a rural-urban gradient. One set of landscapes is in largely rural, sparsely populated areas; these landscapes also tend to be smaller, typically spanning just one or two counties. Another set of landscapes is centered around metropolitan areas; many of these landscapes have seen substantial population growth, urbanization, and residential development in high wildfire hazard areas over recent years. These latter landscapes tend to be larger in area and often span a larger number of counties, including both urbanized and rural areas. This urban-rural variable tends to be associated with economic processes, with ongoing growth in population and per capita income occurring in many counties with urban areas, while such growth in rural areas is much slower.

We also examined two key forms of wildfire adaptations: (1) the treatment of hazardous fuels and (2) the use of planning and regulatory tools at the county scale to address development at the WUI. Examining fuel treatments conducted by the Forest Service over the past 10 years, we found variation in the area treated from less than 4 percent of NFS lands in some landscapes to a high of 20 percent treated in the case of the Four Forest Restoration Initiative landscape that spans six Arizona counties, with most landscapes falling into the range of 9 to 15 percent. Wildfires noted as having fuel treatment benefits (natural ignition fires that benefitted fuel conditions or planned fuel treatment areas burned in wildfire) can make up a critical part of those totals.

We also found that counties ranged substantially in terms of their use of planning, policy, and regulatory tools to reduce wildfire risk, with some having comprehensive approaches in place, while others were only beginning this process. The adoption of land-use, hazard, and wildfire plans were more common than regulations, such as requirements for ignition-resistant construction materials or vegetation management. Efforts to map wildfire hazard, risk, and WUI areas were also common. However, in many communities, it is not clear whether and how these maps are used to inform land-use planning decisions related to future growth and development.

At the county level, we found no clear relationships between county-scale planning and regulatory adaptations and fuel treatment efforts, but counties with larger numbers of WUI housing typically had higher investment in one or both of these adaptations. That is, these counties with greater numbers of houses in the WUI, which typically had higher populations and higher per capita incomes overall, were either in the higher end of the range of fuel treatments on NFS lands in the landscape in the past decade, had more comprehensive land-use planning and regulations, or both.

This report lays the groundwork for more research to examine the human dimensions of implementation of the Wildfire Crisis Strategy, and more broadly, the processes of adaptation to growing wildfire risk in the Western United States. Our research team plans to follow up on this initial assessment of county-level information with indepth research in a subset of specific communities in the WCS landscapes. This will include conducting site visits, interviewing local community members and stakeholders in wildfire adaptation, and collaborating with local agencies to coproduce a more nuanced evaluation of planning and regulatory efforts in those counties. This report aims to support the investment of the WCS in advancing wildfire adaptation as a complex process that requires interwoven and collaborative efforts by diverse actors across jurisdictions.

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Chapter 1: Introduction

Background on the Wildfire Crisis Strategy

By nearly any measure, wildfire impacts on communities and forests have become a crisis in the United States. The average annual area burned reached 7 million acres per year in the past decade (2013 through 2022), a nearly two-fold increase from the average annual area burned from 1993 through 2002. More than 50,000 homes were lost to wildfire over the past 10 years (NIFC, n.d.), and federal wildfire suppression funding rose to more than \$3.6 billion by 2020 (Hoover 2020). Although wildfire is a natural process that has important ecological benefits, the rapid increase in area burned and the intensity, size, and frequency of wildfires pose significant risks to both human communities and ecosystems (Hagmann et al. 2021). These worsening challenges result from a confluence of factors, including past forest management practices and altered fire regimes, a changing climate, and expanding human development in areas typically referred to as the wildland-urban interface (WUI) (Moritz et al. 2022, Nagy et al. 2018, Radeloff et al. 2023b). Across much of the Western United States, worsening drought conditions and extended fire seasons are resulting in an increased frequency of larger fires, and the increased presence of human development is placing more structures at risk in the WUI, resulting in increasing losses from wildfire. Among federal agencies, the U.S. Department of Agriculture, Forest Service plays a pivotal role in wildfire management as the land manager for 193 million acres of national forests and grasslands and a national leader in wildfire policy. In January 2022, the Forest Service launched a 10-year Wildfire Crisis Strategy (WCS), funded by a historic investment of congressional funding for landscape-level fuel treatments in the Bipartisan Infrastructure Law (\$1.51 billion) and Inflation Reduction Act (\$1.8 billion) (USDA FS, n.d.a, 2022a, 2023). Building on a nationwide assessment of wildfire risk, the WCS is intended to collaboratively engage states, American Indian tribes, and other partners in promoting forest resilience and reducing wildfire risk to nearby communities (USDA FS 2022b).

What Is the Wildland-Urban Interface?

In the context of wildfire, it is helpful to consider both the conceptual and spatial definitions of the wildland-urban interface (WUI). This area where development meets or intermingles with vegetation forms a central focus for wildfire managers; it is the area where wildfires tend to be ignited and threaten homes and other buildings.

Conceptually, the WUI can be any developed area where conditions affecting the combustibility of vegetation (i.e., wildland vegetation and/or cultivated landscapes) and structures and infrastructure (built fuels) allow for the ignition and spread of fire through these combined fuels (Governor's Office of Planning 2022; Mowery et al. 2019, 2021). The WUI and associated wildfire risks are not static but rather reflect conditions in the landscape, such as the relationship between homes, the proximity of homes to vegetation, types of vegetation, local weather conditions, and topographical features such as ridgelines. In this regard, a variety of conditions and planning scenarios require practitioners to approach the WUI as a dynamic set of conditions as opposed to a fixed state (Mowery et al. 2021).

Spatially defining the WUI allows planners, land managers, and researchers to analyze and plan for geographic areas (Mowery et al. 2021). In this report, we use WUI categories based on housing unit density and landcover as defined and mapped by the U.S. Department of Agriculture, Forest Service and University of Wisconsin—Madison SILVIS Lab (Radeloff et al. 2005, 2023b). These provide the following classifications:

- WUI intermix (housing intermingled with wildland vegetation)
- WUI interface (housing adjacent to wildland vegetation)
- Non-WUI vegetation (no housing or very low housing density)
- Nonvegetated or agriculture (low and very low housing density)
- Nonvegetated or agriculture (medium and high housing density)

However, different entities have used different approaches to mapping the WUI. For example, the Healthy Forests Restoration Act (2003) applies a distinct definition. WUI maps may be further refined when WUI assessments are developed at the local level, such as when ember exposure is expected (Mowery et al. 2019).

The emphasis on fuel treatments to reduce wildfire risk stems from shifts in wildfire management and fire activity (USDA FS 2023). Historically, many places in the Western United States (hereafter, the West) experienced lower intensity wildfires that burned low to the ground (Hagmann et al. 2021, Halofsky et al. 2020). In response to increasing wildfire concerns, federal policy beginning in 1911 prioritized rapid suppression of all fires. This shift, made in response to the severe fire season in 1910, was intended to protect lives and resources, but it had unintended consequences. Over time, the emphasis on wildfire exclusion and suppression meant that forests in the West became denser and accumulated more fuel, the ecological benefits of low- to moderate-severity wildfire were lost, and wildfire activity became more severe (Hagmann et al. 2021). Since the 1970s, federal wildfire policy has allowed for greater flexibility to manage wildland fires, including allowing some natural ignitions to burn to restore natural fire regimes and therefore emphasizing the protection of human lives and communities rather than all-out suppression (Young et al. 2020).

This emphasis on community protection also occurred during a time when development in the West was rapidly expanding. The federal government manages a high overall proportion of lands in the West (defined here to include 11 U.S. states—Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), but the region has seen rapid population growth and development in past decades. In total, the population in the West has more than doubled (126 percent growth) in the past 50 years, a time when the U.S. population grew more slowly (63 percent in the same period). Much of that population growth has been in urban areas, but the West has also experienced record WUI growth. From 1990 through 2020, the WUI footprint expanded by 38 percent, and the number of WUI housing units increased by 62 percent in the West, while the Eastern conterminous United States had a 30 percent expansion in WUI area and a 42 percent increase in WUI houses during the same period (Radeloff et al. 2023b).

The implementation of the WCS first aimed to address this hazardous fuel buildup and reduce community risk for 10 landscapes in eight states. These 10 initial WCS landscapes (hereafter, initial WCS landscapes), and communities surrounding them, form the basis of our research (fig. 1.1) (USDA FS 2022d). Another 11 landscapes were later added in 2023

What Are Fuel Treatments?

Fuel treatments refer to activities that change the amount or composition of vegetative material that provides fuel for a wildfire, such as trees, shrubs, and other undergrowth; woody debris; and dead leaves and pine needles (fuels). Efforts to reduce hazardous fuel loads are a common strategy for wildfire risk reduction. Fuel treatments can include a range of activities, including removing trees, prescribed fire, and other reductions of fuels through grazing, herbicides, or mechanical means (Ott et al. 2023). Fuel treatments can potentially lead to lower fire intensity and rate of spread, thereby facilitating fire suppression when needed, and are used to enhance ecosystem resilience by restoring fire regimes and vegetation (Prichard et al. 2021). In some cases, wildfire can function as a fuel treatment when the severity is low enough to allow for forest resilience, and the U.S. Department of Agriculture, Forest Service counts some (although not all) wildfires as fuel-reduction benefits. In other cases, fuel treatments may be achieved in part through commercial timber sales, although declines in the wood products industry across the Western United States make finding commercial markets for the material produced through treatments increasingly challenging. The use of prescribed fire, often in tandem with mechanical thinning, is increasingly common and recommended in many contexts as the most effective practice for fuel treatment.

(USDA FS 2023). The initial WCS landscapes were selected using risk modeling at the fireshed scale (typically about 250,000 acres in size), identifying those firesheds where there was a high likelihood that an ignition could expose homes, communities, and infrastructure to wildfire (Ager et al. 2019, 2021). Therefore, these landscapes are all places where wildfire poses a serious threat to communities. In addition, the initial WCS landscapes were selected based on ongoing collaboration with other partners, including work with other federal, tribal, and state and private partner investments, as well as past restoration work and future priorities (e.g., those identified in state forest action plans) (USDA FS 2023).

As the WCS progresses, the Forest Service, in collaboration with local partners, is developing implementation plans, including planning for fuel treatments at the landscape scale (to be completed in 2024). The WCS includes goals to restore fire-adapted vegetation on 35 to 45 percent of firesheds; shorter term objectives to treat 20 million acres of National Forest System (NFS) lands in the West; and plans for additional work with partners on 30 million acres of other federal, state, tribal, and private lands in the West (USDA FS 2022b). Overall, these initial plans and investments are described as a down payment on work that is expected to continue over the next decade and beyond to restore forest conditions and reduce wildfire risk to communities.

Beyond Forest Service Boundaries: Goals of This Research

The goals of the WCS underscore the interconnectedness between NFS lands and surrounding human communities, and the reduction in wildfire risk is a fundamental benefit at local and national levels. Collaborative efforts across ownerships and actors are essential for effective wildfire risk reduction (Charnley et al. 2020, Schultz and Moseley 2019). Given the emphasis on cross-boundary risk reduction across WCS landscapes, socioeconomic trends, land-use planning activities, and wildfire adaptation efforts also make up important pieces of the puzzle.

The 10 initial WCS landscapes span 40 counties across the West and vary considerably in population size, economic conditions, and demographic trends. Many of these counties include substantial areas of NFS lands, some intersect primarily with non-NFS areas of WCS landscapes, and a few of these counties include no NFS lands. We chose to focus on

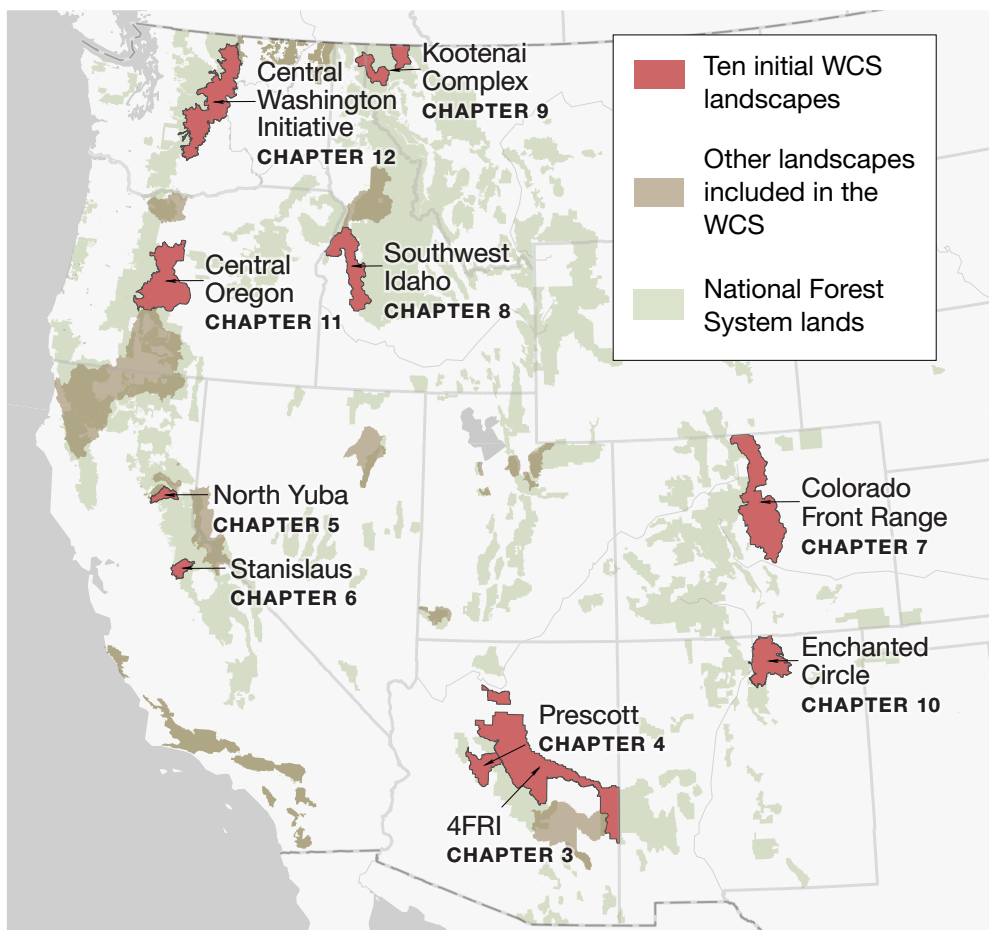


Figure 1.1—Ten initial landscapes prioritized by the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS). 4FRI = the Four Forest Restoration Initiative landscape.

the county level not only because it is a useful scale for assessing socioeconomic and WUI data, but because county governments typically play a significant role in the West in planning for and regulating development and land use. This is particularly the case in the rural, exurban, and suburban areas where wildfire is often a concern (see more on the county role in chapter 2).

Accordingly, the goal of this report is to systematically describe each of these landscapes, synthesizing county-level information on landownership, economic and demographic trends, and wildfire adaptation with landscape-level background on wildfire history and fuel treatments.¹ Although wildfire adaptation has many dimensions, as discussed in the following section, this report focuses on two key forms of adaptation that are ongoing across the WCS landscapes: (1) hazardous fuel treatments conducted by the Forest Service and (2) land-use planning and regulations to reduce wildfire risk at the county level. We emphasize the county scale because of the importance of the county government in planning for wildfire and regulating development, while acknowledging that plans and regulations (as well as other adaptations) may apply at different scales (e.g., municipality/town, district, subdivision, homeowners' association). Understanding these ongoing efforts, as well as the varying social and ecological conditions in each of these landscapes, can support collaboration between the Forest Service and communities and reveal differences between and within individual WCS landscapes. Ultimately, adapting to wildfire risks involves long-term, sustained efforts by federal land managers as well as across communities.

Research to Support the Wildfire Crisis Strategy

This report forms part of a broader portfolio of U.S. Department of Agriculture, Forest Service research projects—social and biophysical—with the intent of building understanding and increasing the efficacy of the Wildfire Crisis Strategy (WCS). This report is the first contribution from a social-science research project entitled Fueling Adaptation: Leveraging Community Capacity to Reduce Wildfire Risk, investigating wildfire adaptation, communications, and governance in the initial WCS landscapes. This project seeks to consolidate social science insights to highlight and understand innovative mitigation efforts undertaken by federal stakeholders, land managers, and other partners. For more information about our research, see the Fueling Adaptation project website (USDA FS 2024a) and the Forest Service Research website on additional social science research to support the WCS (USDA FS, n.d.).

Defining Adaptation to Wildfire

Wildfire adaptation includes efforts to reduce human vulnerability to wildfire, addressing both the likelihood of human exposure to wildfire and damage or losses if or when wildfires occur. Adaptation efforts include a diverse range of activities and investment intended to reduce risk over time and across scales (fig. 1.2) (Edgeley and Paveglio 2024, O'Neill and Handmer 2012, Schumann et al. 2020). Efforts to adapt to, or “live with wildfire,” form one of the central pillars of the National Cohesive Wildland Fire Management Strategy (USDA and USDI 2014), which advocates for the creation of fire-adapted communities (Fire Adapted Communities Learning Network, n.d.) alongside efforts to manage for more fire-resilient landscapes and to support effective fire response. Responsibility for wildfire

¹ Our analysis focuses on counties that make up a meaningful part of Wildfire Crisis Strategy priority landscapes (n = 40). See chapter 2.



Figure 1.2—Fire-adapted communities framework. Source: Fire Adapted Communities Learning Network (n.d.).

adaptation is diffuse; all landowners and residents, emergency responders, land managers, land-use planners, local leaders, and other organizations play a role in reducing wildfire risk. For example, the Forest Service and other land managers can employ fuel treatments to restore ecosystem health and reduce the potential for extreme wildfire activity, homeowners and residents can use fire-resistant building materials and create defensible space by removing fuels from around homes and buildings (Cowan and Kennedy 2023, Meldrum et al. 2018), and land-use planners and emergency responders can coordinate on plans and regulations that result in improved access for firefighters and evacuation.

Many adaptation activities designed to address wildfire are developed and promoted through local, state, or national programs, and may be led by nonprofit organizations; government agencies; neighborhood associations; fire districts; or other local, regional, or state coalitions, councils, or collaboratives. Wildfire adaptation activities may range from research and policy analysis, educational programs and campaigns, capacity-building and technical assistance, on-the-ground programs such as fuels chipping for homeowners, or direct support for fuel reduction (Edgeley and Paveglio 2024, Hamilton et al. 2021). Community-scale adaptation also includes investments in planning, processes, and relationships to support ongoing wildfire risk reduction (discussed below) (Edgeley and Paveglio 2024). Local governments can play a pivotal role as they engage in land-use planning, guide

infrastructure development and recovery planning, and work to organize residents in efforts to address public health, support safety and evacuation efforts, and develop fire prevention and education campaigns, among other initiatives (Mowery et al. 2019, 2021).

The WCS emphasizes the reduction of hazardous fuels through landscape-scale treatments, an element of wildfire adaptation that is most applicable to large-scale land management. However, fuel treatments alone are unlikely to meaningfully reduce wildfire risk to communities and homes (Calkin et al. 2023, Moritz et al. 2014) and are best used as part of a multidimensional strategy of wildfire adaptation. Accordingly, the WCS explicitly notes that treatments are also intended to “complement and support efforts to develop fire-adapted communities” (USDA FS 2022c). For this reason, an understanding of the variation between (and within) local communities across WCS landscapes and the range of adaptation tools being pursued—or not being pursued—by these communities is essential to enhance the strategy’s success.

Planning and regulatory tools are key elements of local-scale adaptation, affecting outcomes in the built and natural environments and shaping human activities that influence wildfire risk. For example, land-use plans (comprehensive plans or general plans) provide a long-term vision for growth and can include development constraints. Regulations, such as building codes, subdivision regulations, and zoning ordinances, can set a minimum standard for safety, construction, or design requirements for structures, landscapes, roads, water supply, and other development features. Other plans, such as community wildfire protection plans (CWPPs) or local hazard mitigation plans, analyze local hazards and corresponding mitigation strategies to reduce risks to people, property, and other identified values. These plans and regulations can serve as indicators of communities’ commitments to addressing wildfire hazard and risk and their willingness to take actions, or make adaptations, at the local level.² Federal and state regulatory and funding processes may also drive the adoption of plans and policies. For example, local hazard mitigation plans are a requirement for Federal Emergency Management Agency funding, which incentivizes counties to adopt them and update them every 5 years, and state law may also require counties to adopt a comprehensive plan, a general plan, or both.

Our research broadly seeks to understand how fuel treatments may be combined with, or leverage, adaptations undertaken by other actors, including planning and regulatory efforts by municipal, regional, county, and state government agencies. Our analysis therefore focused primarily on the nexus of the “landscape treatments” and “regulations, policy, and plans” dimensions of the fire-adapted communities framework (see fig. 1.2), but we included additional information about resident mitigation, partnerships, and other dimensions of wildfire adaptation where possible. An analysis of the scope of ongoing adaptation efforts at the local level, coupled with information about the size and growth rates and the extent of WUI development in the communities surrounding WCS landscapes, can provide valuable insights to support the optimal positioning of federal investments to reduce wildfire risk to communities. Advocacy for (and scholarship on) wildfire adaptation tends to focus on one of two distinct processes and related scales: (1) landscape-scale forest management (e.g., fuel treatments) or (2) residential and community adaptation, including local planning and regulations. By drawing these together, we aim to integrate and compare complementary and intertwined approaches to wildfire adaptation.

² Appendix 1 provides a description of key planning and regulatory adaptation tools, indicates whether the tool is generally required or voluntary, and highlights the potential use of these tools in wildfire adaptation.

Chapter 2: Research Methods and Data

We chose the county scale as our geographic unit of analysis to allow for consistent collection and comparison of available data across multiple categories (e.g., geographic, socioeconomic, fuel treatment, and plans and regulations data). Because of their scale, counties also have more influence on wildland-urban interface (WUI) development and are likely to share a larger geographic boundary with national forests (and therefore have more interaction with wildfire-risk reduction investments on public lands) than local municipalities. A more comprehensive analysis of all jurisdictions (e.g., incorporated cities) on the 10 initial landscapes of the U.S. Department of Agriculture, Forest Service Wildfire Crisis Strategy (WCS) was beyond the resources and scope of this project.

County Selection and Data on Social Characteristics

To identify counties to include in our analysis, we conducted geospatial analysis in ArcGIS Pro software, overlaying county boundaries with those of the 10 initial WCS landscapes (hereafter, initial WCS landscapes).¹ This overlap yielded 62 counties. We removed counties that had only minimal overlap with a landscape (less than 5 percent of the county area overlaps with the landscape) except for Ada County, Idaho, which was included despite minimal overlap because of the presence of a substantial human population in proximity to the landscape. The Forest Service has used a similar approach when considering socioeconomic data in conjunction with the WCS.² Our final dataset yielded 40 counties, ranging from landscapes comprising 1 county (Prescott, Arizona, and Stanislaus, California landscapes) to the Colorado Front Range landscape that includes parts of 12 counties (table 2.1). These 40 counties include a range of National Forest System (NFS) land areas, from 4 counties not overlapping national forests (Douglas County in the Central Washington Initiative, and Arapahoe, Denver, and Fremont Counties in the Colorado Front Range) to the county composed of the most NFS land area at 85 percent of its total (Valley County, Idaho).

For each of these 40 counties, we compiled social and economic data, such as population, per capita income, and racial and age demographics, using the latest available data from the U.S. Census Bureau's American Community Survey (5-year estimates from 2017 through 2021) accessed via the Headwaters Economics Economic Profile System (Headwaters Economics, n.d.). We chose key variables—older adults, mobile housing, per capita income—because they are consistently related to wildfire exposure (i.e., actual occurrence, not just biophysical likelihood or risk) (Modaresi Rad et al. 2023, Schumann et al. 2024). Measures of race and ethnicity have varying patterns with wildfire occurrence, reflecting the diversity of populations across the United States, in WUI and rural areas (Schumann et al. 2024). We included two groups, Hispanic/Latino and American Indian, as groups that are likely to live in proximity to national forests in fire-prone areas of the Western United States (hereafter, the West) and may be linguistically isolated or historically have been underserved in partnerships with federal land management agencies. Because these are county- and landscape-level depictions of these communities, we kept variables as individual measures, not as indices. Each of these variables (age, mobile homes, income, race/ethnicity) came from

¹ This processing reflects the landscape boundaries as drawn at that time; some landscape boundaries may have been redrawn more recently.

² Scanlon, M. 2023. Personal communication. Systems analyst, Wildfire Risk Reduction Infrastructure Team, 3200 SW Jefferson Way, Corvallis, OR 97331, michael.scanlon@usda.gov.

different pillars or components of the two most common social vulnerability indices, SoVI (Schumann et al. 2024) and SVI (Modaresi Rad et al. 2023), making them apt metrics of variation in social characteristics at the county level.

We also included WUI data over time at the county level (Radeloff et al. 2023a). Based on the Federal Register WUI definition (USDA and USDI 2001), these WUI data integrate Census housing data with wildland vegetation data and have been produced by the Forest Service and University of Wisconsin for three decades (1990 through 2020) (Radeloff et al. 2023b). Finally, we calculated landownership for each county using the U.S. Geological Survey Protected Areas Database of the United States (PAD-US) 3.0 (USGS 2022), as well as identifying American Indian tribal nations with connections to the landscape. Tribes may have connections to the landscapes in multiple ways, including direct management of sovereign lands on reservations, rancherias, or off-reservation trust lands (USDA FS 2024d); presence of populations of tribal members on nontribal lands; and/or ancestral connections to lands that are not necessarily represented by modern geographic boundaries or land designations.

Table 2.1—Landscapes analyzed to review wildfire planning and mitigation in the Western United States, associated with the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS)

WCS landscape	State	Population, 2021 ^a	Counties	Urbanization ^b	Chapter of this report
Four Forest Restoration Initiative	Arizona	624,068	Apache, Coconino, Gila, Greenlee, Navajo, Yavapai	Metropolitan (Flagstaff, Prescott Valley-Prescott) Micropolitan (Payson, Show Low) Rural	3
Prescott	Arizona	242,253	Yavapai	Metropolitan (Prescott Valley-Prescott)	4
North Yuba	California	86,704	Sierra, Yuba	Metropolitan (Yuba City) Rural	5
Stanislaus	California	55,810	Tuolumne	Micropolitan (Sonora)	6
Colorado Front Range	Colorado	3,852,503	Arapahoe, Boulder, Clear Creek, Denver, Douglas, El Paso, Fremont, Gilpin, Jefferson, Larimer, Park, Teller	Metropolitan (Denver-Aurora-Lakewood, Boulder, Fort Collins, Colorado Springs) Micropolitan (Cañon City)	7
Southwest Idaho	Idaho	567,581	Ada, Adams, Boise, Gem, Valley, Washington	Metropolitan (Boise) Rural	8
Kootenai Complex	Montana/ Idaho	33,086	Boundary (ID), Lincoln (MT)	Rural	9
Enchanted Circle	New Mexico	46,992	Colfax, Taos	Micropolitan (Taos) Rural	10
Central Oregon	Oregon	308,309	Deschutes, Jefferson, Klamath, Lake	Metropolitan (Bend) Micropolitan (Klamath Falls) Rural	11
Central Washington Initiative	Washington	467,510	Chelan, Douglas, Kittitas, Okanogan, Yakima	Metropolitan (Yakima, Wenatchee) Micropolitan (Ellensburg) Rural	12

^aPopulation totals include all residents of the listed counties, including residents of areas outside of the WCS landscape boundaries. Counties included are those in which at least 5 percent of the county area falls within the WCS landscape, as well as Ada County, Idaho, which was included, despite minimal overlap, because of the presence of a substantial human population in proximity to the landscape. Source: Headwaters Economics (n.d.).

^bU.S. Office of Management and Budget statistical area definition and major cities associated. Source: U.S. Census Bureau (2020).

When possible, we also referred to socioeconomic data, land-use information, and other statistics at various scales, including across the United States, within the West (where the WCS landscapes are located), or within the nonmetropolitan areas of the West. For example, median per capita income is just more than \$75,000 in the West, but just more than \$69,000 in the nonmetropolitan areas (this includes retirement income but is not necessarily reflective of overall wealth). The latter is more typical of the counties associated with the WCS landscapes. We obtained all socioeconomic and demographic data via the Headwaters Economics Economic Profile System (Headwaters Economics, n.d.), including summaries for multiple county areas, which account for population variation across counties (e.g., per capita income is calculated relative to the total population in the area). Statistics reflecting key variables at the landscape scale are included in each individual landscape profile chapter, and a summary of this data at the county scale is included in appendix 2.

Fire History and Fuel Treatments

We obtained information about wildfire history in the initial WCS landscapes from multiple sources to identify and map the five largest fires by area burned and the five most destructive fires by number of structures destroyed. The intent of this analysis was to identify notable fires that may have had a significant effect on forest management practices, local wildfire planning and regulatory adaptations, or both. Although it was not possible to determine universal criteria for the most notable fires, nor how many should be included, we used fire size (acres burned) to reflect the extent of wildfire on the landscape and number of structures destroyed as a proxy for effects on human communities.³ We acknowledge that these are only two ways in which a notable fire can be defined. Residents or other stakeholders in a particular location are likely to have unique perspectives on which fires have had the greatest effect on local communities or have played important historical roles in influencing wildfire adaptations, but cataloging those perspectives is beyond the scope of this report.

For this effort, we conducted a geospatial analysis, intersecting the boundaries of both the initial WCS landscapes and the surrounding counties with fire perimeter data from the Monitoring Trends in Burn Severity Burned Areas Boundaries dataset (USGS et al. 2024). This dataset included fires from 1984 through 2022. We also supplemented this dataset with additional resources to include known large fires that occurred in 2023. For fire size, we identified the five largest fires (by area) that intersected with the relevant WCS landscapes. Next, we cross-referenced wildfire perimeters with data from the ICS-209-PLUS wildland fire dataset (1999 to 2020) (St. Denis et al. 2023), which includes a count of structures destroyed (i.e., damaged beyond repair) in each fire. Here, we expanded our analysis to include fires that intersected any part of the associated counties that overlap with a landscape, rather than limiting losses to those fires that intersected the WCS landscape boundaries. This more-inclusive approach to wildfire losses reflects our expectation that county-level planning and regulations reflect a county's history of destructive fires (i.e., fires notable from a county planner's perspective), and such effects are not limited to the WCS landscape areas. In some cases, fires may therefore be included that have a more direct effect

³We recognize that structure loss is only one measure of the effects of wildfire and does not include many others (loss of life, trauma and health effects on populations, economic losses, or other effects farther from the wildfire perimeter). Our intent in providing structure loss is not to rank or compare individual events but to recognize and highlight the lived experience of wildfire in each landscape through one readily available measure of social effects.

on nearby non-WCS areas, and even neighboring counties, than on the WCS landscape. Finally, we cross-referenced the identified fires with information from federal, state, and local publications and datasets to validate and update the list with any missing fires. In some cases, the same fire may appear in data tables for both the largest and most-destructive fires.

We derived information about hazardous fuel treatments that have been conducted on NFS lands within each of the initial WCS landscapes from the Hazardous Fuel Treatment Reduction geodatabase, based on spatial data on fuel treatment accomplishments reported to the Forest Service's Forest Activity Tracking System (FACTS) database (USDA FS 2024b). Fuel treatment polygons were clipped to the boundaries of the relevant WCS landscape and filtered to include only polygons that represent hazardous fuel reduction accomplishments (within FACTS, key points variable equal to 3 or 6). We then filtered by date completed to include a 10-year period, October 2013 through September 2023, with the recognition that the effectiveness of treatments fades over time. We selected 10 years as the approximate typical lifespan of an effective treatment, with the acknowledgment that this includes treatments nearing the end of that lifespan alongside more recent ones.

We further filtered the treatment data by activity category to separately calculate area for four categories:

- Prescribed fire treatments—includes broadcast burning, underburning, and other related categories (excludes burning of piled materials, as a step that typically overlaps with mechanical treatments)
- Fuels treatments conducted via commercial sales—includes commercial thinning and cutting and other related categories
- Wildfires with fuels reduction benefit—includes natural ignition fires determined to have fuels reduction benefits and planned treatments burned in wildfires
- Mechanical and other noncommercial fuel reductions—includes all other categories coded as hazardous fuel treatment accomplishment, such as noncommercial thinning, mechanical surface treatments, chipping of fuels, piling of fuels, and burning of piled material

For a complete list of FACTS codes used in this analysis, see appendix 3. Within these categories, polygons were dissolved to avoid double-counting areas in overlapping or identical polygons that are documented as multiple treatment activities in each category.

Each of these four categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas). As a result, the sum of these different treatment categories is often greater than the total treatment area reported. Accordingly, all fuel treatment polygons were also separately dissolved across all categories to derive total area treated, counting each acre only once regardless of multiple treatment types (i.e., totals reflect footprint acres as opposed to the larger figures that may be reported as treatment acres). We used these combined areas of fuel treatments to calculate the percentage of all NFS lands (within a given landscape and by county) that have received fuel treatments in the past 10 years. These compiled fuel treatment polygons were mapped along with fire history for each landscape.

Throughout the report, fuel treatment data tables include wildfire with fuel-reduction benefits data separate from other treatments, with the recognition that although wildfire may be an important element of fuel reduction to reduce future wildfire risk in Western

landscapes, it is also often beyond the control of land managers and does not necessarily reflect investment in landscape-scale treatment efforts. When included in total fuel treatment areas, wildfires only include those determined and reported in FACTS to have fuel-reduction benefits (per the categories and key points listed above) and thus represent much smaller areas than the total area burned in wildfire (as sourced from the Monitoring Trends in Burn Severity Burned Areas Boundaries dataset [USGS et al. 2024] and shown on wildfire history maps).

Although this analysis provides a snapshot of the progress made in conducting fuel treatments on the initial WCS landscapes as of September 2023, it comes with significant caveats. This database is the most comprehensive source of Forest Service fuel treatment data available in spatial form; however, it is possible that there may be missing data, perhaps particularly in the earlier years of reporting. This database does not include data about fuel treatments on nonfederal land or future planned fuel treatments.⁴ Wildfires with fuel-reduction benefits may only have been documented and reported for some landscapes and locations, and the potential risk reduction benefit of such wildfires is beyond the scope of this report. When we calculated the percentage of total NFS landscape area burned, we used the total area of all NFS lands, including wilderness areas, previously burned areas, and other areas that are unlikely to receive fuel treatments because of practical or administrative reasons. As such, counties or landscapes with substantial areas of these lands will show a lower overall percentage of area treated. Finally, there is widespread acknowledgment of the limitations of the acreage treated metric used for adequately assessing either forest restoration outcomes or the effects of treatment for reducing wildfire risk to communities. Treatments aimed explicitly at reducing risk by creating access for effective fire response, such as fuel breaks, may have a smaller footprint on the ground, while projects with larger footprints are often aimed at increasing forest resilience, with important but indirect effects for human safety. Landscapes may have different treatment needs, determined by local forest types, ecological conditions, threat to communities, or other factors. These distinctions are not readily reflected in the number of acres treated, but that number does provide an indication of the recent use of fuel treatments on the landscape in the context of the stated intent to increase the pace and scale of such treatments.

Land-Use Planning Adaptations

Based on our determination of the 40 counties, we conducted an inventory to identify whether each county had adopted the following plans and regulations (tools):

- Comprehensive/general plan, or growth policy
- Community wildfire protection plan
- Local or multijurisdictional hazard plan
- Building code
- Fire code
- Subdivision regulations
- Zoning ordinance
- WUI code or other WUI-related regulations (e.g., landscape ordinance)

⁴ As of the writing of this report, Wildland Crisis Strategy (WCS) landscapes are currently undergoing strategic planning and prioritization processes to determine plans for treatment locations and priorities under the WCS.

For each applicable tool, we identified the date of adoption or last update and whether the tool addressed wildfire based on search terms (defensible space, fire-resistant, hazard, hazardous vegetation, wildfire, wildland, wildland-urban interface, WUI).

Following the inventory, we analyzed each county using the Fire and Land Use Planning Evaluation Tool (hereafter, FLUPE) developed by the Community Wildfire Planning Center (CWPC, n.d.). The FLUPE provides a consistent and efficient way to evaluate each of the 40 counties in the initial WCS landscapes to identify, review, and assess local planning and regulatory documents to determine their approach in addressing the WUI and associated wildfire risk. Specifically, we used the FLUPE to assess each county by internally gathering plans and regulations and evaluating based on the following categories:

- Evidence of whether the county has identified its WUI, wildfire hazard, and wildfire risk, and whether these assessments inform decisions related to land use and development
- Evidence of whether the county has incorporated information on wildfire and adopted goals, policies, or objectives within its comprehensive or general plan that address wildfire threat to people and property or other identified values
- Evidence of whether the county has adopted a countywide community wildfire protection plan (CWPP) (or a comparable set of CWPPs that provide similar countywide coverage), a local hazard mitigation plan, or both, including whether these plans include actions to advance the adoption of WUI policies or regulations, and if these plans align with one another and the comprehensive or general plan
- Evidence of whether the county has adopted regulations that reduce risk to people and property through requirements for structures, landscaping and vegetation, fire protection (e.g., water supply, emergency access), siting of homes and neighborhoods, special land uses, or other WUI-related provisions

Within these categories, the FLUPE also considered how recently plans were adopted (e.g., was the CWPP developed or updated within the past 10 years) to generally evaluate its recency. Furthermore, we reviewed all potentially relevant regulations (as identified in appendix 1), but not all were found to be applicable. The FLUPE focuses on what is regulated, not necessarily which or how many regulatory tool(s) are adopted. For example, a county may have adopted fire protection standards for the WUI through their subdivision regulations or a WUI code; the presence of adopting both does not necessarily increase the adaptation unless the scope of what is regulated is expanded.

The FLUPE process strives to reflect where counties are required to adopt state regulations (e.g., building materials, defensible space) and where references to state resources are made in local plans and ordinances (e.g., wildfire hazard maps). Some states may have state WUI codes but do not require local jurisdictions to adopt them—in those cases, the analysis reflects when counties have adopted optional state requirements. However, regulations or codes are not counted twice if state and local requirements are duplicative. Just like local efforts, state-level policy can also be in flux; as noted in individual landscape profiles, several states were updating or developing their regulations at the time of this analysis.

Based on the FLUPE categories, a county could receive a maximum score of 28. A score of 28 would indicate the county has achieved the highest score for using WUI plans and regulations to adapt to wildfire. Conversely, a score of zero would indicate that the county has not taken any land-use planning or regulatory measures to identify, plan for, or address their WUI through these tools.

To help determine overall trends in the FLUPE analysis, we grouped scores into four categories as described in table 2.2.

As an analysis of documents, the FLUPE provided an initial but consistent understanding of county-level investments in fire adaptation through plans and policies. However, FLUPE scores were limited to what can be reviewed online based on available materials. For example, when a CWPP is developed collaboratively across organizations, the process of writing the document can lead to many benefits that are not easily discerned from pages of a report, such as enhanced relationships and collaboration across organizations, and building a shared vision around wildfire risk reduction and needs (Hamilton et al. 2023, Kelly et al. 2019). Conversely, plans and regulations can fall short of their aims and visions if funding and capacity are lacking. The FLUPE analysis of published documents does not necessarily reveal whether or how written plans and regulations are being implemented or enforced. In addition, the FLUPE captures a county's land-use planning and regulatory approach at a specific point in time based on the most current tools in place. However, plans and regulations evolve, and new or updated policies, ordinances, and similar mechanisms may have been adopted after the time of analysis.

Our intent for this analysis is to provide a basic assessment of relevant planning tools currently used within each landscape. For more general information about land-use planning tools and their implementation for the WUI, refer to Mowery et al. (2019).

Table 2.2—Fire and Land Use Planning Evaluation Tool (FLUPE) category scores used to analyze county wildland-urban interface (WUI) planning and regulatory adaptation on U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscapes in the Western United States

FLUPE category	FLUPE score	Category description
Initializing	0–7	Initial stage of using WUI planning adaptation tools, building an approach to identify the WUI, wildfire hazard, and wildfire risk and connect this information to create and adopt WUI-related policies, plans, and regulations. County may have limited, if any, land-use plans, hazard plans, codes, or ordinances for addressing wildfire risk reduction in the WUI.
Emerging	8–14	In the process of becoming more fire adapted through WUI planning adaptation tools. County is likely to have created and adopted several tools (land-use plans, hazard plans, codes, or ordinances) that advance wildfire risk reduction in the WUI, but many opportunities remain to update or adopt additional WUI planning adaptation tools for a more comprehensive approach.
Consolidating	15–21	In the process of combining several WUI planning adaptation tools to form an effective or coherent approach to addressing wildfire risk. County has adopted multiple tools (land-use plans, hazard plans, codes, or ordinances) that advance wildfire risk reduction in the WUI. Some opportunities remain to advance these activities, such as adopting additional regulations or policies or further aligning these efforts.
Comprehensive	22–28	Nearly complete or complete approach to addressing the WUI through planning and regulatory tools. County is using all or nearly all available WUI planning adaptation tools to address its WUI, wildfire hazard, and wildfire risk. Any additional opportunities would build on or strengthen its overall approach toward fire adaptation.

Organization of this Report

In the remainder of this report, we lay out findings from this research. Chapters 3 through 12 are individual landscape profiles for each of the initial WCS landscapes. For each landscape, we first review the characteristics of the area, including biophysical, socioeconomic, demographic, and landownership data and WUI development patterns (see “Physical and Social Characteristics” in chapters 3–12). This section provides useful context for understanding the ecological and social conditions on the ground relevant to wildfire adaptation efforts in the area as well as a baseline for understanding and comparing vulnerabilities across landscapes. The landscapes are large and may be highly variable in setting and characteristics. Our intent is to provide an overview of landscape-level conditions and point to notable exceptions in the overall trends within a landscape (see appendix 2 for more comprehensive county-by-county data). We then provide a brief wildfire history, including listing recent wildfires that are notable for either their overall size or effects to communities, measured in terms of structure losses (see “Fire History and Fuel Treatments” in chapters 3–12). This also describes the level of fuel treatment that has been conducted to date for NFS lands in each of the landscapes. Finally, we turn to our assessment of county-level planning and regulations, presenting both the results of the FLUPE analysis at the county scale and a discussion of the specific planning and regulatory adaptations underway across the relevant counties (see “WUI Plans and Regulations” in chapters 3–12).

We intend for these profiles to be relevant and helpful on an individual landscape level (i.e., as stand-alone chapters) for readers who are interested in wildfire adaptation in a specific landscape. However, we also intend that these chapters be read collectively for meaningful comparisons of patterns and trends across diverse WCS landscapes; to that end, chapter 13 provides a synthesis and cross-case comparison of these landscapes. Additionally, chapter 13 highlights broad socioeconomic and demographic trends and conditions, including similarities and differences among landscapes. We also compare the degree of ongoing wildfire adaptations across the landscapes, including correlations between socioeconomic patterns, trends in fuel treatment, and the results from our FLUPE analysis.

Chapter 3: Four Forest Restoration Initiative Landscape, Arizona

Physical and Social Characteristics

The Four Forest Restoration Initiative landscape spans substantial parts of six counties in eastern Arizona and is the largest area of the initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS) landscapes, including almost 6 million acres. The landscape lies within the Arizona/New Mexico Mountains ecoregion, a mountainous transition zone located between lower elevation deserts to the west and south and the Colorado Plateau to the north. The northern portion of the landscape drains northward to the Little Colorado River, joining the Colorado River in northern Arizona near the Grand Canyon. The southern portion of the landscape drains south and then westward via the Salt and Gila Rivers, joining the Colorado River farther downstream in southwestern Arizona.

Dense stands of ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) dominate elevations above 5,000 feet, with some stands of Gambel oak (*Quercus gambelii* Nutt.), Arizona walnut (*Juglans major* (Torr.) A. Heller), quaking aspen (*Populus tremuloides* Michx.), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), and white fir (*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.). These higher elevation stands transition to pinyon-juniper stands, consisting of junipers (*Juniperus* spp.) and twoneedle pinyon (*Pinus edulis* Engelm.), down to interior chaparral in the elevation ranges of 3,000 to 5,500 feet, with grasslands in the 4,000- to 5,000-foot elevations in some locations, and finally down to desert scrub with shrubs, cacti, and grasses. The montane and subalpine areas consist of Arizona fescue (*Festuca arizonica* Vasey), Parry's oatgrass (*Danthonia parryi* Scribn.), and various grasses and sedges, with some minor areas of quaking aspen, white fir, Douglas-fir, and ponderosa pine. Mid-elevation chaparral understory communities include desert ceanothus (*Ceanothus greggii* A. Gray), alderleaf mountain mahogany (*Cercocarpus montanus* Raf.), Sonoran scrub oak (*Quercus turbinella* Greene), manzanitas (*Arctostaphylos* spp.), and catclaw mimosa (*Mimosa aculeaticarpa* Ortega).

The Four Forest Restoration Initiative landscape includes almost 6 million acres and consists primarily of National Forest System (NFS) lands across four national forests—Kaibab, Coconino, Apache-Sitgreaves, and Tonto—with a relatively small area of privately owned land. The Four Forest

Landscape at a Glance

- The Four Forest Restoration Initiative is a large landscape that spans six Arizona counties, including Flagstaff and more-rural areas around it.
- The landscape is primarily composed of public lands.
- More than a quarter of county populations identify as American Indian, and there are numerous tribal nations within the counties.
- Wildland-urban interface (WUI) housing growth has been rapid in past decades, particularly in Yavapai and Coconino Counties.
- Key vulnerabilities include lower incomes and an older population, and mobile homes represent a large proportion of housing.
- Fuel treatments have been widespread throughout the landscape—up to 18.9 percent of National Forest System lands in the landscape in the past decade.
- Coconino County stands out because of the amount of fuel treatments in the past decade, and it is in the consolidating Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk.

Restoration Initiative landscape is adjacent both to the Prescott landscape, to the west (see chapter 4), and the San Carlos Apache Tribal Forest Protection landscape (1 of 11 landscapes added in the second round of WCS planning in 2023) to the south. The four national forests have a long history of working on landscape-level restoration with partners and have been Collaborative Forest Landscape Restoration Program participants since 2010 (Four Forest Restoration Initiative 2023).

The six counties that are associated with the Four Forest Restoration Initiative landscape had a total population of more than 600,000 as of 2021 (table 3.1). This landscape includes the urban area in and around Flagstaff, Arizona (in southern Coconino County), as well as substantial wildland-urban interface (WUI) areas around Sedona, Payson, Show Low, and other smaller cities and towns (fig. 3.1). Urban areas that are in these counties but not in the Four Forest Restoration Initiative landscape include those in Prescott, Arizona (in Yavapai County), which we have included in our profile of the Prescott landscape in chapter 4.

The Tonto Apache Reservation and Off-Reservation Trust Land and Yavapai-Apache Nation Reservation and Off-Reservation Trust Land overlap with the Four Forest Restoration Initiative landscape footprint. Tribal lands adjacent to the landscape include the Fort Apache (White Mountain) Reservation, San Carlos Apache Reservation, Navajo Nation Reservation and Off-Reservation Trust Land, and Havasupai Reservation. Other tribals lands that are near the landscape include the Hopi Reservation and Off-Reservation Trust Land, Zuni Reservation and Off-Reservation Trust Land, Fort McDowell Yavapai Nation Reservation, Salt River Reservation, and Yavapai-Prescott Reservation (USDA FS 2024d). The Fort Apache Reservation and San Carlos Apache Reservation are within the San Carlos Apache Tribal Forest Protection landscape (one of the WCS landscapes that was added in 2023). The Forest Service consults with 17 Native American tribes as well as 10 Navajo Nation chapters on forest management in the Four Forest Restoration Initiative landscape (USDA Forest Service 2022d).

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Four Forest Restoration Initiative landscape in Arizona is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 3.1—Counties associated with the Four Forest Restoration Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Apache	7.1	65,623
Coconino	22.8	145,052
Gila	29.2	53,589
Greenlee	63.9	9,404
Navajo	8.5	108,147
Yavapai	9.9	242,253
Total		624,068

The six counties associated with the Four Forest Restoration Initiative landscape are representative of many of the general trends in the Western United States (hereafter, the West) (table 3.2). These include the following:

- Rapid population growth (even faster than the West); more than tripling from 1970 to 2021.
- Despite this growth, overall income remains well below the Western and national averages, at about \$53,000 per capita, and is consistently lower in all counties, even Coconino County (metropolitan Flagstaff).
- A high proportion of federally managed lands (fig. 3.2), except for Apache and Navajo Counties, which overlap significantly with sovereign American Indian nations.
- Despite a low proportion of WUI areas (2 percent), a substantial proportion of all housing (90 percent) is in the WUI.
- Rapid growth in housing in the WUI (75 percent increase from 1990 to 2020; this growth is distributed unevenly and most pronounced in Yavapai and Coconino Counties).

However, the Four Forest Restoration Initiative landscape is more racially diverse than many of the other WCS landscapes; 26 percent of the combined counties' populations identify as American Indian, by far the highest figure of any of the initial WCS landscapes. Navajo and Apache Counties have 47 and 73 percent American Indian populations, respectively. Proportions of Hispanic/Latino populations are lower across most of the landscape than in

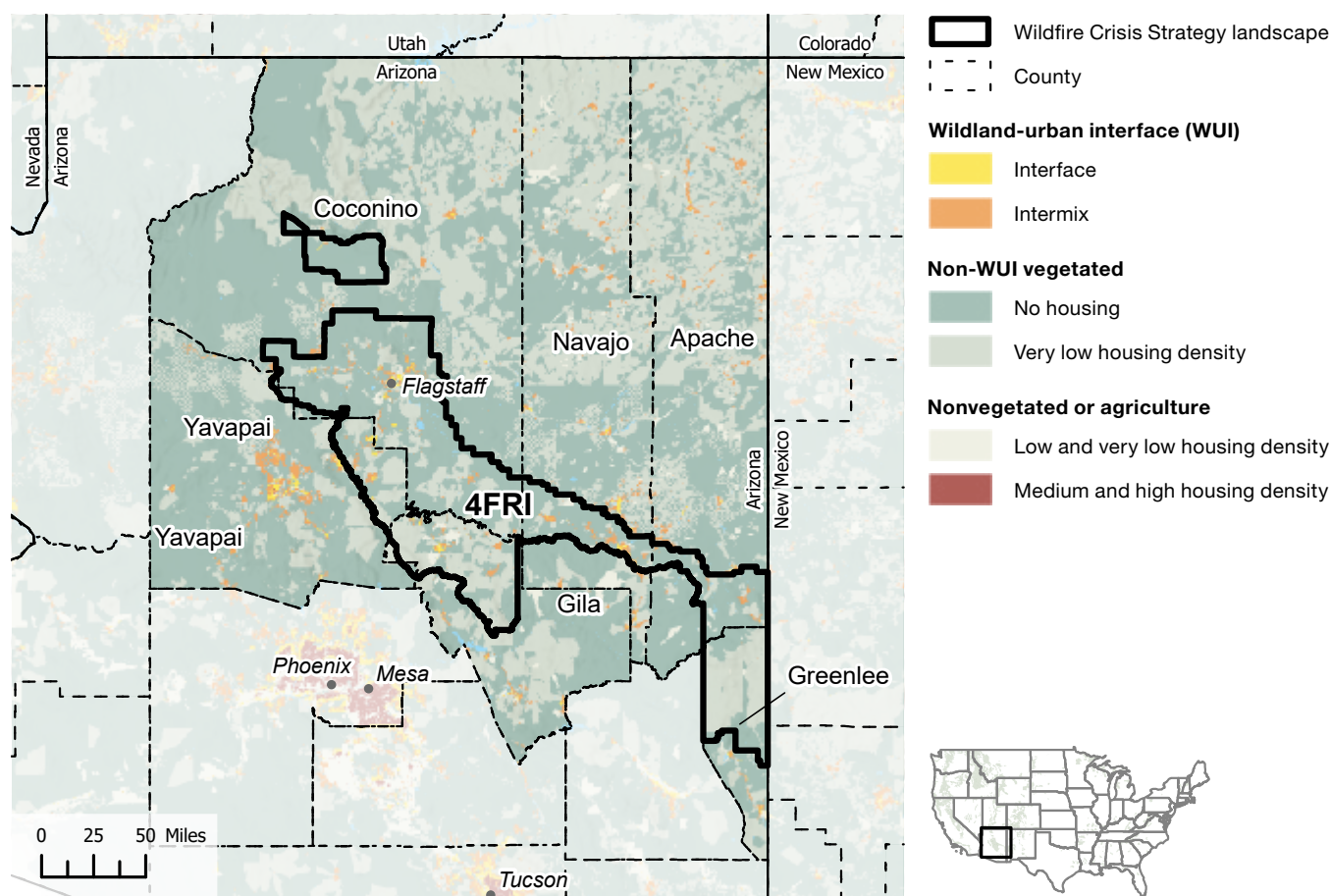


Figure 3.1—Wildland-urban interface (WUI) in the counties associated with the Four Forest Restoration Initiative (4FRI), Arizona, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credit: Rob Anderson and Kathryn Hixson.

Table 3.2—Physical and social characteristics of counties associated with the Four Forest Restoration Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
Four Forest Restoration Initiative landscape counties	624,068	200.2	53,146	14.7	32.2	18.0	57.8	25.7	14.3	22.7
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Counties associated with the Four Forest Restoration Initiative landscape include Apache, Coconino, Gila, Greenlee, Navajo, and Yavapai. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

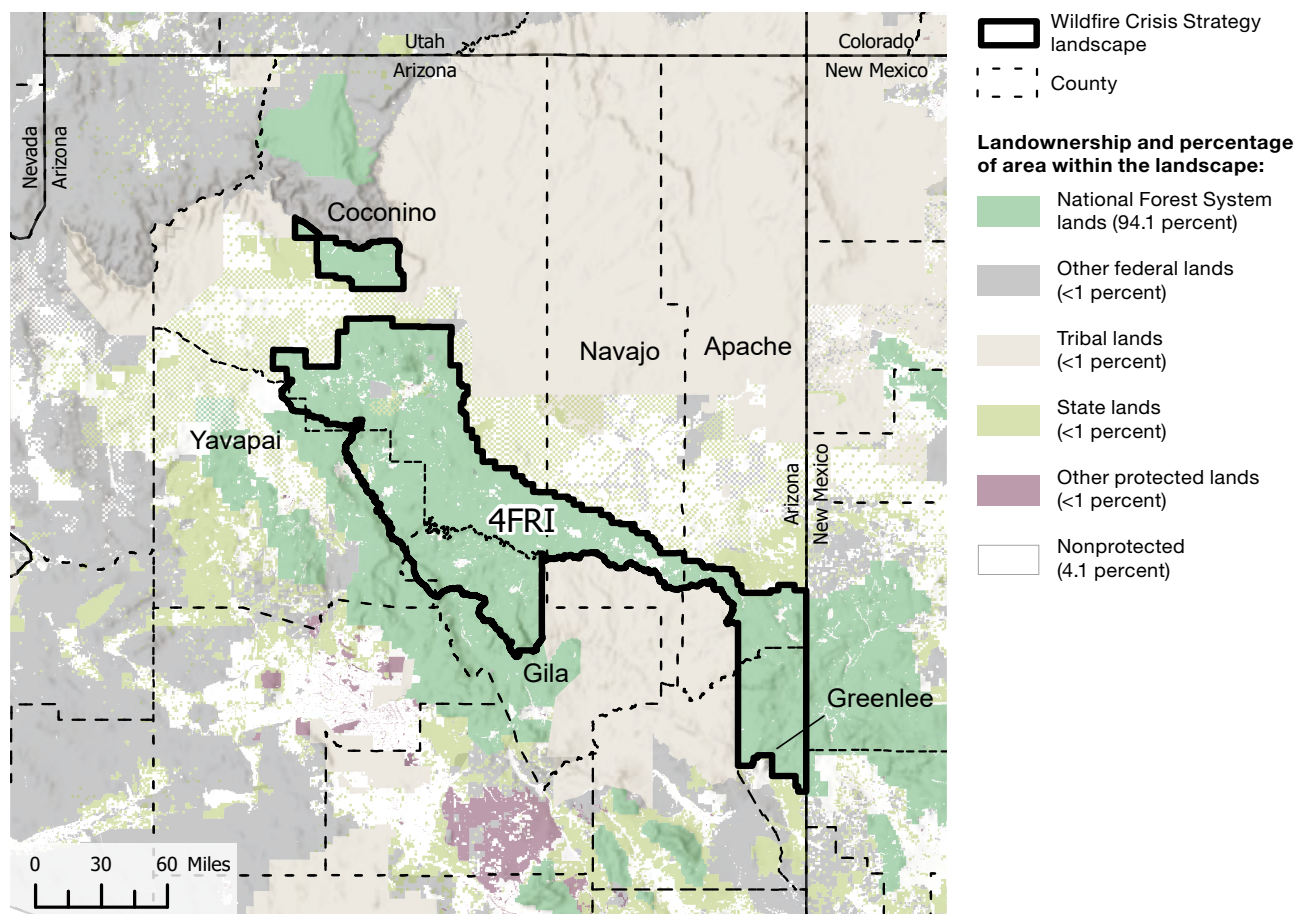


Figure 3.2—Land management and protection status of and around the Four Forest Restoration Initiative (4FRI) landscape, Arizona, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

much of the West (14 percent in the landscape, 31 percent in the West), with higher representation in Greenlee County (48 percent). Finally, there are substantial numbers and proportions of older adults, particularly in Greenlee and Yavapai Counties.

Fire History and Fuel Treatments

The Four Forest Restoration Initiative landscape has experienced multiple large wildfires in the past three decades (table 3.3). The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 1.6 million acres, or about 28 percent of the landscape (fig. 3.3). Except for the 1990 Dude Fire that destroyed 63 structures, four of the five most destructive fires in terms of structure losses occurred after 2010 (table 3.4).

Table 3.3—Five largest wildfires in the counties overlapping the Four Forest Restoration Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties ^a
ACRES			
Wallow Fire	563,664	2011	Apache, Catron, Graham, Greenlee
Rodeo-Chediski Fire	461,774	2002	Coconino, Gila, Navajo
Willow Fire	118,494	2004	Gila, Maricopa, Yavapai
Rafael Fire	75,741	2021	Coconino, Yavapai
Backbone Fire	41,168	2021	Gila, Yavapai

^a All counties are in Arizona except for Catron County, which is in New Mexico.

Source: USGS et al. (2024).

Note: Apache, Coconino, Gila, Greenlee, Navajo, and Yavapai Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Table 3.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Four Forest Restoration Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties ^a
NUMBER			
Yarnell Hill Fire	114	2013	Yavapai
Tinder Fire	96	2018	Coconino
Wallow Fire	72	2011	Apache, Catron, Graham, Greenlee
Dude Fire	63	1990	Coconino, Gila
Goodwin Fire	33	2017	Yavapai

^a All counties are in Arizona except for Catron County, which is in New Mexico.

Sources: USGS et al. (2024), except for the Dude Fire: NWCG (n.d.).

Note: Apache, Coconino, Gila, Greenlee, Navajo, and Yavapai Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 619,000 acres of NFS lands in the Four Forest Restoration Initiative landscape (USDA FS 2024b). This represents 11 percent of NFS lands in the landscape (NFS lands compose about 94 percent of the landscape area) (fig. 3.2).

Fuel treatments included the following:

- More than 397,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 76,000 acres of treatments via commercial sales
- More than 232,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Over the same period, the Four Forest Restoration Initiative landscape had more than 548,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire).

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

Including wildfires reported with fuel-reduction benefits, the total treatment area was more than 1.1 million acres, or 19.9 percent of NFS lands in the landscape. Of the initial WCS landscapes, the Four Forest Restoration Initiative landscape had by far the highest proportion of treatments. The amount of treated area recorded through wildfire was nearly 50 percent of the total area of fuel treatments and was substantially higher on the Four Forest Restoration Initiative than it was in any of the other WCS landscapes.

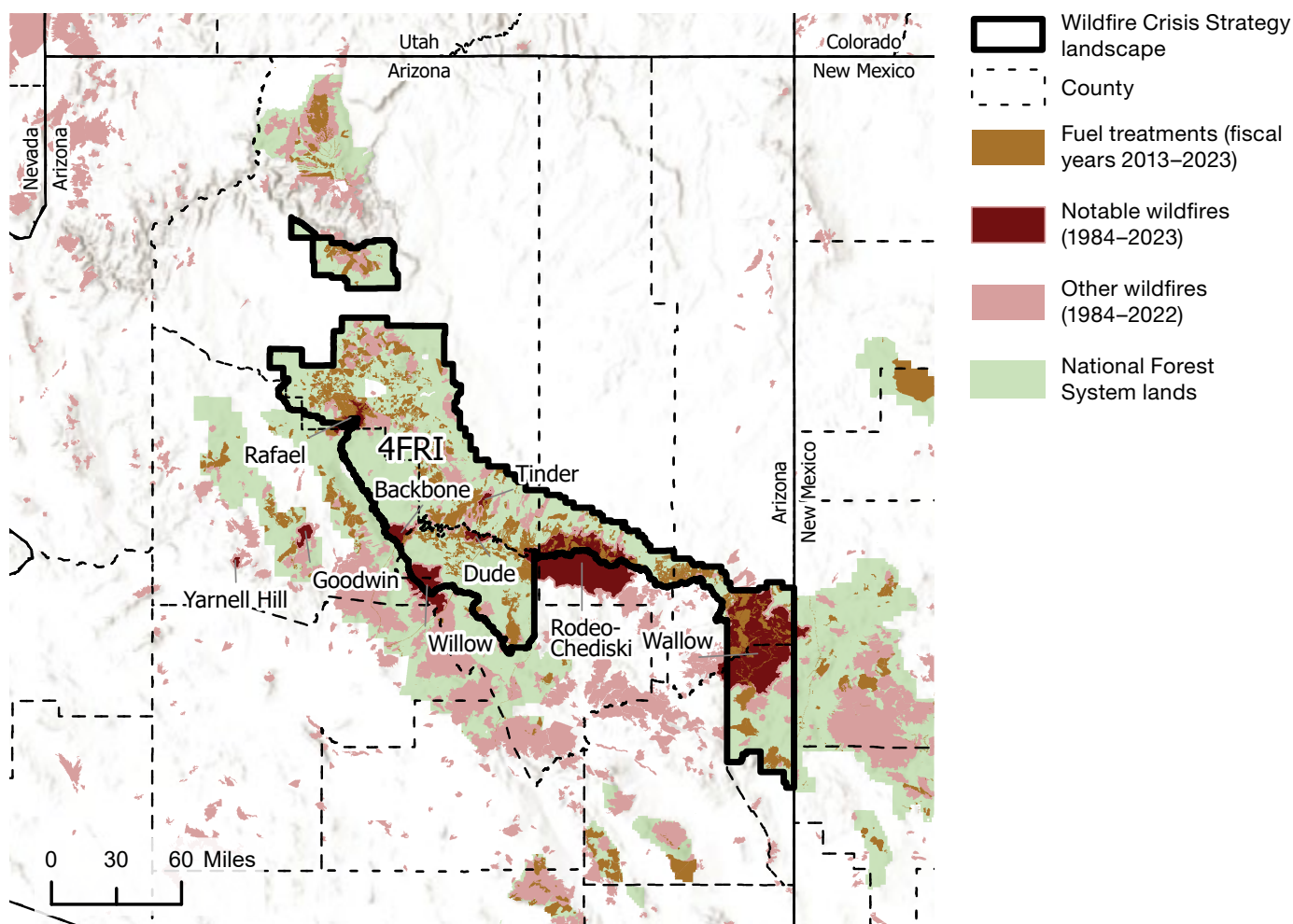


Figure 3.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Four Forest Restoration Initiative (4FRI) landscape, Arizona, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System (completed by fiscal year 2023); wildfires are based on the Monitoring Trends in Burn Severity project (1984–2022). Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Four Forest Restoration Initiative landscape indicates that counties are in the emerging or consolidating categories of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 3.5 with other WUI development trends for reference.

Overall, Coconino County has taken the most concerted planning and regulatory approach to fire adaptation among the counties in the Four Forest Restoration Initiative landscape. The county has adopted policies in its comprehensive plan (Coconino 2015) to support communities and land managers in restoring forest health; this includes reducing the likelihood of high-severity wildfire to improve ecosystem resiliency and watershed health and assessing new developments in forested areas for their vulnerability to wildfire.

Table 3.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Four Forest Restoration Initiative landscape, a priority landscape in the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER	PERCENT			
Apache	11—Emerging	1.9	18,779	65.4	13.3	20.5	21.7
Coconino	18—Consolidating	1.0	64,156	92.8	71.0	11.8	24.2
Gila	10—Emerging	2.2	31,072	96.0	40.9	12.6	15.0
Greenlee	11—Emerging	1.1	4,016	91.5	24.1	6.0	19.4
Navajo	13—Emerging	2.5	48,726	86.7	56.2	12.1	16.6
Yavapai	15—Consolidating	4.4	114,395	94.4	127.7	0.1	7.1
Combined six counties above	N/A	2.1	281,144 ^a	90.1	74.8	11.0	19.9
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the emerging category (8–14) indicate counties that are in the process of becoming more fire adapted via WUI planning adaptation tools; scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for all counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

The county's zoning ordinance has detailed requirements for subdivisions and developments to maintain defensible space and requires the submission of a Firewise USA program plan and emergency response plan for the approval of campgrounds. WUI building construction regulations, such as a requirement for ignition-resistant construction materials for new development, are required in a portion of Coconino County (Sedona Fire District), which is the only part of this landscape that we identified as having this requirement.

Other counties, including Apache, Yavapai, and Navajo Counties, have information on fire history in their comprehensive plans and include policies to support safer development in the WUI. Apache, Gila, Navajo, and Yavapai Counties also recently adopted or updated community wildfire protection plans (CWPPs) for part of or all their county areas in the past 10 years (Gila 2021, 2022; Navajo 2016; Navajo and Apache 2016; Yavapai 2023b). Although some counties have only limited planning and regulatory adaptations currently in place, they may still be taking steps toward fire adaptations. For example, Gila County's CWPPs (for the southern and northern portions of the county) (Gila 2021, 2022) and hazard mitigation plan (Gila 2019) include actions to update its comprehensive plan and adopt local ordinances to address wildfire hazard. In 2023 and 2024, three Community Wildfire Defense Grants were allocated for the landscape, all supporting CWPPs, including the Greater Flagstaff Region, rural fire districts, and tribal communities in Coconino County, and Gila County (USDA FS 2024c).

Coconino County stands out as a location with the highest proportion of land with fuel treatments in the past decade (24.3 percent of NFS lands, including wildfires with fuel-reduction benefits recorded in FACTS) and the highest score on land-use planning and regulations (under the consolidating FLUPE category). Yavapai County, which is home to the greatest number of people and has the fastest WUI increase, similarly is in the consolidating category of land-use planning and regulations but has the smallest proportion of land with fuel treatments on NFS lands in this landscape (see "Chapter 4: Prescott Landscape, Arizona"). Apache County has less investment in land-use planning and regulations compared to the other counties; more than 20 percent of NFS lands in the landscape have been treated (with only minimal area from wildfires with fuel-reduction benefits in FACTS). Many other local adaptations in the Four Forest Restoration Initiative landscape are occurring. For example, the Greater Flagstaff Forests Partnership is a core member of the Fire Adapted Communities Learning Network and a founding member of the Arizona Fire Adapted Community Network. Other partners in the Arizona Fire Adapted Community Network include the Forest Service; U.S. Department of the Interior, Bureau of Land Management; Arizona Department of Forestry and Fire Management; and University of Arizona Agricultural Extension. At the local level, communities are taking an active role in mitigation through efforts that include participation in the Firewise USA and Ready, Set, Go! programs, and other local activities.

Chapter 4: Prescott Landscape, Arizona

Physical and Social Characteristics

The Prescott landscape is in Yavapai County in central Arizona and comprises about 12 percent of the county's area. The landscape lies within the Arizona/New Mexico Mountains ecoregion, a mountainous transition zone between lower elevation deserts to the west and south and the Colorado Plateau to the northeast. The Prescott landscape is adjacent to the Four Forest Restoration Initiative, another priority U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS) landscape, to the east (see chapter 3). The Prescott landscape lies primarily within the watershed of the Agua Fria River, draining southward to join the Gila River and then the Colorado River.

The Prescott landscape is dominated by pinyon-juniper stands, interior chaparral, and grasslands, with desert scrub in the lowest elevations. Vegetation primarily consists of junipers (*Juniperus* spp.), twoneedle pinyon (*Pinus edulis* Engelm.), gray oak (*Quercus grisea* Liebm.), Emory oak (*Quercus emoryi* Torr.), and Gambel oak (*Quercus gambelii* Nutt.). The chaparral community beneath the trees consists of shrubs, such as desert ceanothus (*Ceanothus greggii* A. Gray), alderleaf mountain mahogany (*Cercocarpus montanus* Raf.), Sonoran scrub oak (*Quercus turbinella* Greene), manzanitas (*Arctostaphylos* spp.), and catclaw mimosa (*Mimosa aculeaticarpa* Ortega) in mid-elevations and grassy areas. Scattered oaks or junipers are present in other areas. Ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) and Madrean Pine-Oak Woodlands occur in the isolated highest areas of the landscape.

The landscape is composed of more than 600,000 acres, including more than 360,000 acres of National Forest System (NFS) lands on the Prescott National Forest, as well as other state- and privately owned lands. Yavapai County had a total population of more than 242,000 as of 2021. The Prescott landscape includes substantial wildland-urban interface (WUI) areas in and around the metropolitan area of Prescott and Prescott Valley, Arizona (fig. 4.1). The surrounding county also includes other urbanized areas, including Chino Valley, Arizona.

The Yavapai-Apache Nation Reservation and Off-Reservation Trust Land and Yavapai-Prescott Reservation overlap with the landscape footprint (USDA FS 2024d). The following tribes were identified as having connections to the landscape in the initial landscape

Landscape at a Glance

- The Prescott landscape is entirely within Yavapai County in central Arizona, west of the Four Forest Restoration Initiative landscape.
- The landscape is primarily composed of public lands in the Prescott National Forest.
- A little more than a quarter of the landscape is privately owned, with substantial wildland-urban interface (WUI) areas within and around the metropolitan Prescott area.
- Nearly 95 percent of all housing in the county is within the WUI.
- Yavapai County has experienced rapid growth in population and WUI housing.
- Key vulnerabilities include lower incomes, an older population, and mobile homes represent a larger proportion of housing.
- Fuel treatments have been applied to more than 13.3 percent of National Forest System lands in the landscape.
- Yavapai County is in the consolidating Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk and has a recent community wildfire protection plan and a recently updated and adopted comprehensive plan (Yavapai 2023a).

description: Yavapai-Prescott Indian Tribe, Yavapai-Apache Nation, Fort McDowell Yavapai Nation, Hopi Tribe, Hualapai Tribe, Tonto Apache Tribe (USDA FS 2022d).

Yavapai County shows many of the general trends in the Western United States (hereafter, the West) (table 4.1). These include the following:

- Extremely rapid population growth (much faster than in the United States or the West); the population grew by more than 500 percent from 1970 through 2021.
- Despite this growth, overall income remains well below the national average, at about \$53,000 per capita.
- Low racial diversity (lower than the United States or the West).
- A high proportion of federally managed lands (fig. 4.2).
- Despite a low proportion of WUI areas (4 percent), a substantial proportion of all housing is in the WUI (94 percent).
- Rapid growth in housing in the WUI (128 percent increase from 1990 through 2020).
- Key vulnerabilities include lower incomes, an older population, and mobile homes represent a larger proportion of housing.

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Prescott landscape in Arizona is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

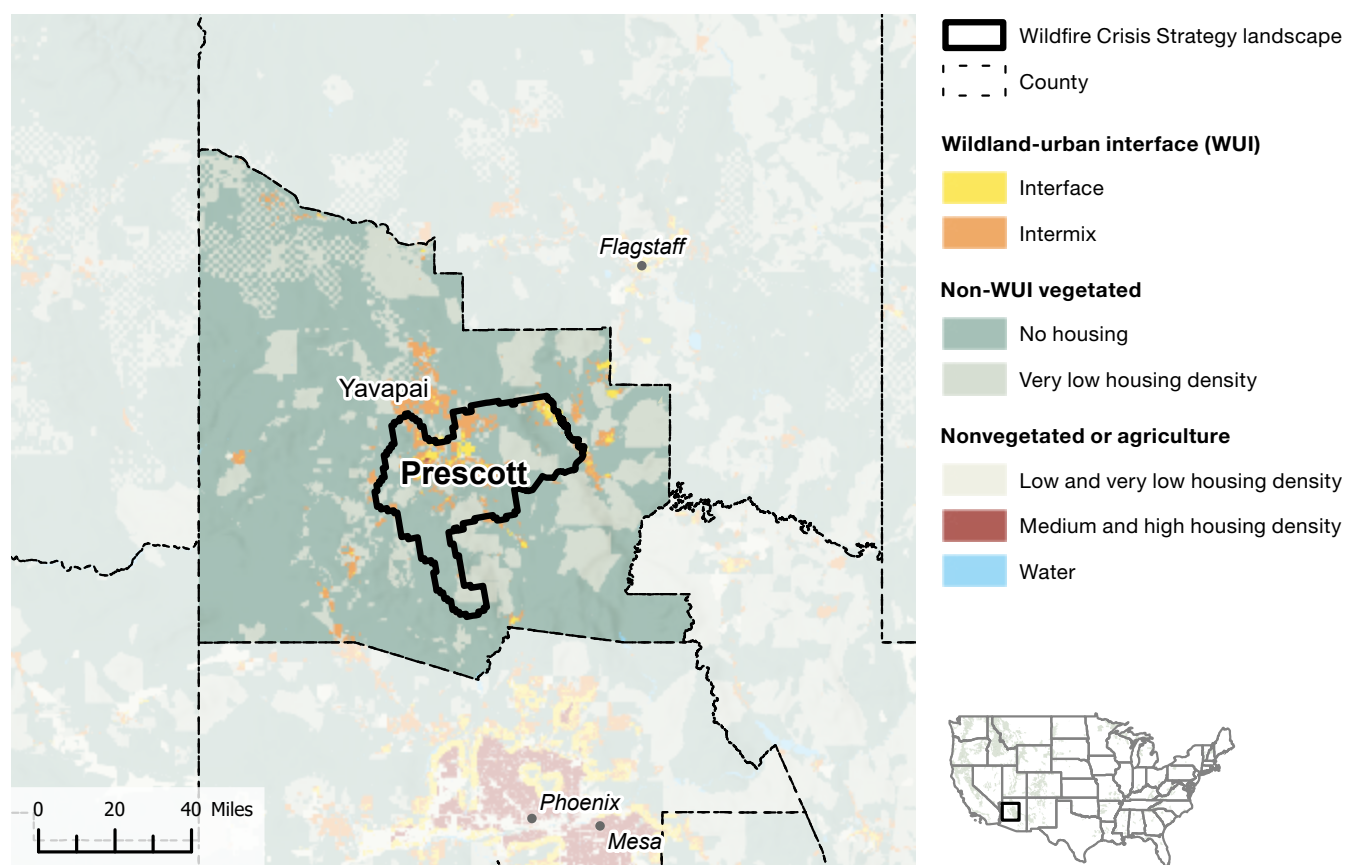


Figure 4.1—Wildland-urban interface (WUI) in Yavapai County, Arizona, associated with the Prescott landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credit: Rob Anderson and Kathryn Hixson.

Table 4.1—Physical and social characteristics of Yavapai County, associated with the Prescott landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS				PERCENT			
Yavapai County	242,253	544.8	52,985	25.5	49.8	17.5	79.4	4.2	15.0	31.9
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Note: The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

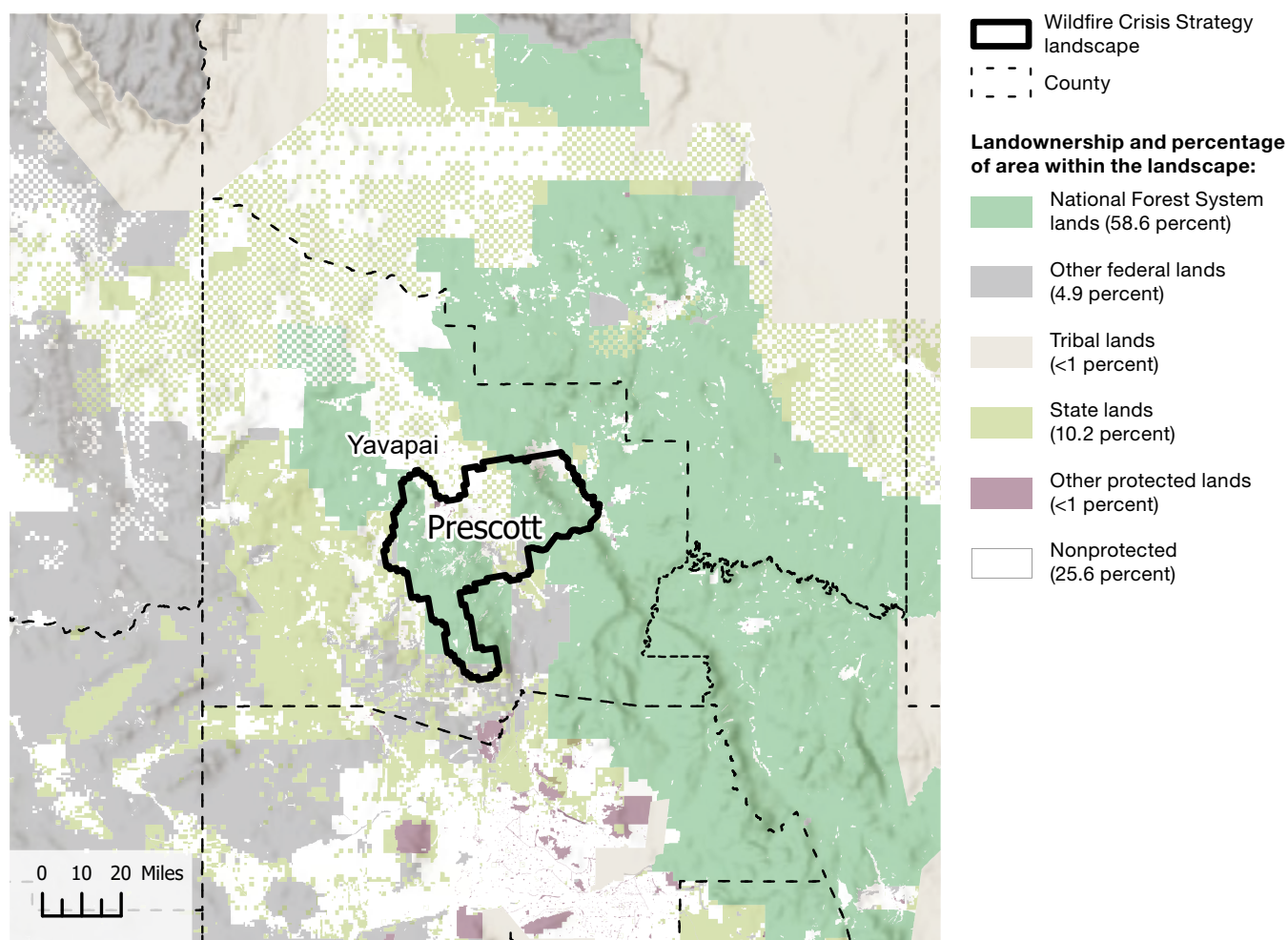


Figure 4.2—Land management and protection status of and around the Prescott landscape, Arizona, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Fire History and Fuel Treatments

The five largest wildfires in the Prescott landscape since 1984 occurred between 2008 and 2021 (table 4.2), and the five most destructive wildfires in terms of structure losses occurred between 2002 and 2017 (table 4.3). The 2013 Yarnell Hill Fire not only resulted in the most structure losses in the landscape but also is notorious for the deaths of 19 firefighters. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 72,000 acres, or about 11 percent of the landscape.

Table 4.2—Five largest wildfires in the counties overlapping the Prescott landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	County
ACRES			
Goodwin Fire	28,192	2017	Yavapai
Tiger Fire	16,380	2021	Yavapai
Gladiator Fire	16,096	2012	Yavapai
Horse Fire	9,174	2020	Yavapai
Lane 2 Fire	8,562	2008	Yavapai

Note: Yavapai County has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 4.3—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Prescott landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	County
NUMBER			
Yarnell Hill Fire	114	2013	Yavapai
Goodwin Fire	33	2017	Yavapai
Lane 2 Fire	18	2008	Yavapai
Indian Fire	6	2002	Yavapai
Gladiator Fire	6	2012	Yavapai

Note: Yavapai County has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024).

From October 2013 through September 2023, hazardous fuel conditions have been addressed on more than 41,000 acres of NFS lands in the Prescott landscape through fuel treatment activities conducted and reported by the Forest Service (USDA FS 2024b). This represents 11.4 percent of NFS lands in the landscape (NFS lands compose about 59 percent of the landscape) (fig. 4.3).

Fuel treatments included the following:

- More than 25,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 1,000 acres of treatments via commercial sales
- More than 18,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

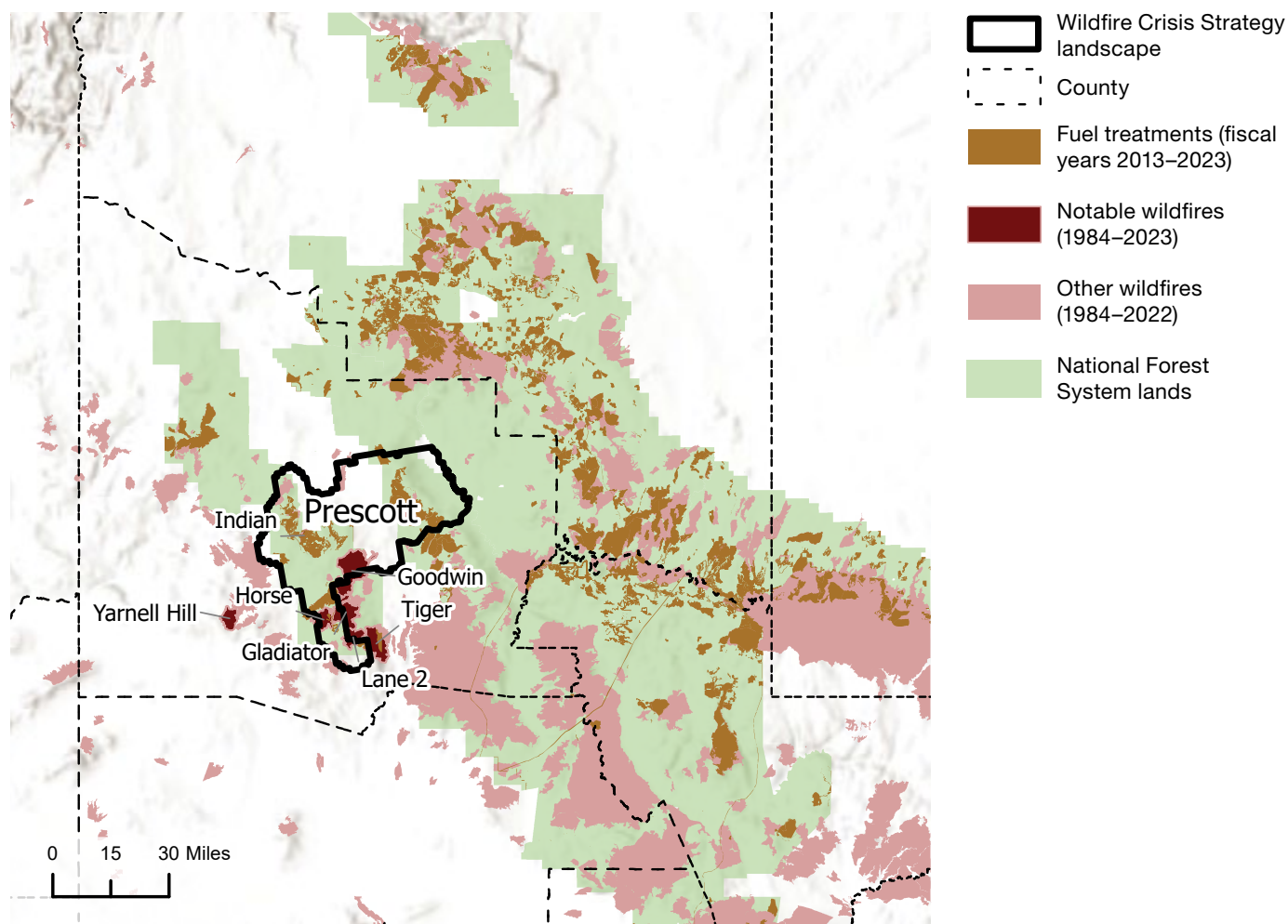


Figure 4.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Prescott landscape, Arizona, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

Over the same period, the Prescott landscape had more than 7,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire).

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

Including wildfires reported with fuel-reduction benefits, the total treatment area was more than 48,000 acres, or 13.3 percent of NFS lands in the landscape.

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire-risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Prescott landscape indicates that Yavapai County is in the consolidating category of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 4.4 with other WUI development trends for reference.

These planning and regulatory adaptations include a recently updated and adopted comprehensive plan (Yavapai 2023a), which contains information on wildfire and its local impacts on the environment, and policies for safer development in forested areas. Although the county’s community wildfire protection plan (CWPP) (Yavapai 2023b) discusses the need for more comprehensive legislation to support wildfire risk reduction through landscaping and building construction requirements in the WUI (similar to requirements adopted by the city of Prescott), there is no indication that Yavapai County has requirements for wildfire-related landscaping practices or building materials in unincorporated areas. As noted in the Four Forest Restoration Initiative landscape section (see chapter 3), there are many other activities at the state and local levels in Arizona to support fire adaptation. Yavapai County (and Coconino County) received funding from the Community Wildfire Defense Grant program in 2024 to update the Greater Flagstaff Region CWPP (USDA FS 2024c).

Table 4.4—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for Yavapai County, associated with the Prescott landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020	Active treatment only	Including wildfires with fuel-reduction benefits	
		PERCENT	NUMBER		PERCENT		
Yavapai	15—Consolidating	4.4	114,395	94.4	127.7	11.4	13.4
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Chapter 5: North Yuba Landscape, California

Physical and Social Characteristics

The North Yuba, California, landscape spans parts of two counties (Sierra and Yuba) in northern California. The landscape is on the west side of the Sierra Nevada mountains and is part of the Yuba River watershed draining westward to the Sacramento River.

The vegetation on the western portion of the North Yuba landscape consists of annual grasses and forbs and is used mostly for dryland range and pasture. There are some isolated stands of blue oak (*Quercus douglasii* Hook. & Arn.) woodlands, primarily at high elevations. The eastern portion of the landscape includes needlegrass (*Achnatherum* spp.) and annual grasslands, chamise (*Adenostoma* spp.), manzanita (*Arctostaphylos* spp.), interior live oak (*Quercus wislizeni* A. DC.), ceanothus (*Ceanothus* spp.), blue oak, and California foothill pine (*Pinus sabiniana* Douglas ex Douglas).

The North Yuba landscape is composed of more than 350,000 acres, largely consisting of National Forest System (NFS) lands on the Tahoe National Forest (more than 200,000 acres) and Plumas National Forest (more than 55,000 acres) as well as privately owned lands. The two counties that are associated with the North Yuba landscape had a total population of about 86,000 as of 2021. The landscape mostly falls in Sierra County, while far more people live in Yuba County (table 5.1).

The landscape does not have major urban areas but does have areas of wildland-urban interface (WUI) in the foothills of the Sierra to the west (fig. 5.1). The major nearby urbanized area (in Yuba County but outside of the North Yuba landscape) is Yuba City, California.

Landscape at a Glance

- The North Yuba landscape in northern California is a smaller and more rural Wildfire Crisis Strategy landscape, spanning two counties (Sierra and Yuba) on the west side of the Sierra Nevada mountains.
- Most of the landscape consists of National Forest System (NFS) lands on the Tahoe and Plumas National Forests.
- The population of Yuba County is larger and more diverse than that of smaller Sierra County.
- Per capita incomes are low, and population and housing growth has been slow in past decades.
- Fuel treatments have been applied to about 4 percent of NFS lands in the landscape, and the counties are in the consolidating (Sierra County) to comprehensive (Yuba County) Fire and Land Use Planning Evaluation Tool categories for addressing the wildland-urban interface and associated wildfire risk.
- As required by the state, each county has mapped fire hazard severity zones and incorporated wildfire concerns into planning efforts.

Table 5.1—Counties associated with the North Yuba landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Sierra	44.1	3,283
Yuba	17.5	83,421
Total		86,704

The North Yuba landscape footprint does not overlap with tribal lands (USDA FS 2024d). The Nisenan Tribe of the Nevada City Rancheria was identified as having connections to the landscape in the initial landscape description (USDA FS 2022d).

The two counties associated with the North Yuba landscape are not representative of some of the general trends in the Western United States (hereafter, the West) (table 5.2), such as rapid growth in population and income levels. In contrast to these trends, the North Yuba landscape has grown more slowly. These include the following:

- Population in Yuba County grew by 85 percent from 1970 through 2021, a rate of growth that was higher than that of the United States but lower than that of the West.
- Sierra County's population grew by 37 percent (to just more than 3,000 people as of 2021). WUI growth has also been lower than many other WCS landscapes (18 percent increase from 1990 through 2020, lower than in the United States).
- Among the 40 counties we examined, Sierra County was the only county to show a reduction in the amount of WUI housing (0.8 percent decrease) from 1990 through 2020.

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The North Yuba landscape in California is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

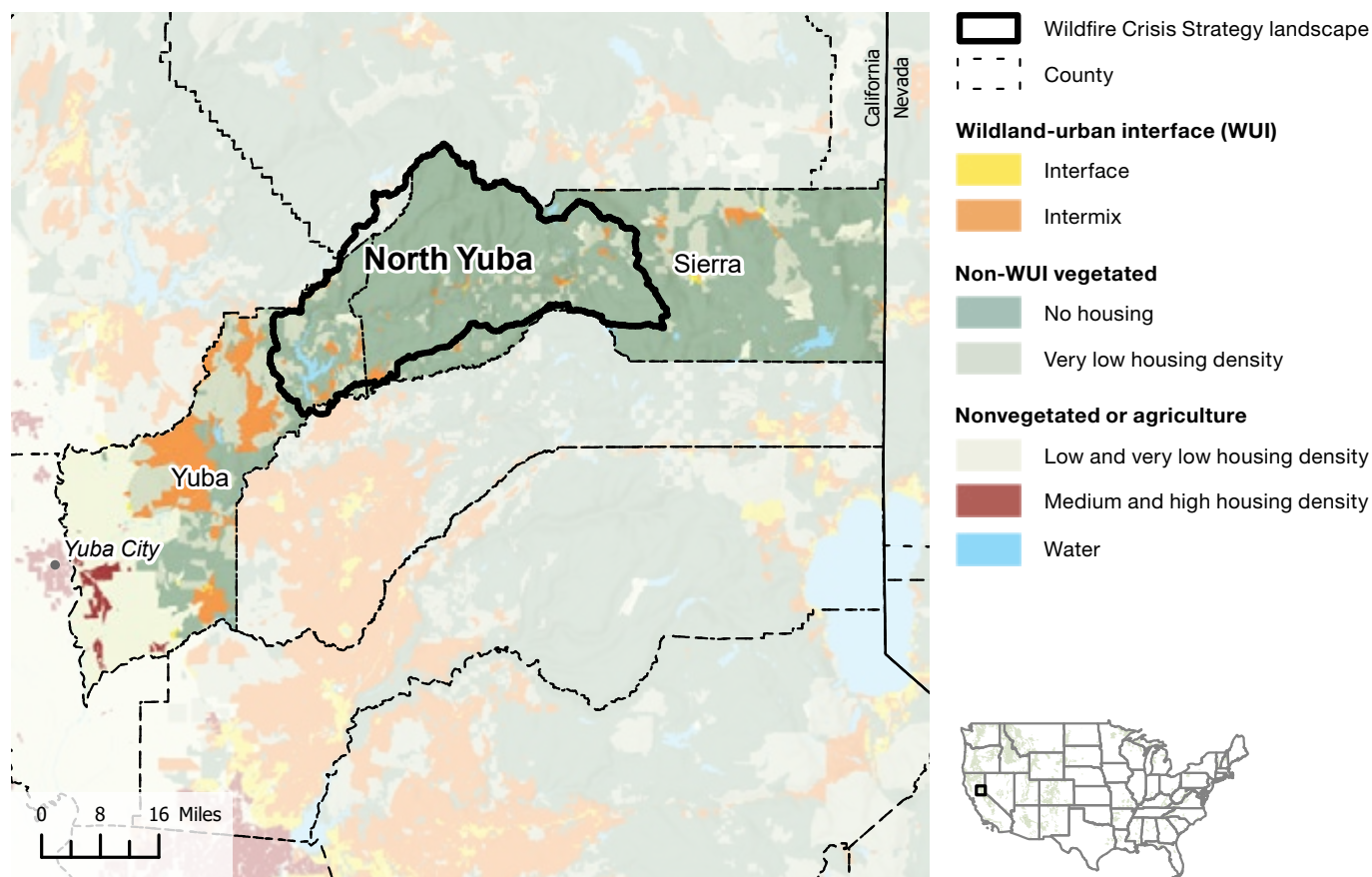


Figure 5.1—Wildland-urban interface (WUI) in the counties associated with the North Yuba landscape, California, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credits: Rob Anderson and Kathryn Hixson.

- Per capita incomes are low in comparison to the West and to other WCS landscapes.
- Seven percent of the combined counties' population identifies as American Indian, higher than the four percent across the West.

Table 5.2—Physical and social characteristics of counties associated with the North Yuba landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
North Yuba landscape counties	86,704	83.1	52,827	46.6	48.6	7.4	53.9	6.6	28.8	13.0
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Counties associated with the North Yuba landscape include Sierra and Yuba. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

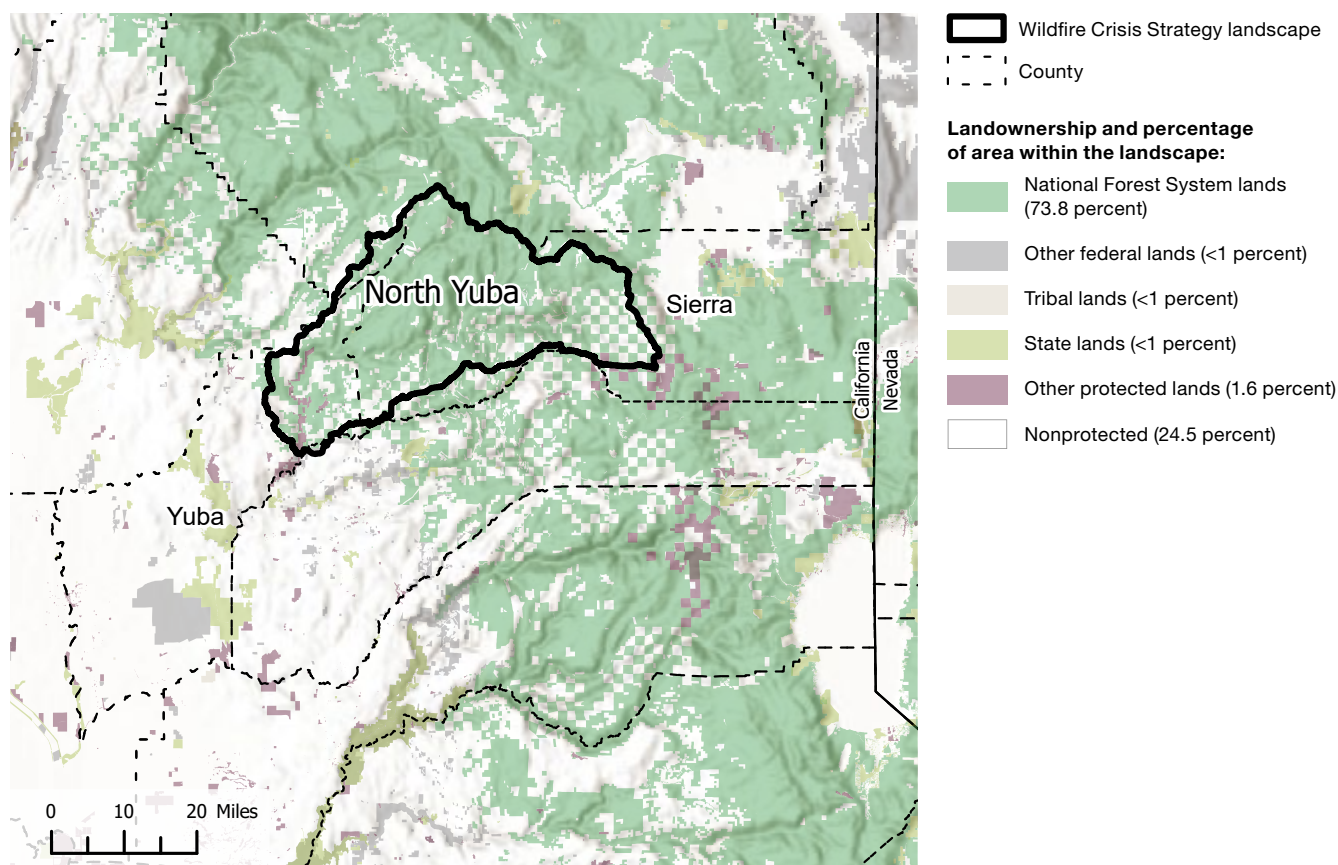


Figure 5.2—Land management and protection status of and around the North Yuba landscape, California, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

In other ways, North Yuba landscape counties are representative of other general trends in the West: a high proportion of federal lands (fig. 5.2), mobile homes represent a large proportion of housing, and substantial proportions of the population are Hispanic or Latino and older adults (age 65 and older).

Fire History and Fuel Treatments

The largest wildfires in the North Yuba landscape since 1984 occurred between 1987 and 2010 (table 5.3), and the five most destructive fires in terms of structure losses occurred between 1988 and 2020 (table 5.4). The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 19,000 acres, or about 5 percent of the landscape.

Table 5.3—Four largest wildfires^a in the counties overlapping the North Yuba landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	County
ACRES			
Pendola Fire	11,768	1999	Yuba
Indian Fire	8,803	1987	Sierra
Bassetts Fire	2,320	2006	Sierra
Bullard Fire	1,311	2010	Yuba

Note: Sierra and Yuba Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

^aOnly four largest wildfires are included, in contrast to five for other landscape profiles, because these are the only known fires within our data sources for the landscape, although additional fires have occurred in the counties surrounding the landscape.

Table 5.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the North Yuba landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
NUMBER			
Williams Fire	417	1997	Yuba
49er Fire	312	1988	Nevada, Yuba
Cascade Fire	200	2017	Butte, Yuba
Pendola Fire	72	1999	Yuba
Willow Fire	41	2020	Yuba

Note: Only Yuba County has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024), except the Williams Fire: Cal Fire (n.d.), Yuba (n.d.) and 49er Fire: Cal Fire (n.d.), Martin and Sapsis (1995).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 10,000 acres of NFS lands in the North Yuba landscape (USDA FS 2024b). This represents 3.9 percent of NFS lands in the landscape (NFS lands compose about 74 percent of the landscape area) (fig. 5.3).

Fuel treatments included the following:

- More than 1,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 3,000 acres of treatments via commercial sales

- More than 7,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

During this period, the North Yuba landscape did not experience any wildfire that was recorded as having fuel-reduction benefits (such as natural ignition fires that benefitted fuel conditions or planned fuel treatment areas burned in wildfire).

Although a smaller area of the landscape is in Yuba County, a higher proportion of NFS lands in the landscape have been treated there over the past decade, where there is a larger population than in more rural Sierra County.

In 2023, Sierra County received funding from the Community Wildfire Defense Grant program (about \$2.5 million) for additional fuel reduction and to update its community wildfire protection plan (CWPP), and Yuba County received funding to update its CWPP (USDA FS 2024c).

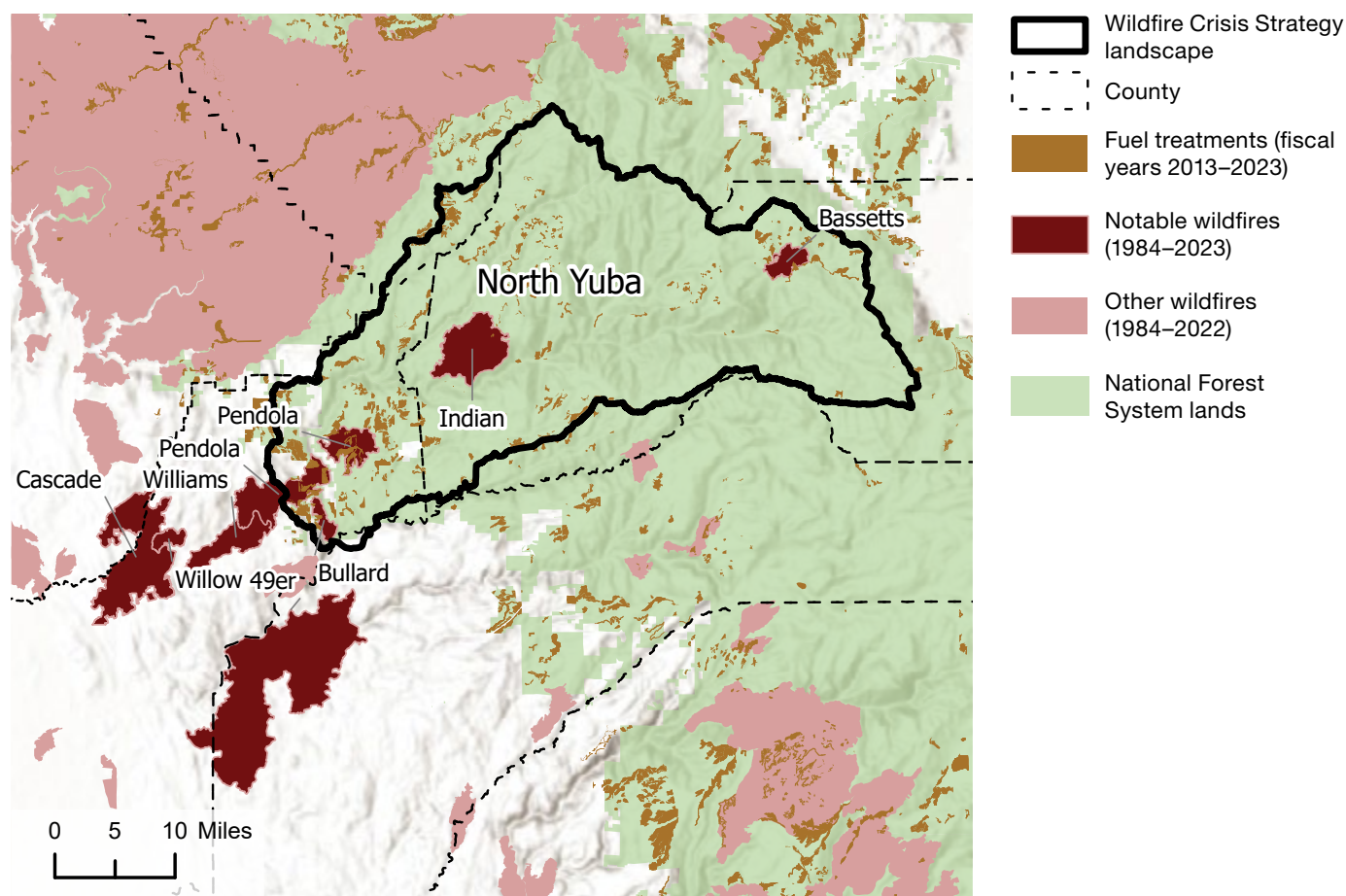


Figure 5.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the North Yuba landscape, California, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

This section summarizes countywide plans and regulations that focus on wildland-urban interface development (WUI) and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the North Yuba landscape indicates that counties are in consolidating or comprehensive categories of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 5.5 with other WUI development trends for reference.

California has a comprehensive set of state requirements that apply to many local jurisdictions, such as those with lands in designated “state responsibility areas” and “identified fire hazard severity zones,” which includes both Sierra and Yuba Counties. State-level requirements include maintaining an updated general plan safety element with relevant data and policies focused on fire safety; adopting the state’s building and residential codes to address ignition-resistant construction methods and design; adopting the state’s fire code, which includes a chapter on the WUI; and adopting the state’s minimum fire safe regulations. As a result, many counties in the state would be expected to fall within a moderate or above rating for plans and regulatory adaptations.

Table 5.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the North Yuba landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER	PERCENT			
Sierra	15—Consolidating	1.8	1,832	86.1	–0.8	1.6	1.6
Yuba	22—Comprehensive	16.1	5,726	19.4	24.9	14.6	14.6
Combined two counties above	N/A	7.5	7,558 ^a	23.9	17.5	3.9	3.9
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk; scores in the comprehensive category (22–28) indicate counties that are using all or nearly all available WUI planning adaptation tools to address the WUI, wildfire hazard, and wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for both counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

In addition, jurisdictions may go beyond these state requirements by adopting additional plans, policies, or regulations to address the WUI. For example, Yuba County has additional subdivision design requirements for fire safety in its development code. This includes locating housing sites and building envelopes in a manner that allows for the implementation and maintenance of fuel modification zones and maximizes defensibility from wildland fires (e.g., access easements).

Other adaptations are occurring in both counties, many of which are coordinated through local fire safe councils. Fire Safe Sierra County receives grants and collaborates with local stakeholders to implement fuel reduction projects; support planning activities for wildfire mitigation, forest health, and resilience; promote defensible space; and build local capacity. Similarly, the Yuba Watershed Protection and Fire Safe Council offers financial assistance to homeowners for conducting home assessments and mitigation, undertakes a roadside fuel treatment program, and offers a reflective address safety sign program.

Chapter 6: Stanislaus Landscape, California

Physical and Social Characteristics

The Stanislaus landscape is located primarily in Tuolumne County, California, and includes 20.5 percent of the county's area. The landscape is on the west side of the Sierra Nevada mountains, and spans the Stanislaus and Tuolumne watersheds, draining westward to the San Joaquin River.

The higher elevations of the Stanislaus landscape (4,000 to 6,000 feet) are characterized by Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson), canyon live oak (*Quercus chrysolepis* Liebm.), California live oak (*Quercus agrifolia* Née), and California black oak (*Quercus kelloggii* Newberry). Moving west and to lower elevations, the forest vegetation transitions to pines, oaks, and chaparral. The farthest west portions of the landscape are characterized by needlegrass (*Achnatherum* spp.), annual grasslands, chamise (*Adenostoma* spp.), manzanita (*Arctostaphylos* spp.), interior live oak (*Quercus wislizeni* A. DC.), ceanothus (*Ceanothus* spp.), blue oak (*Quercus douglasii* Hook. & Arn.), and California foothill pine (*Pinus sabiniana* Douglas ex Douglas).

The Stanislaus landscape includes more than 300,000 acres, and largely consists of National Forest System (NFS) lands on the Stanislaus National Forest (more than 175,000 acres), as well as other state- and privately owned lands. Tuolumne County had a total population of more than 55,000 as of 2021. The landscape includes substantial areas of wildland-urban interface (WUI) in the foothills on the west side of the Sierra, including the city of Sonora, California, and surrounding areas along the Sonora Pass Highway heading eastward into the mountains (fig. 6.1).

The Tuolumne Rancheria is entirely inside the landscape footprint, and the initial landscape description identified the Tuolumne Band of Me-Wuk Indians as having connections to the landscape (USDA FS 2022d, USDA FS 2024d).

Tuolumne County is representative of many of the general trends in the Western United States (hereafter, the West) (table 6.1). These include the following:

- Rapid population growth (slightly faster than the West); the population grew by 150 percent from 1970 through 2021, with associated growth in per capita income.
- Despite this growth, overall income remains well below the national average, at about \$56,000 per capita.
- Low racial diversity (less than the United States or the West).
- A high proportion of federally managed lands (fig. 6.2).

Landscape at a Glance

- The Stanislaus landscape in northern California is the smallest Wildfire Crisis Strategy landscape. It is located almost entirely within Tuolumne County.
- Tuolumne County had a population of more than 55,000 as of 2021, and growth has been relatively modest.
- Key vulnerabilities include lower incomes and an older population.
- A total of 12.5 percent of the National Forest System lands in the landscape have received fuel treatments in the past decade, and the county is in the comprehensive Fire and Land Use Planning Evaluation Tool category for addressing the wildland-urban interface and associated wildfire risk, in line with state requirements.
- In 2023, Tuolumne County received \$10 million in Community Wildfire Defense Grant funding from the U.S. Department of Agriculture, Forest Service to support planning and risk reduction efforts.

- Despite a relatively low proportion of WUI areas (7 percent), a substantial proportion of all housing is in the WUI (96 percent). In contrast to many of the other WCS landscapes, the rate of growth in housing in the WUI has been relatively low (26 percent increase from 1990 through 2020, slightly less than in the United States).

Fire History and Fuel Treatments

The largest wildfires in the Stanislaus landscape since 1984 occurred between 1987 and 2013 (table 6.2), and the five most destructive fires in terms of structure losses occurred between 2008 and 2018 (table 6.3). Only one of the five most destructive fires was large enough to be included with the five largest fires, and vice versa. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 46,000 acres, or about 15 percent of the landscape. The Rim Fire of 2013 burned a large area immediately to the south but only intersected with a small portion of the Stanislaus landscape.

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Stanislaus landscape in California is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

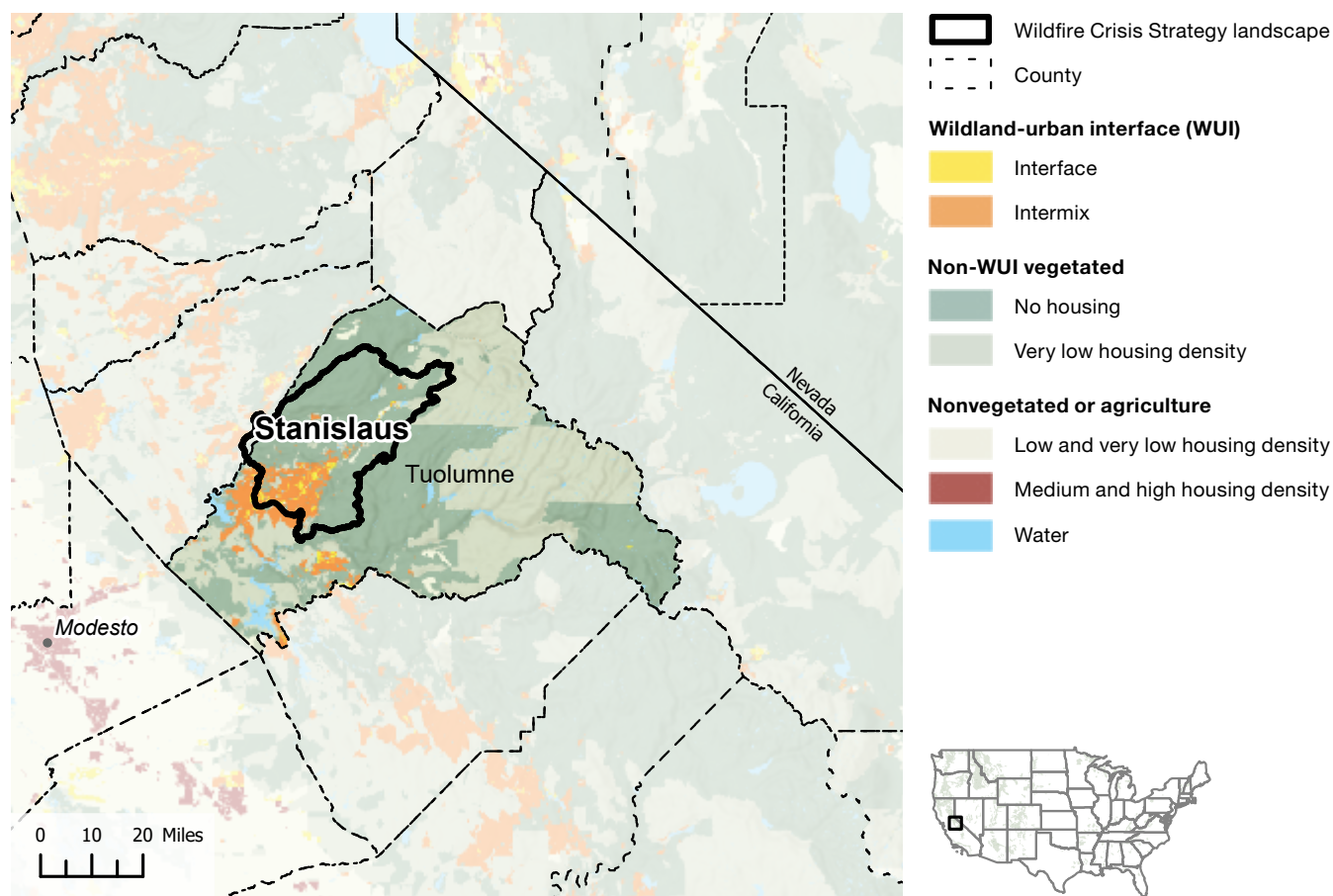


Figure 6.1—Wildland-urban interface (WUI) in Tuolumne County, associated with the Stanislaus landscape, California, a priority landscape of the U.S. Department of Agriculture Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credits: Rob Anderson and Kathryn Hixson.

Table 6.1—Physical and social characteristics of Tuolumne County, associated with the Stanislaus landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
Tuolumne County	55,810	149.6	56,490	24.6	74.8	10.8	79.1	5.5	12.9	26.2
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Note: The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

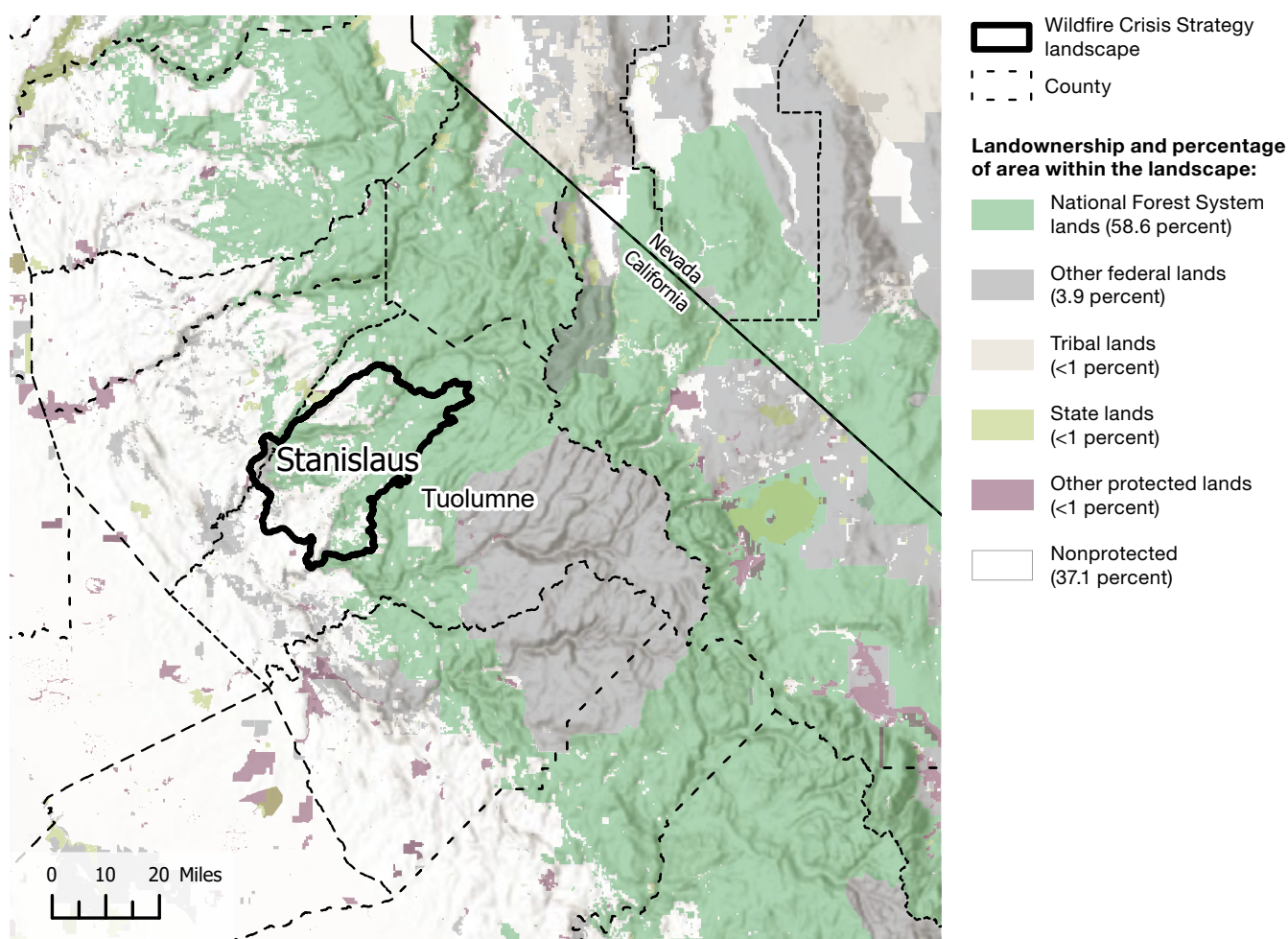


Figure 6.2—Land management and protection status of and around the Stanislaus landscape, California, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Table 6.2—Five largest wildfires in the counties overlapping the Stanislaus landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties
ACRES			
Rim Fire	257,084	2013	Mariposa, Tuolumne
Paper Fire	49,296	1987	Tuolumne
Old Gulch Fire	18,019	1992	Calaveras
Rogge Fire	17,559	1996	Tuolumne
Darby Fire	14,734	2001	Calaveras, Tuolumne

Note: Only Tuolumne County has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 6.3—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Stanislaus landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
NUMBER			
Donnell Fire	135	2018	Alpine, Tuolumne
Rim Fire	112	2013	Mariposa, Tuolumne
Armario Fire	7	2012	Tuolumne
Oak Fire	3	2015	Tuolumne
LaGrange Fire	2	2008	Tuolumne

Note: Only Tuolumne County has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 22,000 acres of NFS lands in the Stanislaus landscape (USDA FS 2024b). This represents 12.4 percent of NFS lands in the landscape (NFS lands compose about 59 percent of the landscape) (fig. 6.3).

Fuel treatments included the following:

- More than 4,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 5,000 acres of treatments via commercial sales
- More than 18,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Over the same period, the Stanislaus landscape had more than 100 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire).

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

In 2023, Tuolumne County received Community Wildfire Defense Grant funding from the Forest Service, including \$10 million for work on defensible space, roadside vegetation management, and community efforts to adapt to wildfire, while the utilities district received additional funding to create a community wildfire protection plan (CWPP). The Chicken Ranch Rancheria of Me-Wuk Indians of California also received a grant for work on tribal and adjacent lands (USDA FS 2024c).

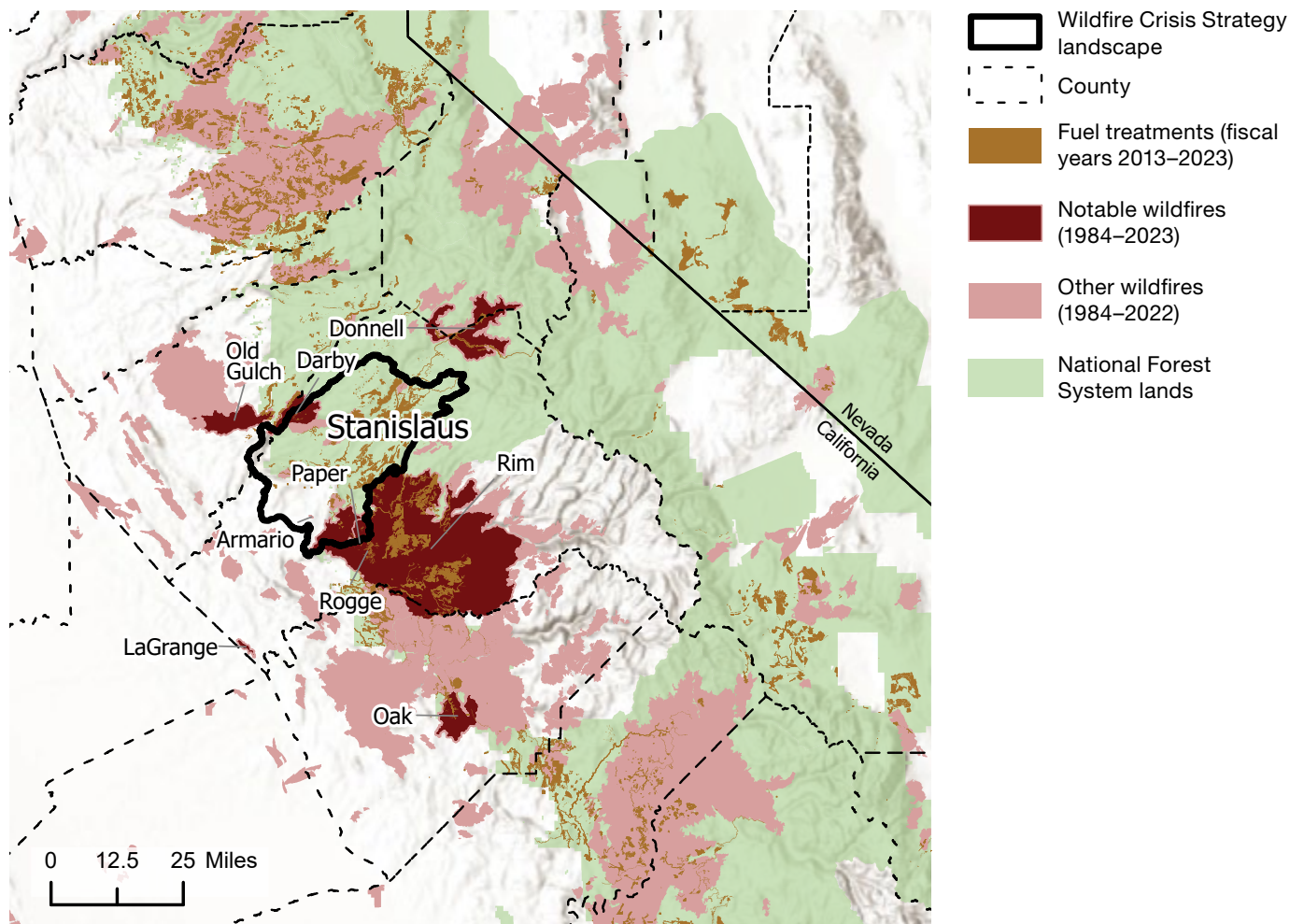


Figure 6.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Stanislaus landscape, California, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Stanislaus landscape indicates that Tuolumne County is in the consolidating category of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 6.4 with other WUI development trends for reference.

As noted in the North Yuba landscape section (see chapter 5), California has a comprehensive set of state requirements that apply to many local jurisdictions, such as those with lands in “state responsibility areas” and “identified fire hazard severity zones,” which includes Tuolumne County. State-level requirements include maintaining an updated general plan safety element with relevant data and policies focused on fire safety; adopting the state’s building and residential codes to address ignition-resistant construction methods and design; adopting the state’s fire code, which includes a chapter on the WUI; and adopting the state’s minimum fire safe regulations.

In addition, jurisdictions may go beyond these state requirements by adopting additional plans, policies, or regulations to address the WUI. For example, Tuolumne County has adopted a hazardous vegetation management ordinance to require the removal of hazardous vegetation in unincorporated areas of the county, including along applicable driveways, roadways, road easements, and near structures.

Tuolumne County is also working in partnership with the Tuolumne Fire Safe Council to develop a CWPP. Other adaptations implemented by the Tuolumne Fire Safe Council include the construction of shaded fuel breaks and fuel reduction projects, education and outreach activities, and providing wildfire safety and preparedness resources for residents.

Table 6.4—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for Tuolumne County, associated with the Stanislaus landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development			NFS lands in the landscape with fuel treatment, fiscal years 2014–2023		
					Growth in WUI housing, 1990–2020	Active treatment only	Including wildfires with fuel-reduction benefits
		Area in the WUI, 2020	Housing units in the WUI, 2020				
		PERCENT	NUMBER			PERCENT	
Tuolumne	18—Consolidating	6.6	30,263	96.3	26.2	12.5	12.5
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Chapter 7: Colorado Front Range Landscape

Physical and Social Characteristics

The Colorado Front Range landscape spans substantial parts of 12 counties on the eastern side of the Front Range in central Colorado, where the Rocky Mountains meet the Great Plains. The landscape is largely in the watershed of the South Platte River, which flows northeastward to the Platte River and then to the Mississippi River.

The vegetation on the highest alpine areas (10,500 to 11,000 feet) in the Colorado Front Range landscape includes low shrubs, cushion plants, and wildflowers and sedges in wet meadows. At the tree line, forests are stunted, deformed krummholz vegetation that include Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), and limber pine (*Pinus flexilis* James), as well as Rocky Mountain bristlecone pine (*Pinus aristata* Engelm.). At elevations between about 9,000 and 10,500 feet, forests transition to dense stands of Engelmann spruce and subalpine fir with isolated stands of lodgepole pine (*Pinus contorta* Douglas ex Loudon). At even lower elevations (7,000 to 9,000 feet), the forest vegetation transitions to quaking aspen (*Populus tremuloides* Michx.), ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), and pockets of lodgepole pine and limber pine. Extending out into the foothills (6,000- to 8,500-foot elevation), the vegetation is characterized by sagebrush (*Artemisia* L.) and mountain mahogany (*Cercocarpus* Kunth), pinyon-juniper woodlands, a variety of shrubs, and grasslands.

The Colorado Front Range landscape includes almost 3.6 million total acres and consists of 1.5 million acres of National Forest System (NFS) lands on the Arapaho and Roosevelt National Forests and the Pike-San Isabel National Forests mostly in the mountainous terrain of the Front Range. The most urbanized of the initial Wildfire Crisis Strategy (WCS) landscapes, the Colorado Front Range landscape also consists of more than 2 million acres of non-NFS lands that include highly developed areas at the base of the Front Range on the western edge of the Great Plains, in the urban megaregion that includes the Fort Collins, Boulder, Denver-Aurora-Lakewood, and Colorado Springs metropolitan areas.

Landscape at a Glance

- The Colorado Front Range is one of the largest Wildfire Crisis Strategy (WCS) landscapes, containing more than 12 counties and 4 million people.
- The most urbanized of the initial WCS landscapes, the Colorado Front Range landscape includes more than 2 million acres of non-National Forest System (NFS) lands.
- Housing and wildland-urban interface (WUI) growth have been rapid and per capita incomes are high.
- The Colorado Front Range has experienced many notable wildfires over the past two decades, including thousands of structures lost.
- Across the 12 counties in this landscape, there is substantial variation in the proportion of NFS land that has received fuel treatments and in the level of county investment in land-use planning and regulations to reduce wildfire risk.
- Jefferson, Boulder, and Larimer Counties stand out as counties with 5 percent or more of NFS lands treated, and these counties are in the comprehensive Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk.

The 12 counties associated with the Colorado Front Range landscape had a total population of nearly 3.9 million as of 2021 (table 7.1). Major urban areas in the landscape include Boulder, part of Denver, much of Denver’s southwestern suburbs (e.g., Lakewood and Littleton), and part of Colorado Springs (fig. 7.1). Other major urban areas within these counties (but outside of the Colorado Front Range landscape) include Fort Collins and Aurora.

The Colorado Front Range landscape footprint does not have overlapping tribal lands (USDA FS 2024d). The following tribes were identified as having connections to the landscape in the initial landscape description: the Apache Tribe of Oklahoma; Cheyenne and Arapaho Tribes; Cheyenne River Sioux Tribe; Comanche Nation; Jicarilla Apache Nation; Kiowa Tribe of Oklahoma; Navajo Nation; Northern Arapaho Tribe; Northern Cheyenne Tribe; Oglala Sioux Tribe; Osage Nation; Pawnee Nation; Rosebud Sioux Tribe; Southern Ute Indian Tribe; Standing Rock Sioux Tribe; Pueblo of Taos; Mandan, Hidatsa and Arikara Nation (also known as MHA Nation or Three Affiliated Tribes); and Ute Mountain Ute Tribe (USDA FS 2022d).

The Colorado Front Range is unique among the initial WCS landscapes in that it represents a portion of a major metropolitan area associated with different demographic and socioeconomic characteristics. For example, it is the only initial WCS landscape in which personal income is higher than the national average, at about \$83,000 per capita

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Colorado Front Range landscape is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 7.1—Counties associated with the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Arapahoe	6.5	654,900
Boulder	66.2	329,543
Clear Creek	71.7	9,446
Denver	26.0	711,463
Douglas	66.8	368,990
El Paso	20.4	737,867
Fremont	12.5	49,661
Gilpin	85.3	5,873
Jefferson	80.4	579,581
Larimer	48.6	362,533
Park	43.2	17,720
Teller	98.6	24,926
Total		3,852,503

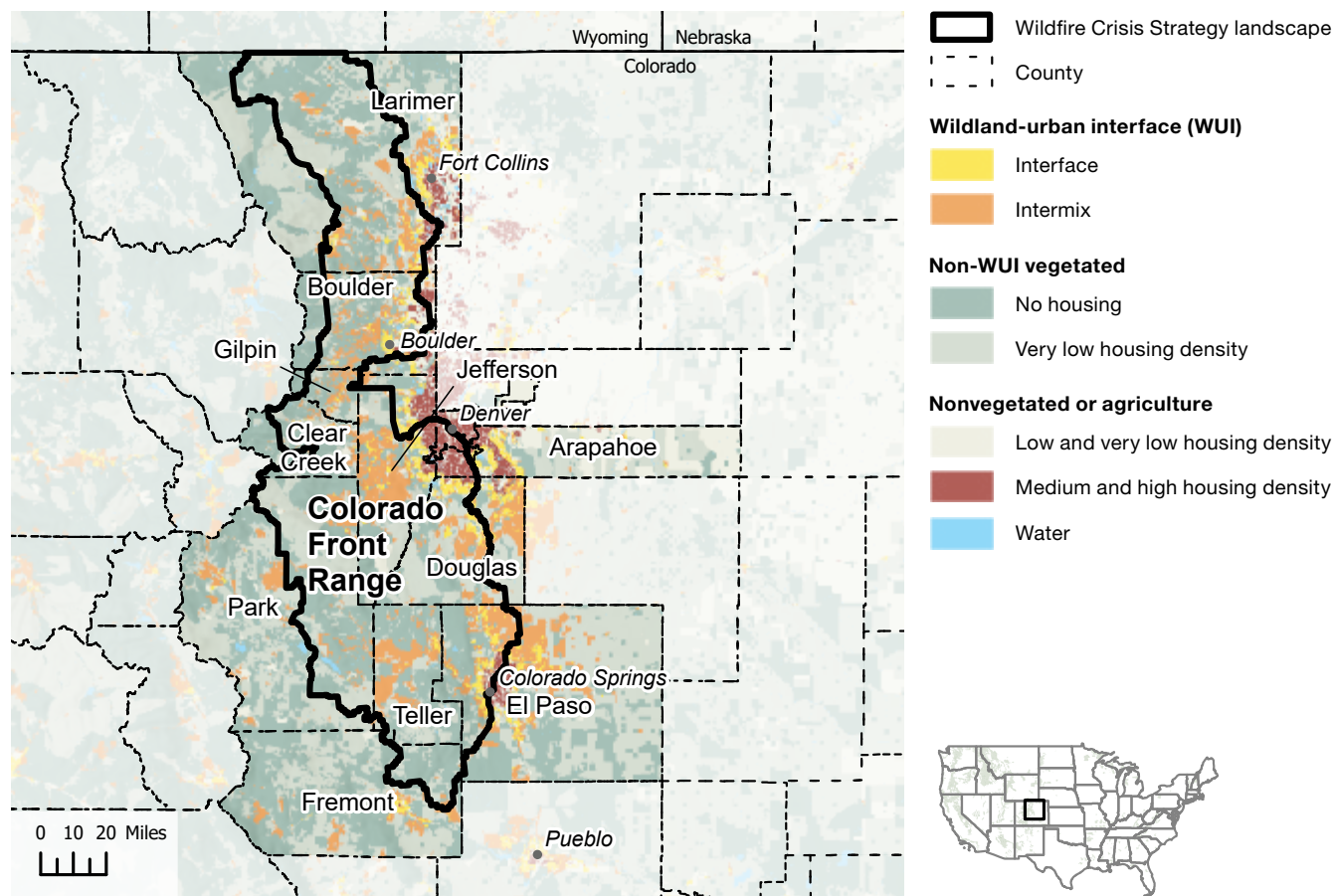


Figure 7.1—Wildland-urban interface (WUI) in the counties associated with the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credits: Rob Anderson and Kathryn Hixson.

Table 7.2—Physical and social characteristics of counties associated with the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
Colorado Front Range landscape counties	3,852,503	170.9	83,182	52.7	36.3	1.6	68.6	3.2	18.1	13.9
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Note: Arapahoe, Boulder, Clear Creek, Denver, Douglas, El Paso, Fremont, Gilpin, Jefferson, Larimer, Park, and Teller Counties are associated with the Colorado Front Range landscape. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

(table 7.2). However, income levels vary substantially across the 12 counties, ranging from \$44,000 in Fremont County to \$107,000 in Denver County. The landscape also includes a higher proportion of privately owned lands than many of the other landscapes. Because of the level of urban and suburban development, the Colorado Front Range has a substantially higher proportion of wildland-urban interface (WUI) (14 percent) than any other initial WCS landscape. More than 600,000 housing units (representing 41 percent of all housing in the counties) are located in the WUI, by far the largest number of WUI homes in the initial WCS landscapes. The proportion of housing in mobile homes was lower than or similar to trends across the Western United States (hereafter, the West), except for more rural Fremont County (where mobile homes represent 13 percent of housing).

Despite these key differences, the 12 counties associated with the Colorado Front Range landscape are representative of many of the general trends in the West, including the following:

- Rapid population growth (even faster than the West), nearly tripling in population from 1970 through 2021.
- Lower percentages of American Indian and Hispanic/Latino populations (lower than the United States or the West), except for some parts of metropolitan Denver and Colorado Springs (e.g., Denver County was 29 percent Hispanic/Latino, in line with the rest of the West).
- A high proportion of federally managed lands, at least within the less-urban counties in the Colorado Front Range (fig. 7.2). In contrast to most of the counties we included in this report, several of the counties in the Colorado Front Range do not include NFS lands.
- Rapid growth in housing in the WUI (102 percent increase from 1990 through 2020).

Fire History and Fuel Treatments

The five largest wildfires in the Colorado Front Range landscape since 1984 occurred between 2002 and 2020 (table 7.3), and the five most destructive wildfires in terms of structure losses occurred between 2002 and 2021 (table 7.4). The Marshall Fire (2021) was the first fire on this landscape to result in significant structure losses in an area not previously considered to be WUI, but it was not one of the five largest fires on this landscape. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 458,000 acres, or about 13 percent of the landscape.

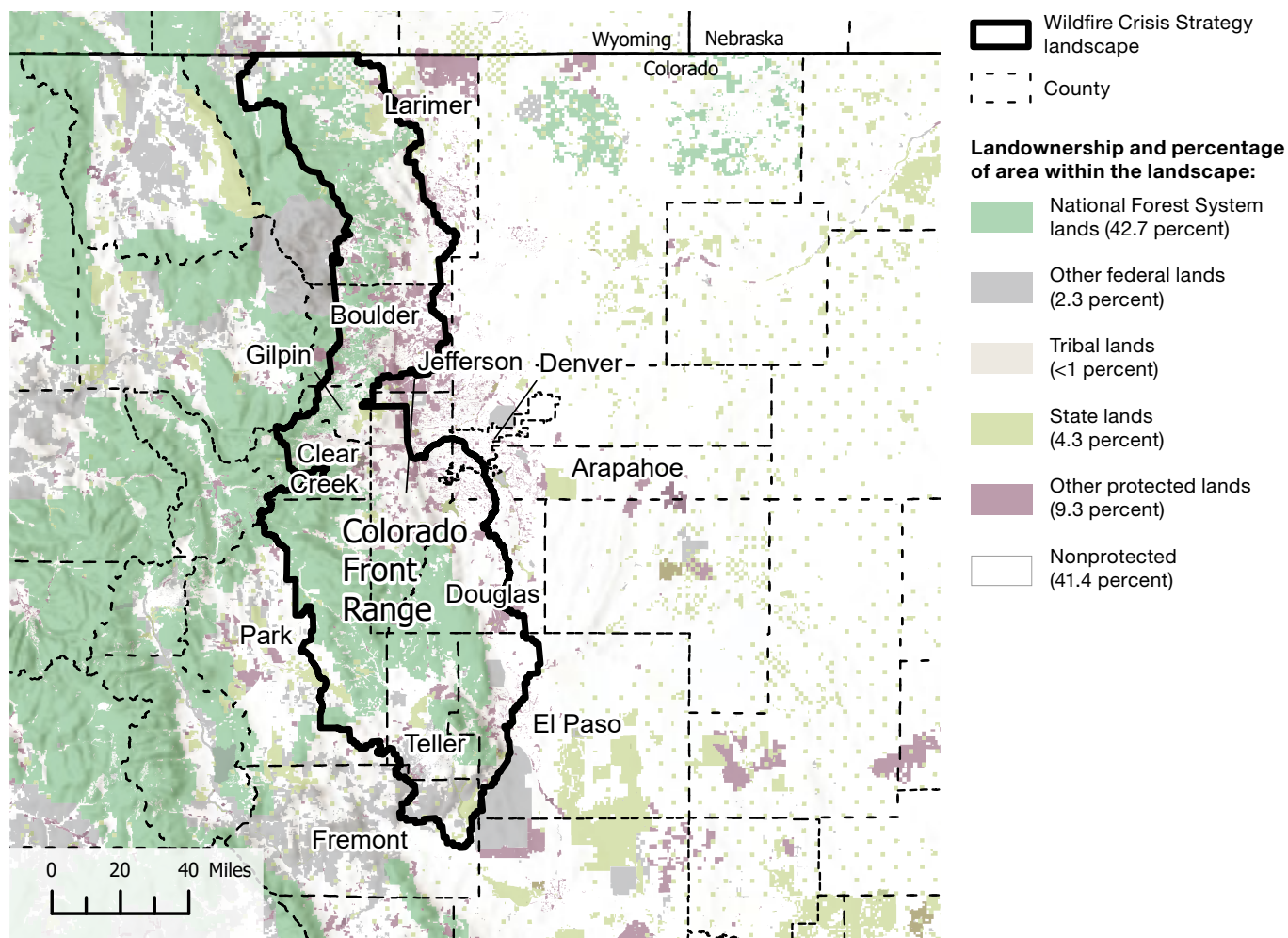


Figure 7.2—Land management and protection status of and around the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Table 7.3—Five largest wildfires in the counties overlapping the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties
	ACRES		
Cameron Peak Fire	208,910	2020	Larimer
Hayman Fire	129,417	2002	Douglas, Jefferson, Park, Teller
High Park Fire	90,769	2012	Larimer
Waldo Canyon Fire	20,112	2012	El Paso
Black Forest Fire	11,885	2013	El Paso

Note: Douglas, El Paso, Jefferson, Larimer, Park, and Teller Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 65,000 acres of NFS lands in the Colorado Front Range landscape (USDA FS 2024b). This represents 4.3 percent of NFS lands in the landscape (NFS lands compose about 43 percent of the landscape) (fig. 7.3).

Table 7.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
	NUMBER		
Marshall Fire	1084	2021	Boulder
Hayman Fire	600	2002	Douglas, Jefferson, Park, Teller
Black Forest Fire	533	2013	El Paso
Cameron Peak Fire	444	2020	Larimer
High Park Fire	371	2012	Larimer

Note: Boulder, Douglas, El Paso, Jefferson, Larimer, Park, and Teller Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024), except the Marshall Fire: Boulder (2022).

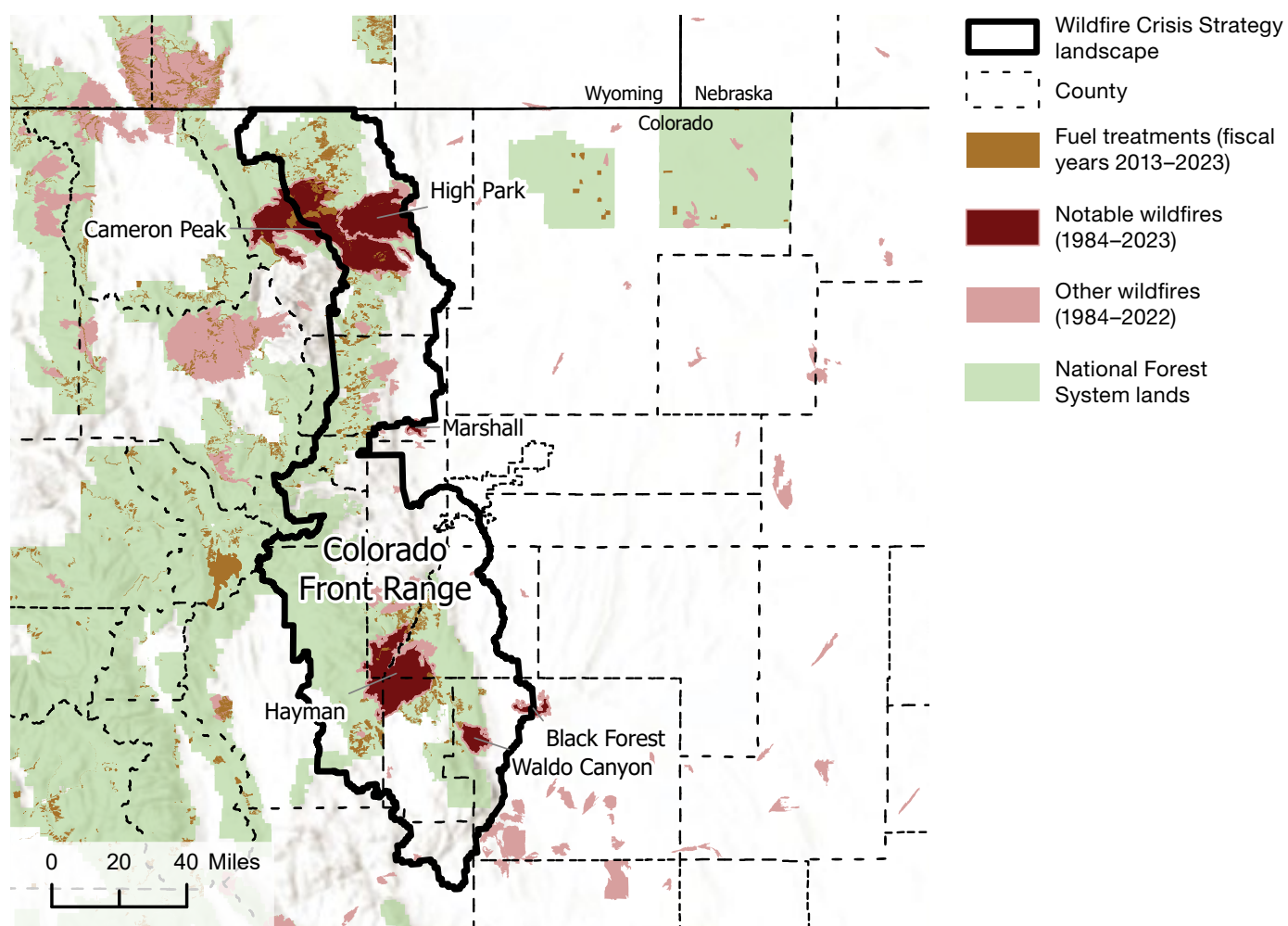


Figure 7.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

Fuel treatments included the following:

- More than 15,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 3,000 acres of treatments via commercial sales
- More than 51,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

During this period, the Colorado Front Range landscape did not experience any wildfire that was counted as hazardous fuel reduction (such as natural ignition fires that benefitted fuel conditions or planned fuel treatment areas burned in wildfire).

In 2024, organizations in the northern portion of the landscape received funding from the Community Wildfire Defense Grant program for fuel treatments around Estes Valley and in the Red Feather Lakes area as well as support for community wildfire protection plans (CWPPs) in both the Red Feather Lakes and Allenspark Fire Protection Districts (USDA FS 2024c).

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Colorado Front Range landscape indicates that counties are making varying levels of investments in these tools as adaptations to address the WUI. FLUPE results are shown in table 7.5 with other WUI development trends for reference.

Boulder, Douglas, El Paso, Jefferson, and Larimer Counties are all in the comprehensive category for their investment in land-use planning and regulation to address the WUI and associated wildfire risk. These five counties differ from those in the consolidating category (Clear Creek, Teller) based primarily on the currency of several local plans. It's worth noting that many counties in the Colorado Front Range across multiple FLUPE categories have adopted wildfire regulations as part of their adaptations. These include Boulder, Clear Creek, Douglas, El Paso, Fremont, Gilpin, Jefferson, Larimer, Park, and Teller Counties. However, regulations vary in scope and type depending on the county.

The wide variety of regulatory adaptations may also be because Colorado is a home rule state, where local jurisdictions retain more authority to determine which regulations they choose to adopt (Mowery et al. 2021). Although many of the counties in the Colorado Front Range landscape have experienced the effects of wildfire in their communities, there is currently no state minimum requirement for local jurisdictions to adopt requirements for

structures, access, water supply, or defensible space in the WUI (unlike in some other states, such as California, that have minimum building code standards and other requirements in designated “fire hazard severity zones” and “state responsibility areas”). However, state legislation in 2023 established a Wildfire Resilience Code Board in the Division of Fire Prevention and Control to help enhance community safety and resilience from wildfires through the adoption of codes and standards; the application of these requirements will be determined as part of this new process.

Given the number of counties in the Colorado Front Range landscape, many other fire adaptations are in place to address local wildfire risk. These include coalitions and collaborations both at the state and local levels (e.g., Fire Adapted Colorado, Upper South Platte Partnership, Fire Adapted Bailey) and outreach, education, and mitigation programs, such as Boulder County’s Wildfire Partners and Elk Creek Fire Protection District’s Wildfire Prepared programs that offer home assessments, local chipping, and slash removal.

Table 7.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Colorado Front Range landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development			NFS lands in the landscape with fuel treatment, fiscal years 2014–2023 ^a		
		Area in the WUI, 2020	Housing units in the WUI, 2020		Growth in WUI housing, 1990–2020	Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Arapahoe	14—Emerging	6.6	84,500	32.2	93.3	N/A	N/A
Boulder	23—Comprehensive	21.5	70,525	50.1	33.0	7.6	7.6
Clear Creek	20—Consolidating	8.1	5,352	94.4	17.3	0.5	0.5
Denver	3—Initializing	6.5	32,253	9.3	82.3	N/A	N/A
Douglas	23—Comprehensive	29.1	111,947	82.5	531.6	3.8	3.8
El Paso	22—Comprehensive	18.3	158,855	55.3	120.7	3.7	3.7
Fremont	12—Emerging	6.1	17,678	87.3	43.5	N/A	N/A
Gilpin	14—Emerging	21.0	3,336	94.9	47.0	3.8	3.8
Jefferson	22—Comprehensive	32.2	106,494	42.9	56.1	5.7	5.7
Larimer	22—Comprehensive	10.0	53,928	34.0	98.1	7.3	7.3
Park	12—Emerging	6.9	10,982	77.8	105.2	1.7	1.7
Teller	18—Consolidating	23.7	12,698	95.4	86.0	4.9	4.9
Combined 12 counties above	N/A	14.0	668,548 ^b	40.9	102.0	4.3	4.3
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the initializing (0–7) category indicate the initial stage of WUI planning adaptation tool use; the emerging category (8–14) indicates becoming more fire adapted via WUI planning adaptation tools; the consolidating category (15–21) indicates the process of combining several WUI planning adaptation tools to address wildfire risk; and the comprehensive (22–28) category indicates nearly complete or complete approaches to addressing the WUI through planning and regulatory tools. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aThe final two columns represent the same total areas because no wildfires with fuels reduction benefits were reported on this landscape during this period.

^bTotal for all counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Chapter 8: Southwest Idaho Landscape

Physical and Social Characteristics

The Southwest Idaho landscape spans substantial parts of six counties in western Idaho, on the western edge of the Rocky Mountains, north of the Boise metropolitan area. The landscape is within the Snake River watershed and includes portions of the Boise and West Ranges as well as the North Fork Payette River valley that separates them.

The lower elevation southern and western portions of the Southwest Idaho landscape were occupied by sagebrush-grass prior to European settlement. In undisturbed areas, the understory is dominated by grasses, such as bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh) Á. Löve), sandberg bluegrass (*Poa secunda* J. Presl), and Idaho fescue (*Festuca idahoensis* Elmer). Moving north and east, this transitions to higher elevation shrub and grass cover, including saltbush (*Atriplex* L.)-greasewood (*Sarcobatus* Nees) and sagebrush (*Artemisia* L.) steppe. Invasives, such as cheatgrass (*Bromus tectorum* L.) and crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.), which significantly influence the fire season, are also common across this portion of the landscape.

The northern and eastern portions of the landscape transition to open ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) and Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), with dispersed lodgepole pine (*Pinus contorta* Douglas ex Loudon) at mid-elevations to grand fir (*Abies grandis* (Douglas ex D. Don) Lindl.), ponderosa pine, western larch (*Larix occidentalis* Nutt.) (north-facing slopes), white fir (*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.) and Englemann Spruce (*Picea engelmannii* Parry ex Engelm.) at higher elevations. Subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.) occurs at the highest elevations.

The landscape is composed of 1.7 million acres, including more than 900,000 acres of National Forest System (NFS) lands in the Boise and Payette National Forests, as well as other federal, state, and private lands, with private lands primarily located near Payette Lake and Lake Cascade in the upper basin of the North Fork Payette River. The six counties associated with the Southwest Idaho landscape had a total population of more than 560,000 as of 2021 (table 8.1), although most of this population is located in the greater Boise area (in and around Ada County, with a population of more than half a million, immediately to the southwest) and is largely not included in the Southwest Idaho landscape.

Landscape at a Glance

- The Southwest Idaho landscape extends from the outskirts of Boise in Ada County north to Adams County, across parts of the Boise and Payette National Forests.
- These counties have experienced dramatic population and housing growth over past decades, primarily urban expansion within and around Boise.
- More than half a million people live in Ada County, including Boise. The other five counties in the landscape have a combined population of just 55,000.
- Key vulnerabilities for some of these smaller population counties include lower incomes, an older population, and mobile homes represent a larger proportion of housing.
- A total of 14.3 percent of the National Forest System lands in the landscape have been modified with fuel treatments in the past decade.
- Of the six counties in this landscape, three are in initializing or emerging Fire and Land Use Planning Evaluation Tool categories, and three are in the consolidating category for addressing the wildland-urban interface (WUI) and associated wildfire risk.
- Valley County stands out as having more WUI homes and more investment in fuel treatments and land-use planning and regulations, relative to the landscape.

The Southwest Idaho landscape does include substantial areas of wildland-urban interface (WUI) in and around the city of McCall, Payette Lake, other parts of the Payette River valley, and elsewhere (fig. 8.1).

The Southwest Idaho landscape footprint does not have overlapping or adjacent tribal lands (USDA FS 2024d). The following tribes were identified as having connections to the landscape in the initial landscape description: Nez Perce Tribe, Shoshone-Paiute Tribes, and Shoshone-Bannock Tribes (USDA FS 2022d).

The six counties associated with the Southwest Idaho landscape are representative of many of the general trends in the Western United States (hereafter, the West) (table 8.2). These include the following:

- Rapid population growth (even faster than for the West), more than quadrupling in population from 1970 through 2021. This growth is primarily in the more urban areas around Boise (Ada, Boise, and Gem Counties) and the Payette River valley (Valley County), while Adams and Washington Counties have grown more slowly.
- Personal income also grew rapidly (731 percent increase over the same period); and like population growth, this was focused in urban and exurban areas.
- Despite this growth, overall income remains slightly below the national average, at about \$66,000 per capita.
- Low racial diversity (less than either the United States or the West).
- A high proportion of federally managed lands (fig. 8.2).
- Despite a low proportion of WUI areas (3 percent), a substantial proportion (40 percent) of all housing is in the WUI. The latter figure is lower than for many of the other WCS landscapes because of the presence of large amounts of housing in nonvegetated areas, primarily in the Boise metropolitan area.
- Rapid growth in housing in the WUI (99 percent increase from 1990 through 2020).
- Prevalence of mobile homes in the landscape is on par with the West in general but is higher in counties with smaller populations.

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Southwest Idaho landscape is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 8.1—Counties associated with the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Ada	2.9	511,931
Adams	76.0	4,625
Boise	41.1	8,094
Gem	21.3	19,792
Valley	13.7	12,241
Washington	12.2	10,898
Total		567,581

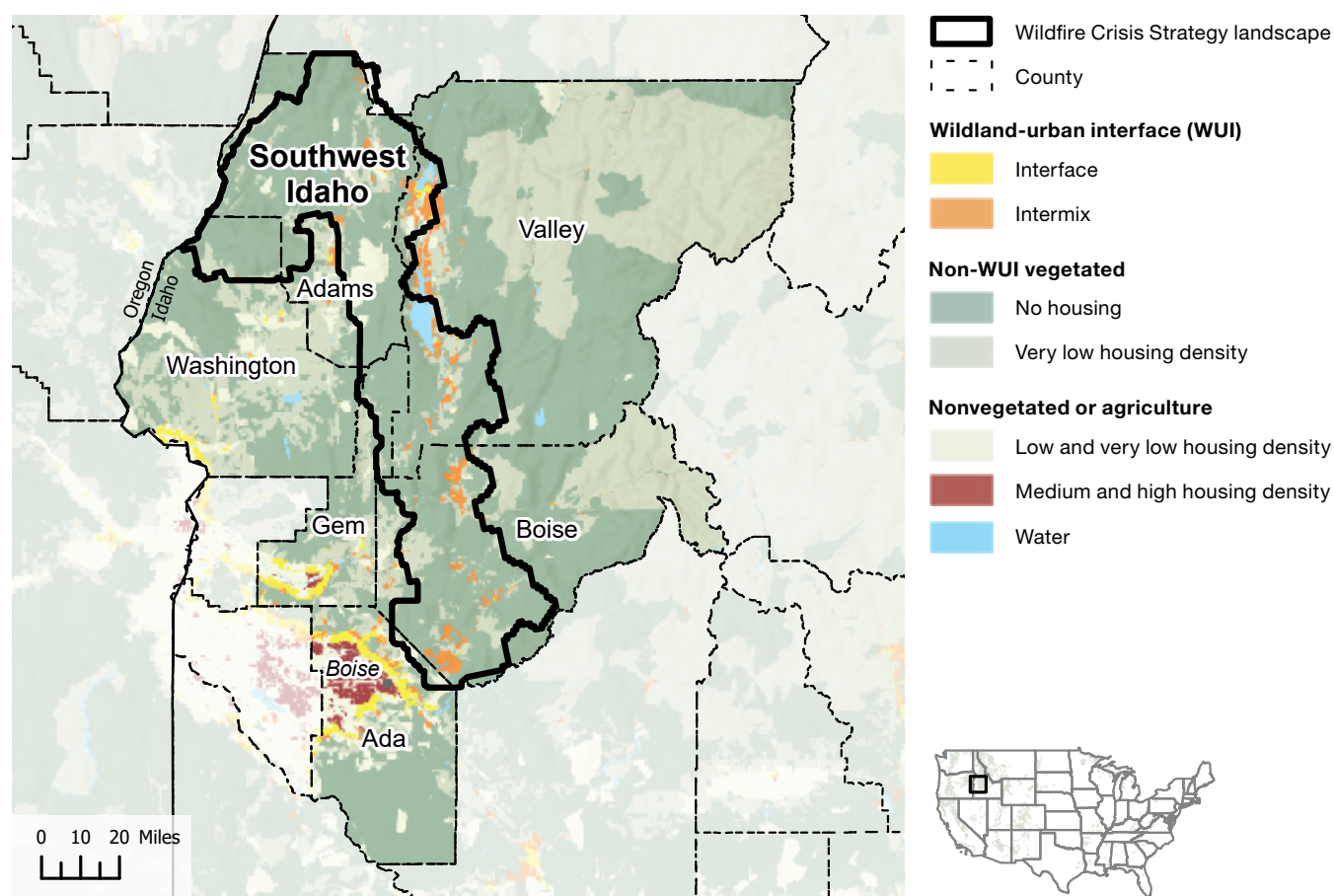


Figure 8.1—Wildland-urban interface (WUI) in the counties associated with the Southwest Idaho Wildfire Crisis Strategy landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credits: Rob Anderson and Kathryn Hixson.

Table 8.2—Physical and social characteristics of counties associated with the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS				PERCENT			
Southwest Idaho landscape counties	567,581	309.9	66,110	28.6	66.1	4.2	83.7	2.8	8.7	15.7
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Ada, Adams, Boise, Gem, Valley, and Washington Counties are associated with the Southwest Idaho landscape. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

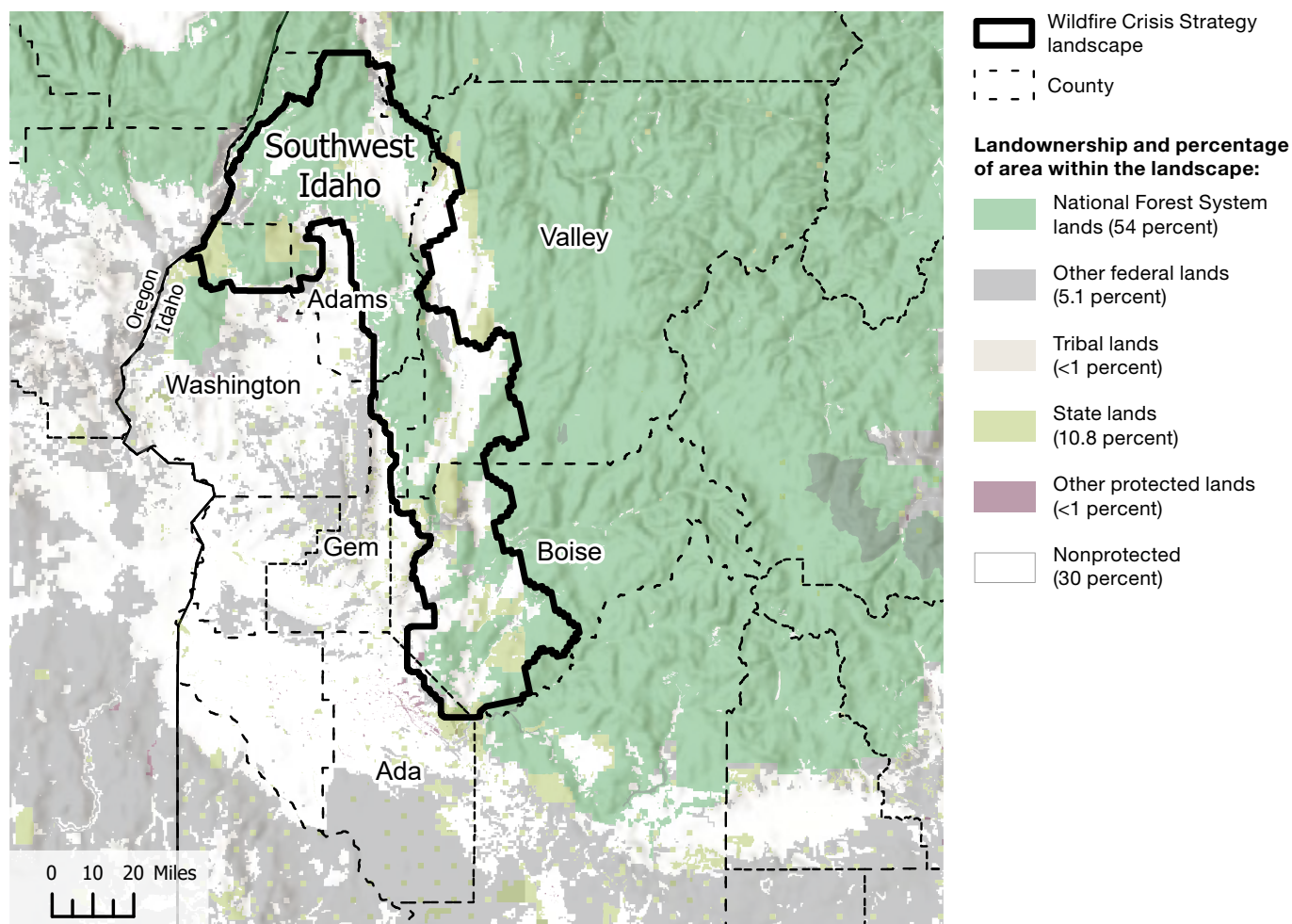


Figure 8.2—Land management and protection status of and around the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Fire History and Fuel Treatments

Historically, disturbance from fire occurred in sagebrush systems in this landscape less frequently; low-severity burns were most common. Because of the introduction of exotic species, such as cheatgrass, and managed burns to clear sagebrush for rangeland improvements, fire regimes have been altered, resulting in decreased fire-return periods with higher severity. Research by Whisenant (1990) found that fire-return intervals had decreased from more than 75 years to as little as 5 to 10 years in some areas.

Since European settlement, fire exclusion has resulted in significant encroachment of juniper (*Juniperus* spp.) into many sagebrush and grassland ecosystems of southwestern Idaho. This, in addition to prolonged drought and the effects of climate change, has resulted in more large wildfires. The growth of human population and development have increased the potential exposure of structures and communities to wildfire, particularly in the Boise area.

The five largest wildfires in the Southwest Idaho landscape since 1984 (table 8.3) occurred between 1994 and 2020, and the five most destructive wildfires in terms of structure losses occurred between 2010 and 2020 (table 8.4). One of the five most destructive

fires also ranked as one of the five largest fires. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 275,000 acres, or about 16 percent of the landscape.

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 113,000 acres of NFS lands in the Southwest Idaho landscape (USDA FS 2024b). This represents 12.2 percent of NFS lands in the landscape (NFS lands compose about 54 percent of the landscape) (fig. 8.3).

Fuel treatments included the following:

- More than 60,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 18,000 acres of treatments via commercial sales
- More than 62,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Over the same period, the Southwest Idaho landscape also had more than 14,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire). Including these wildfires, the total treatment area was more than 127,000 acres, or 13.7 percent of NFS lands in the landscape.

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

Table 8.3—Five largest wildfires in the counties overlapping the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties
	ACRES		
Idaho City Complex (Rabbit Creek)	150,456	1994	Boise, Elmore
Corral Creek-Blackwell Complex	140,101	1994	Adams, Idaho, Valley
Woodhead Fire	98,995	2020	Adams, Washington
Tepee Springs Fire	94,878	2015	Idaho
Rattlesnake Complex	48,330	2006	Boise, Valley

Note: Adams, Boise, Valley, and Washington Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).
Source: USGS et al. (2024).

Table 8.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
NUMBER			
Woodhead Fire	34	2020	Adams, Washington
Hog Fire	8	2011	Elmore
Big Fire	6	2010	Ada
Highland Fire	6	2013	Ada
Pioneer Fire	6	2016	Boise, Valley

Note: Ada, Adams, Boise, Valley, and Washington Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

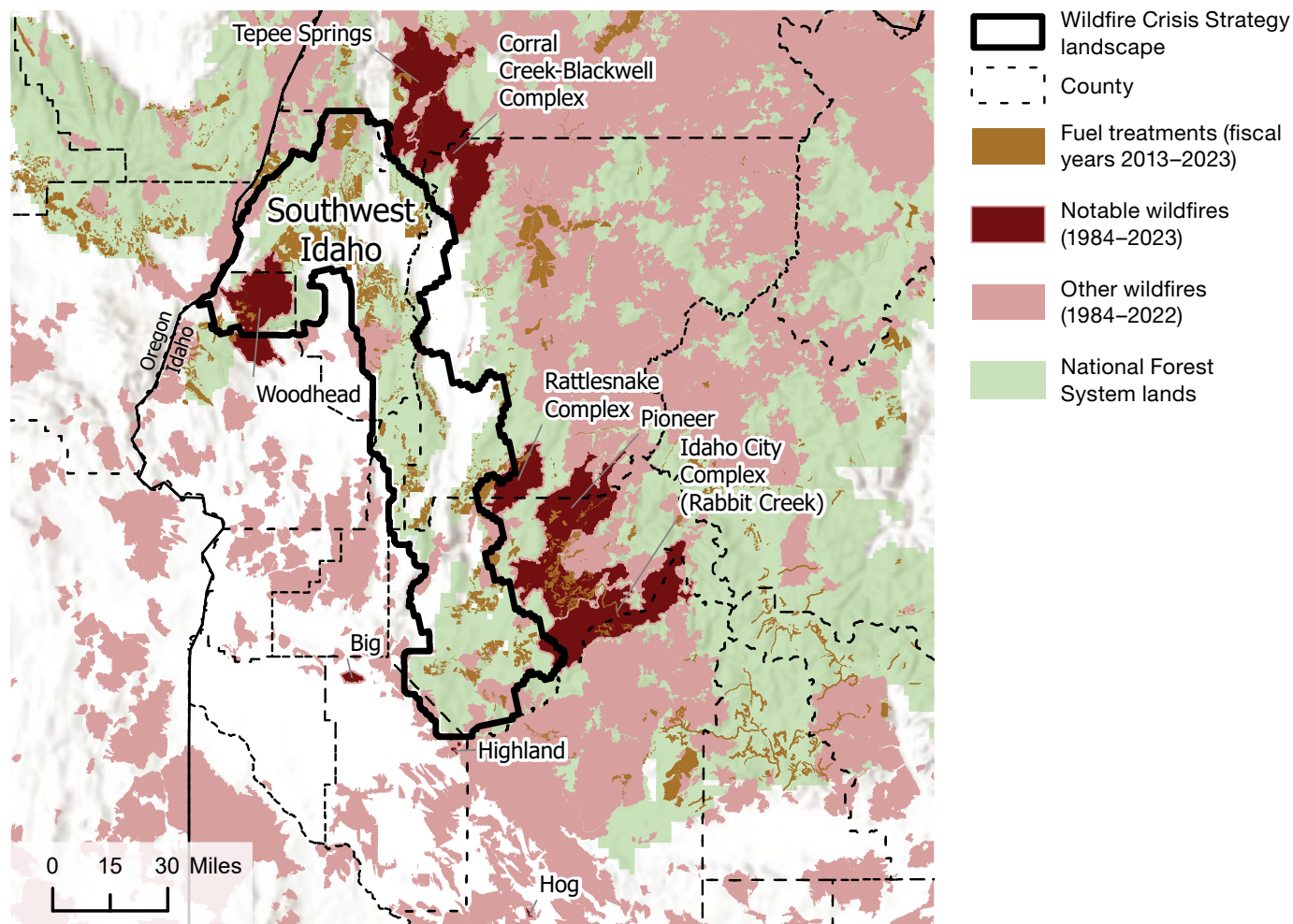


Figure 8.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects on communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Southwest Idaho landscape indicates that counties are making varying levels of investment in these tools as adaptations to address the WUI. FLUPE results are shown in table 8.5 with other WUI development trends for reference.

Boise County is currently using the most planning and regulatory tools to address its WUI. These tools include a recently updated community wildfire protection plan, a comprehensive plan, and a WUI ordinance. The county's comprehensive plan (Boise 2019) has a chapter on hazardous areas, with objectives to identify and consider hazardous areas when determining development suitability. The county's WUI ordinance, established in 2011, requires defensible space for all applicable structures; adequate access in developments and subdivisions; water supply; and in some cases, the preparation of a fire mitigation plan.

Table 8.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Southwest Idaho landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Ada	15—Consolidating	8.2	66,750	33.9	107.4	0.0	0.0
Adams	7—Initializing	2.2	1,852	70.1	51.3	19.0	19.6
Boise	20—Consolidating	3.2	4,628	85.0	106.9	6.6	9.4
Gem	12—Emerging	7.3	3,364	44.5	111.7	0.8	1.0
Valley	17—Consolidating	2.2	11,316	92.8	93.5	8.7	12.3
Washington	6—Initializing	1.8	3,357	74.4	22.0	3.4	3.4
Combined six counties above	N/A	3.2	91,267 ^a	39.8	99.1	12.2	13.7
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the initializing (0–7) category indicate the initial stage of WUI planning adaptation tool use; the emerging category (8–14) indicates becoming more fire adapted via WUI planning adaptation tools; the consolidating category (15–21) indicates the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for all counties.

Ada and Valley Counties are also using several WUI planning and regulatory tools. Ada County, for example, has policies in its comprehensive plan (Ada 2023) to maintain and update the county's map of WUI lands. The county has also adopted the WUI code, with amendments, for building construction and has a WUI overlay zone with standards for subdivisions, roads, private roads, and new construction, and maintains an Ada Fire Adapted Community website as an educational resource for residents (Boise 2024). Similarly, Valley County has multiple objectives in its comprehensive plan (Valley 2018) to address the threat of wildfire and requires that all developers of proposed subdivisions provide a WUI fire protection plan for review and approval as part of their preliminary application for planned unit development.

Although Gem County has a limited number of WUI planning and regulatory adaptations in place, its recently updated comprehensive plan (Gem 2023) includes a goal to mitigate and adapt to impacts from natural hazards, with an objective to implement the county's all hazard mitigation plan, use WUI best practices in areas prone to wildfires, and manage or limit development activity in known hazardous areas.

Chapter 9: Kootenai Complex Landscape, Montana/Idaho

Physical and Social Characteristics

The Kootenai Complex landscape spans substantial parts of two counties—Lincoln County in northwestern Montana and Boundary County in northern Idaho. The landscape is at the southern end of the Purcell Range within the Northern Rocky Mountains and is part of the Kootenai River watershed draining to the Columbia River.

The vegetation on the eastern side of the Kootenai Complex landscape is characterized by subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), and grand fir (*Abies grandis* (Douglas ex D. Don) Lindl.) forests, with some Engelmann spruce (*Picea engelmannii* Parry ex Engelm.). In some instances, where disturbance has resulted in the loss of these climax species, ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson), western larch (*Larix occidentalis* Nutt.), and isolated lodgepole pine (*Pinus contorta* Douglas ex Loudon) stands are present. The climate conditions in the central portion of the landscape result in the presence of a unique mix of Douglas-fir, grand fir, western redcedar (*Thuja plicata* Donn ex D. Don), and ponderosa pine, with some western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) in the northern portions. Transitioning to the western end and higher elevations, tundra, alpine grassland, meadows, and wetlands dominate above tree line, with subalpine fir, lodgepole pine, whitebark pine (*Pinus albicaulis* Engelm.), mountain hemlock (*Tsuga mertensiana* (Bong.) Carrière), and subalpine larch (*Larix lyallii* Parl.) present at the tree line transition.

The landscape is composed of about 1 million acres, consisting primarily of National Forest System (NFS) lands on the Kootenai and Idaho Panhandle National Forests (a total of about 680,000 acres) as well as other state and private lands. The two counties associated with the Kootenai Complex landscape had a total population of about 33,000 as of 2021 (table 9.1).

The landscape does not include major urban areas but does include wildland-urban interface (WUI) around the towns of Libby and Eureka, Montana, and Bonners Ferry, Idaho (fig. 9.1).

Landscape at a Glance

- The Kootenai Complex landscape spans two counties in northwestern Montana and northern Idaho (Lincoln County, Montana, and Boundary County, Idaho).
- Although this landscape extends more than a million acres, the two counties have a total population of 33,000.
- Key vulnerabilities include an older population, lower incomes, and mobile homes represent a larger proportion of housing.
- In the past decade, hazardous fuel conditions have been treated on 9 percent of the landscape, with similar proportions of National Forest System lands treated in both counties.
- Lincoln County, Montana, where most of the landscape is located and which has a larger population, has been more active in land-use planning and regulation to reduce wildfire risk.
- Despite recent wildland-urban interface (WUI) growth in Boundary County, Idaho, the county has been less active in land-use planning or regulations to reduce wildfire risk and is in the initializing Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk.

The Kootenai Reservation and Off-Reservation Trust Land overlap with the landscape footprint (USDA FS 2024d). The Confederated Salish and Kootenai Tribes of the Flathead Reservation (Montana) and the Kootenai Tribe of Idaho were identified as having connections to the landscape in the initial landscape description (USDA FS 2022d).

In contrast to the general trend of rapid growth in population and income levels in the Western United States (hereafter, the West), the rural counties associated with the Kootenai Complex landscape have grown slowly and remain sparsely populated (table 9.2). The population in Boundary County, Idaho, doubled (to slightly more than 12,000) from 1970 through 2021, on track with the average rate of population growth across the West. Meanwhile, the population in Lincoln County, Montana, has grown little (14 percent increase, to 20,000 people) over the same period.

Apart from these unique characteristics, Kootenai Complex landscape counties are representative of many of the other general trends in the West. These include the following:

- Income remains well below the national average, at about \$47,000 per capita.
- Much less racial diversity than either the United States or the West.
- A high proportion of federally managed lands (fig. 9.2).
- Despite a relatively low proportion of WUI (4 percent), a substantial proportion (83 percent) of all housing is in the WUI.
- Rapid growth in housing in the WUI (58 percent increase from 1990 through 2020, with much of this growth in Boundary County).

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Kootenai Complex landscape in Montana and Idaho is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 9.1—Counties associated with the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Boundary	15.1	12,561
Lincoln	36.9	20,525
Total		33,086

Note: Boundary County is in Idaho, and Lincoln County is in Montana.

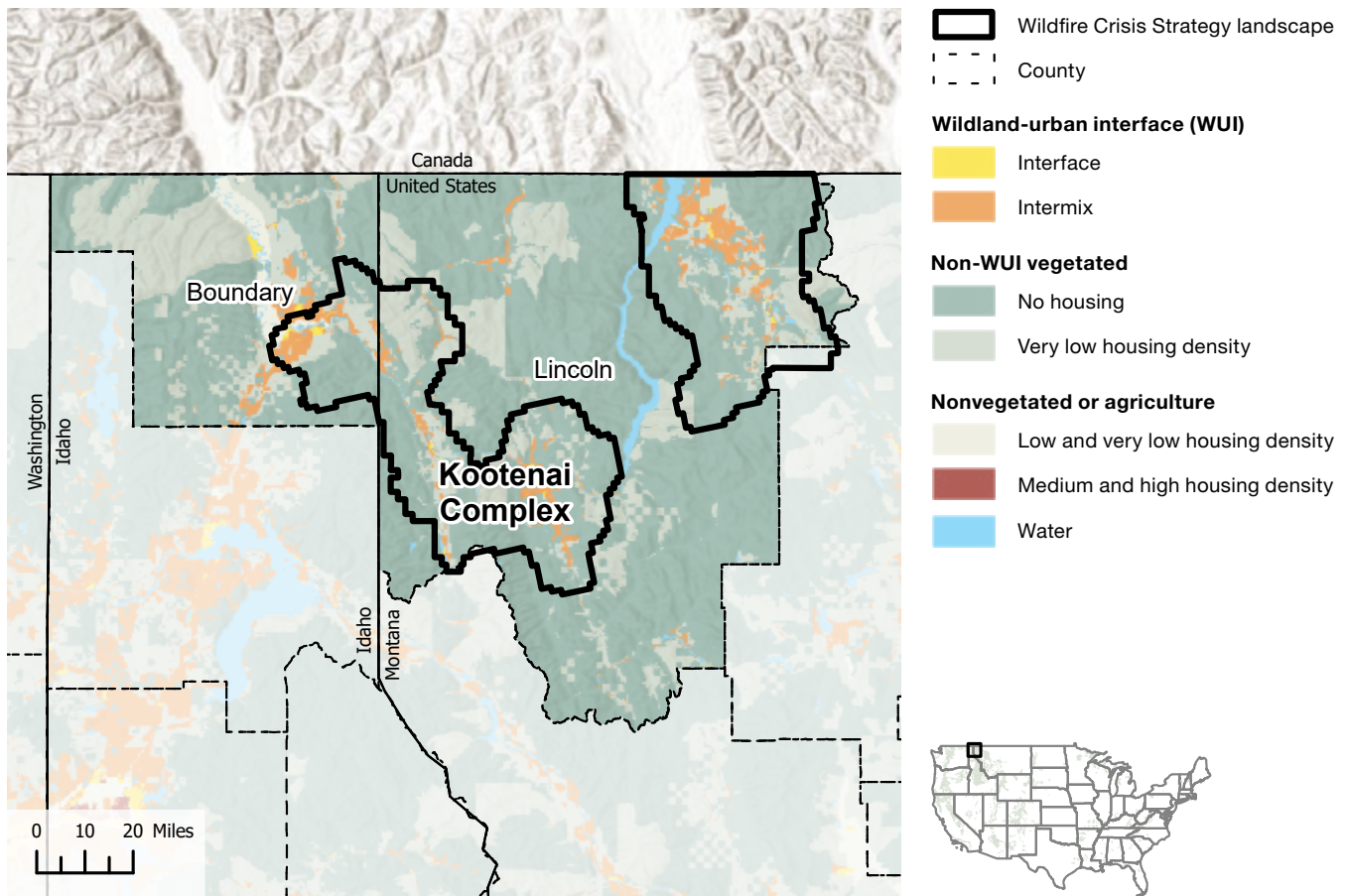


Figure 9.1—Wildland-urban interface (WUI) in the counties associated with the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credits: Rob Anderson and Kathryn Hixson.

Table 9.2—Physical and social characteristics of counties associated with the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS				PERCENT			
Kootenai Complex landscape counties	33,086	40.3	47,456	23.3	70.9	12.8	90.4	4.0	4.1	26.6
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Counties associated with the Kootenai Complex landscape include Boundary County in Idaho and Lincoln County in Montana. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

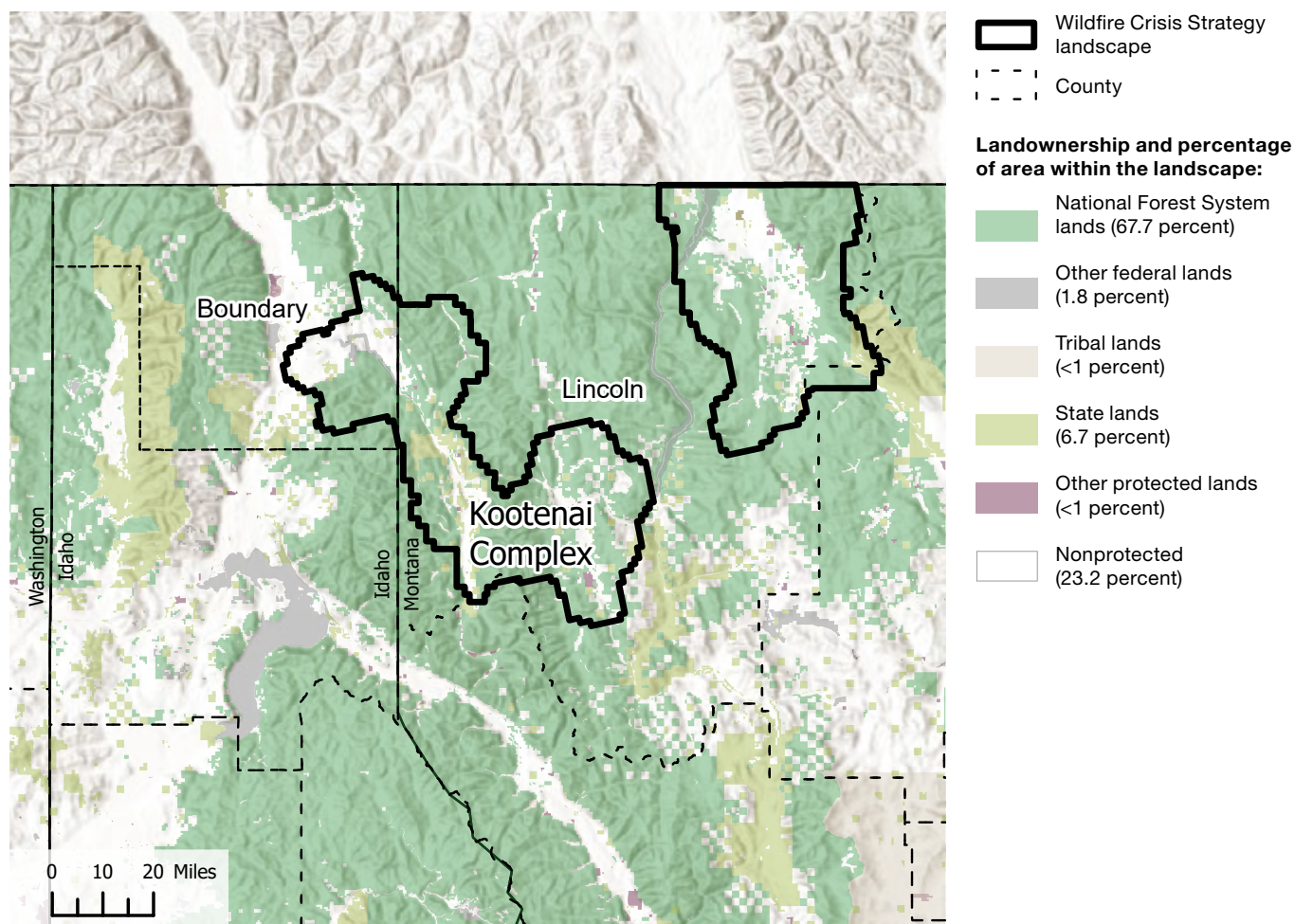


Figure 9.2—Land management and protection status of and around the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Fire History and Fuel Treatments

The five largest wildfires in the Kootenai Complex landscape since 1984 (table 9.3) occurred between 2000 and 2021, and the five most destructive wildfires in terms of structure losses occurred between 2005 and 2017 (table 9.4). The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 73,000 acres, or about 7 percent of the landscape.

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 38,000 acres of NFS lands in the Kootenai Complex landscape (USDA FS 2024b). This represents 5.7 percent of the NFS lands in the landscape (NFS lands compose about 68 percent of the landscape) (fig. 9.3).

Fuel treatments included the following:

- More than 12,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 17,000 acres of treatments via commercial sales
- More than 16,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Table 9.3—Five largest wildfires in the counties overlapping the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	County
ACRES			
Caribou Fire	28,101	2017	Lincoln
West Fork Fire	21,154	2017	Lincoln
South Yaak Fire	12,866	2021	Lincoln
Stone-Young Complex (Stone Hill)	11,271	2000	Lincoln
Marston Fire	7,587	2015	Lincoln

Note: Lincoln County, Montana has substantial overlap with the landscape and was included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 9.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	County
NUMBER			
Caribou Fire	40	2017	Lincoln
Camp 32 Fire	4	2005	Lincoln
Parker Ridge Fire	1	2015	Boundary
Upper Priest Fire	1	2015	Boundary
Gibraltar Ridge Fire	1	2017	Lincoln

Note: Lincoln County, Montana and Boundary County, Idaho have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Over the same period, the Kootenai Complex landscape had more than 25,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire). Including these wildfires, the total treatment area was more than 61,000 acres, or 9 percent of the NFS lands in the landscape.

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

In 2023, the Montana Department of Natural Resources and Conservation received \$5.8 million through the Community Wildfire Defense Grant program to reduce wildfire risk in Lincoln County WUI communities (USDA FS 2024c).

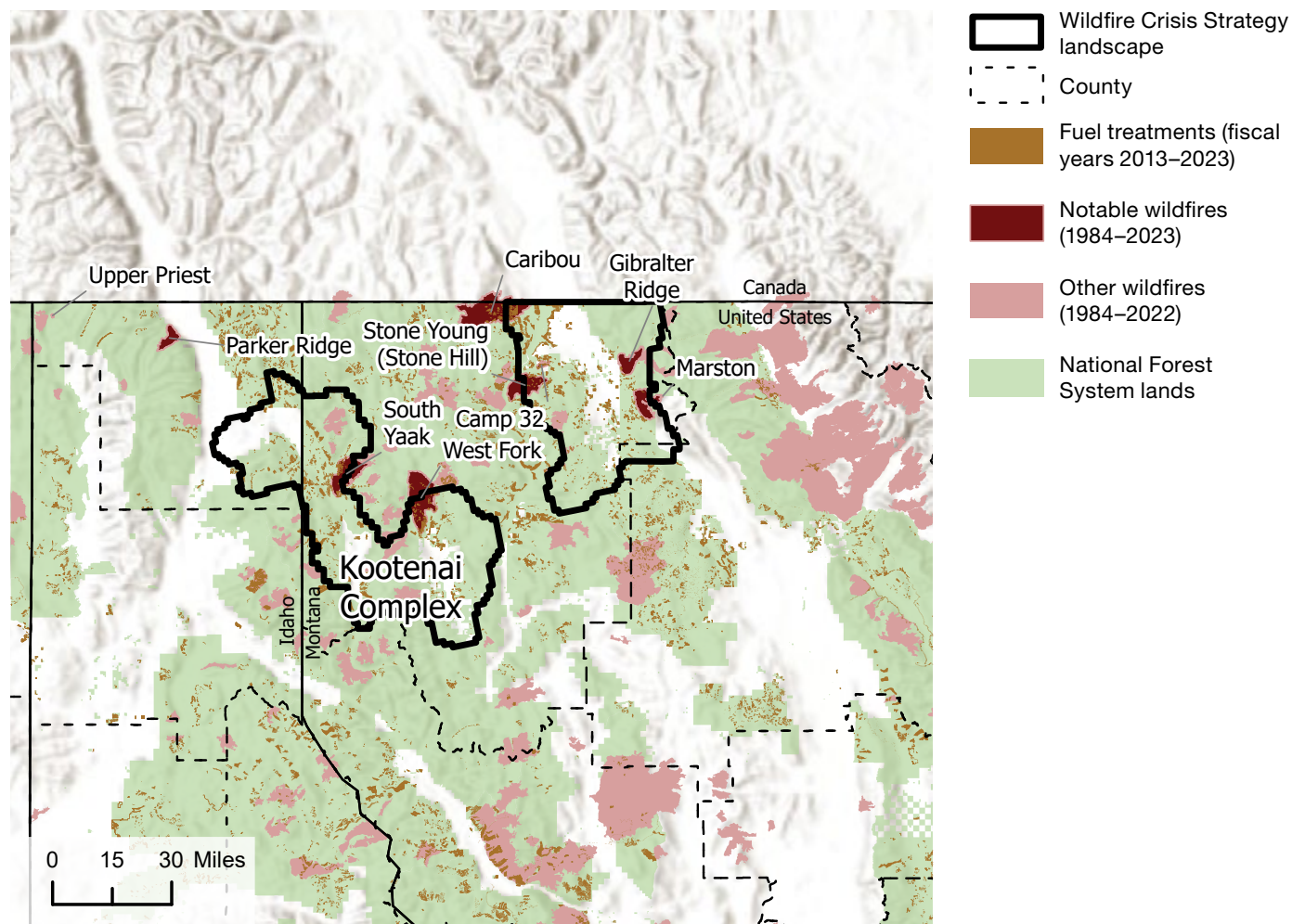


Figure 9.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Kootenai Complex landscape indicates that counties are in the initializing or consolidating categories of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 9.5 with other WUI development trends for reference.

The approach of Lincoln County, Montana, reflects the adoption of both plans and regulations to address the WUI. For example, wildfire is a key focus area in the county's updated growth policy (Lincoln 2019), which reflects wildfire risk reduction being listed as high priority by residents who responded to a growth policy survey. The growth policy discusses fire history; fire protection; the WUI; and current resources for addressing wildfire risk, including the county's subdivision regulations that require all subdivisions to be planned, designed, constructed, and maintained to minimize the risk of fire. The county noted in its growth policy that it received praise from the Montana Department of Natural Resources and Conservation for its wildfire protection regulations and fire risk assessment program during the subdivision review process.

Table 9.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Kootenai Complex landscape, Montana/Idaho, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/ geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Boundary	6—Initializing	5.8	4,127	76.4	110.0	7.2	7.8
Lincoln	15—Consolidating	3.6	9,487	86.6	43.0	5.6	9.4
Combined two counties above	N/A	4.2	13,614 ^a	83.3	58.3	5.7	9.0
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the initializing (0–7) category indicate the initial stage of WUI planning adaptation tool use; scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for both counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Another adaptation being used by Lincoln County is their Community Wildfire Protection Plan (CWPP), updated in 2024 (Lincoln 2024). This plan contains a range of suggested mitigations in its action plan, including a review of the International Wildland-Urban Interface Code (International Code Council 2021) and possible future adoption. The CWPP also discusses Fire Adapted Kootenai, a concept supported through the Lincoln County FireSafe Council (Fire Adapted Kootenai, n.d.), and many other local risk reduction activities.

Despite growth in the WUI from 1990 through 2020 in Boundary County, Idaho, the FLUPE process revealed that this county has limited planning mechanisms currently in place. Identified plans (comprehensive plan, CWPP, local hazard mitigation plan) were dated 15 years or older with limited applicable content, and no regulations were identified. Limited information related to other fire adaptations was found in the *Boundary County Annual Run Report* (Boundary County Fire Chiefs Association 2020), related to the Boundary County Fire Prevention Cooperative, which helps prevent wildfires through public outreach and education activities.

Chapter 10: Enchanted Circle Landscape, New Mexico

Physical and Social Characteristics

The Enchanted Circle landscape spans substantial parts of two counties—Taos and Colfax—in northern New Mexico. The landscape straddles the southern end of the Sangre de Cristo Mountains, marking the southernmost extent of the Rocky Mountain range. The western portion of the landscape drains into the Rio Grande River, flowing south toward the United States-Mexico border. The eastern portion of the landscape drains via the Canadian River to the Arkansas River and eventually the Mississippi River.

The south and east extents of the landscape are characterized by shortgrass prairie, some midgrass prairie, scattered juniper savanna, and juniper woodland on the hills. Grasslands continue with a species shift to bunchgrasses as the landscape transitions north. Moving west, pinyon-juniper woodlands, sagebrush (*Artemisia* L.) and mountain mahogany (*Cercocarpus* Kunth) shrublands, Gambel oak (*Quercus gambelii* Nutt.) woodlands, and grasslands dominate. With farther transition west and an increase in elevation, the dominant vegetation is ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) forest with some areas of twoneedle pinyon (*Pinus edulis* Engelm.) or junipers (*Juniperus* spp.). Even higher elevations have areas of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and white fir (*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.) forests with isolated quaking aspen (*Populus tremuloides* Michx.) stands. Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), corkbark fir (*Abies lasiocarpa* (Hook.) Nutt. var. *arizonica* (Merriam) Lemmon) or subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), quaking aspen stands, and subalpine meadows occupy the farthest western extent and highest elevations. There are some limber pine (*Pinus flexilis* James) and bristlecone pine (*Pinus aristata* Engelm.) in these areas, with Douglas-fir, white fir, and blue spruce (*Picea pungens* Engelm.) occurring at lower elevations.

The landscape is composed of almost 1.5 million acres, which includes more than 500,000 acres of National Forest System (NFS) lands on the Carson National Forest, as well as substantial other state and private lands.

Landscape at a Glance

- The Enchanted Circle landscape spans more than 1.5 million acres of Taos and Colfax Counties in northern New Mexico.
- The two counties have a total population of 47,000, including the Pueblo tribe of the Taos Pueblo, making it the only initial Wildfire Crisis Strategy (WCS) landscape to include a substantial area of tribal land.
- The Enchanted Circle landscape has a more diverse population than many WCS landscapes, with a high proportion of residents identifying as Hispanic/Latino, American Indian, or both.
- Vulnerabilities include an older population, lower incomes, and mobile homes represent a large proportion of housing.
- About 4.5 percent of the National Forest System lands in the landscape have had fuel reduction treatments in the past decade, nearly all in Colfax County, which has a smaller population and has experienced less wildland-urban interface (WUI) growth than Taos County.
- Taos County is notable for being in the comprehensive Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk.

The two counties associated with the Enchanted Circle landscape had a total population of about 47,000 as of 2021 (table 10.1). The landscape does not include major urban areas but does include areas of wildland-urban interface (WUI) around the towns of Taos and Angel Fire, New Mexico (fig. 10.1).

The landscape encompasses the Taos Pueblo and Off-Reservation Trust Land and overlaps with the Picuris Pueblo, making it the only initial Wildfire Crisis Strategy (WCS) landscape to include a substantial area of tribal lands (USDA FS 2024d). The following tribes were identified as having connections to the Enchanted Circle landscape in the initial landscape description: Pueblo of Taos, Pueblo of Picuris, and Pueblo of Sandia (USDA FS 2022d).

In contrast to the general trend of rapid growth in population and income levels in the Western United States (hereafter, the West), the counties associated with the Enchanted Circle landscape have grown more slowly (table 10.2). The population in Taos County doubled from 1970 through 2021, a rate of growth higher than that of the United States but lower than that of the West. Meanwhile, Colfax County's population remains essentially unchanged (2 percent increase) over the same period. Increases in personal income levels are similarly varied across the two counties, at 439 percent in Taos County and only 123 percent in Colfax County from 1970 through 2021 (compared to 257 percent in the United States and 390 percent in the West). Colfax County also has one of the lowest proportions of federally managed lands in our analysis of counties, at only 3 percent. Finally, the Enchanted Circle landscape counties are more ethnically diverse than many other initial WCS landscapes. In particular, a high proportion of residents identify as Hispanic/Latino (55 percent, compared to 19 percent in the United States and 31 percent in the West).

Apart from these unique characteristics, the Enchanted Circle landscape counties are representative of many of the other general trends in the West. These include the following:

- Income remains well below the national average, at about \$49,000 per capita.
- A high proportion of federally managed lands in Taos County (substantially lower in Colfax County) (fig. 10.2).
- Despite a relatively low proportion of WUI areas (3 percent), a substantial proportion (92 percent) of all housing is in the WUI.
- Rapid growth in housing in the WUI (54 percent increase from 1990 through 2020), with much of this growth in Taos County (77 increase percent over the same period).

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Enchanted Circle landscape in New Mexico is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 10.1—Counties associated with the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Colfax	21.6	12,369
Taos	61.7	34,623
Total		46,992

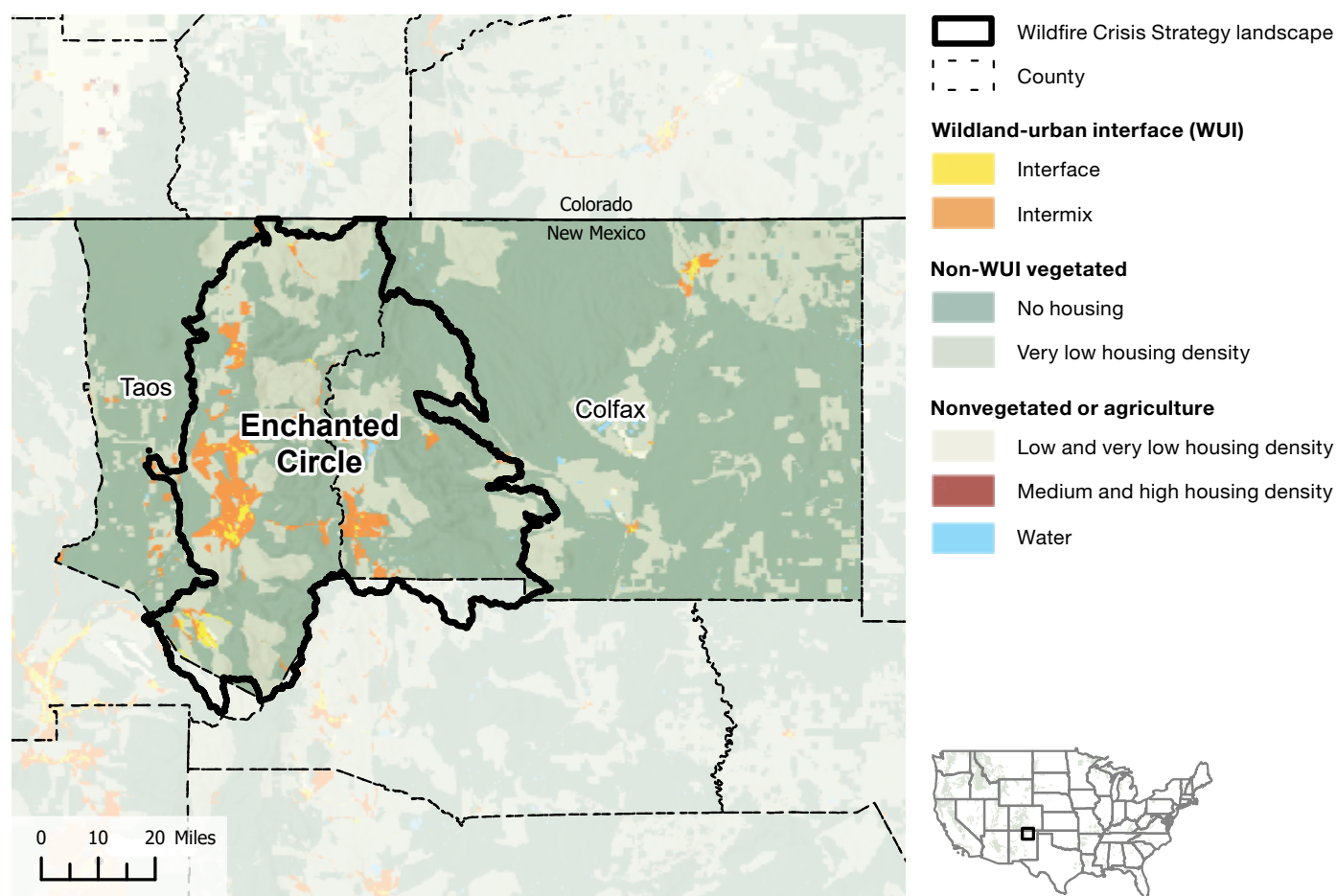


Figure 10.1—Wildland-urban interface (WUI) in the counties associated with the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credit: Rob Anderson and Kathryn Hixson.

Table 10.2—Physical and social characteristics of counties associated with the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS				PERCENT			
Enchanted Circle counties	46,992	57.7	49,097	65.6	22.3	16.8	38.3	8.2	54.8	26.9
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Counties associated with the Enchanted Circle landscape include Colfax and Taos. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

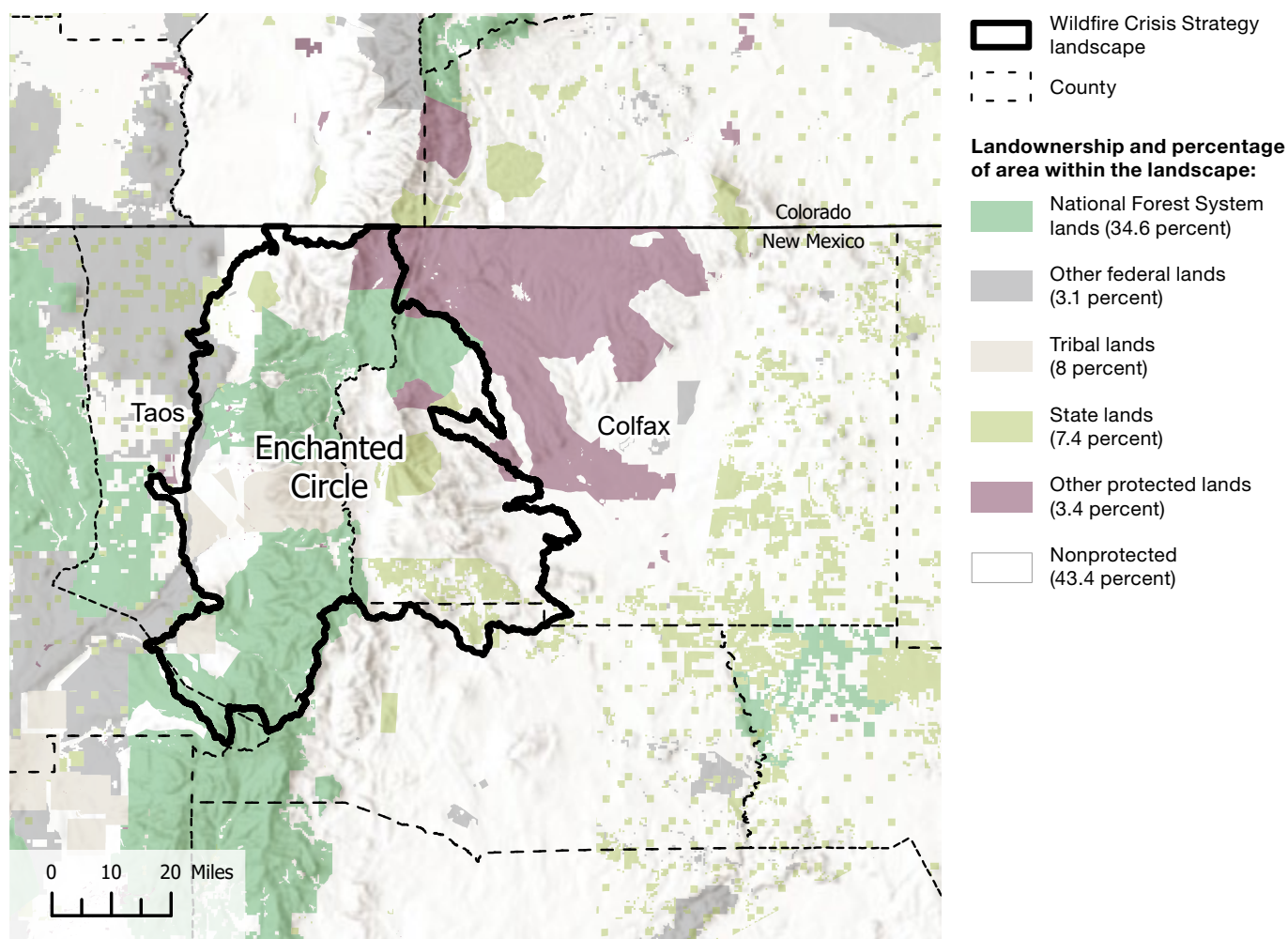


Figure 10.2—Land management and protection status of and around the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Fire History and Fuel Treatments

The five largest wildfires in the Enchanted Circle landscape since 1984 (table 10.3) occurred between 2002 and 2020, and the five most destructive wildfires in terms of structure losses occurred between 2002 and 2022 (table 10.4). One wildfire is included in both the five largest and the five most destructive wildfires. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 152,000 acres, or about 10 percent of the landscape.

Table 10.3—Five largest wildfires in the counties overlapping the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties
ACRES			
Ponil Complex Fire	89,084	2002	Colfax
Ute Park Fire	30,177	2018	Colfax
Casa Fire	27,452	2006	Colfax
Rivera Mesa Fire	16,412	2006	Colfax, Mora
Luna Fire	10,849	2020	Colfax, Mora, Taos

Note: Colfax and Taos Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 10.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
NUMBER			
Hermit's Peak/Calf Canyon Fire	900	2022	Mora, San Miguel, Taos
Track Fire	21	2011	Colfax, Las Animas
Ute Park Fire	14	2018	Colfax
Ojo Feliz Fire	3	2006	Mora
Cerro Pelon Fire	3	2002	Mora

Note: Colfax and Taos Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024), except the Hermit's Peak/Calf Canyon Fire: NM FWRI (2022).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 20,000 acres of NFS lands in the Enchanted Circle landscape (USDA FS 2024b). This represents 4 percent of the NFS lands in the landscape (NFS lands compose about 35 percent of the landscape) (fig. 10.3).

Fuel treatments included the following:

- More than 18,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- Nearly 1,000 acres of treatments via commercial sales
- More than 1,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Over the same period, the Enchanted Circle landscape had more than 2,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire). Including these wildfires, the total treatment area was more than 22,000 acres, or 4.5 percent of the NFS lands in the landscape.

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of

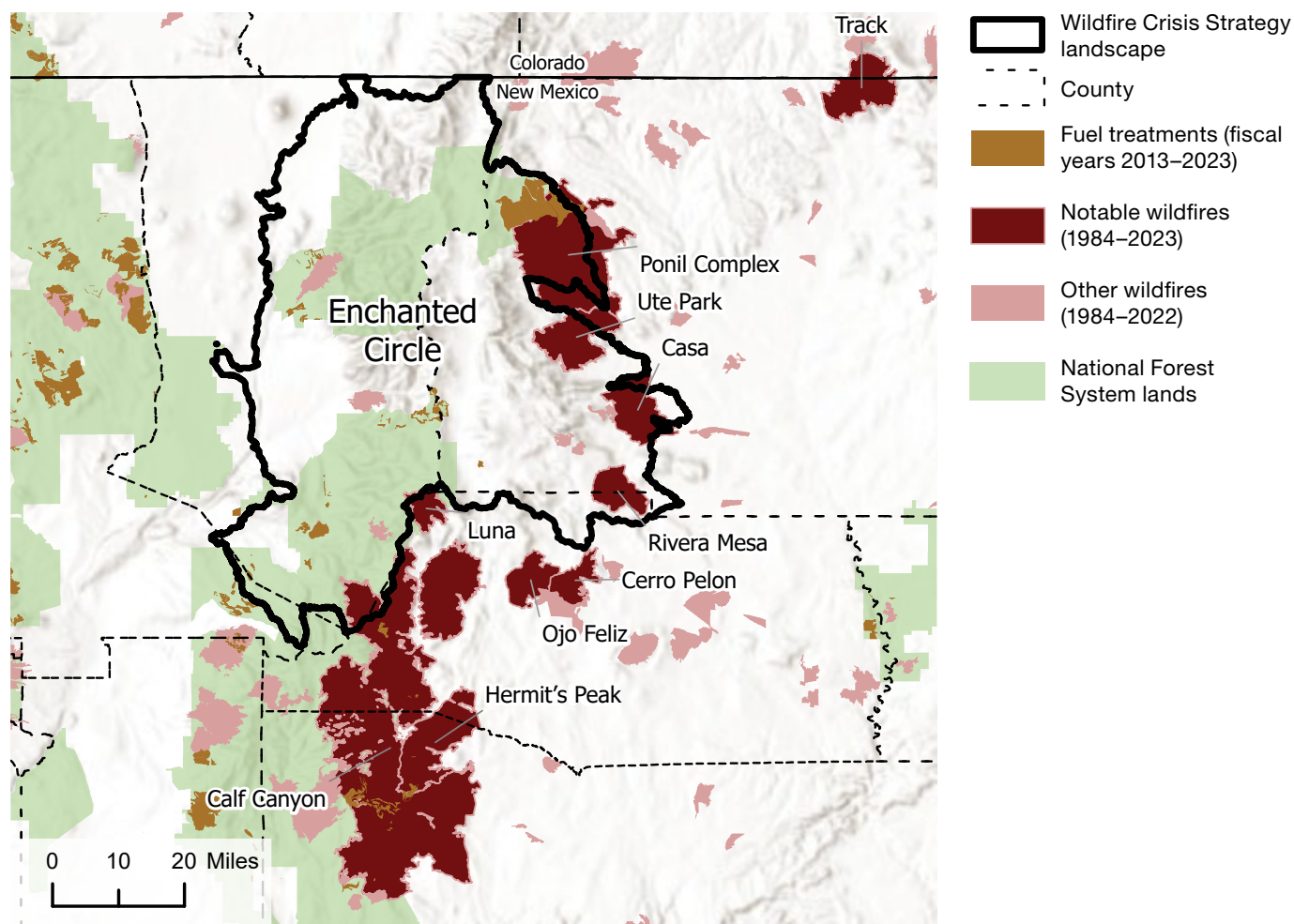


Figure 10.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

The Hermit’s Peak Fire of 2022 was the result of an escaped prescribed fire and led to a Forest Service-wide pause and review of prescribed fire practices in 2022. This history contributes to the challenge of developing support for the ongoing use of prescribed fire as a management tool on this and other landscapes.

From 2023 through 2024, organizations in the Enchanted Circle landscape received nearly \$28 million in funding from the Community Wildfire Defense Grant program for fuel breaks and vegetation management in Colfax and Taos Counties (Cimarron Watershed Alliance Flying Horse Ranch Fuel Break Project, West Latir Ditch Association’s Collaborative Forest Fuel Reduction and Watershed Protection Initiative, and the Angel Fire Community Protection projects) (USDA FS 2024c).

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Enchanted Circle landscape indicates that each county is taking a different approach to using these tools as adaptations to address the WUI. FLUPE results are shown in table 10.5 with other WUI development trends for reference.

Taos County has taken a comprehensive approach to planning and regulating its WUI, reflecting several tools the county has used. The county's comprehensive plan has a hazards mitigation element that includes a focus on wildfire and WUI development policies (Taos 2017). The county's updated community wildfire protection plan (CWPP) discusses the application of county land use regulations and corresponding challenges to address implementation (Taos 2022). Policies in the local hazard mitigation plan also support safer development activities in the WUI (Taos 2018). Finally, the county's land use regulations for development in WUI areas require a range of fire protection and suppression requirements. These include minimum standards for access, driveways, defensible space, vegetation management, water supply, and ignition-resistant construction in designated wildfire hazard and WUI areas.

Table 10.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Enchanted Circle landscape, New Mexico, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/eographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Colfax	14—Emerging	1.5	8,443	88.8	17.6	25.6	26.1
Taos	24—Comprehensive	6.3	19,590	93.7	77.1	0.9	1.4
Combined two counties above	N/A	3.3	28,033 ^a	92.2	53.7	4.0	4.5
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the emerging category (8–14) indicate counties that are in the process of becoming more fire adapted via WUI planning adaptation tools; scores in the comprehensive (22–28) category indicate nearly complete or complete approaches to addressing the WUI through planning and regulatory tools. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for all counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Colfax County has also used several planning tools to address its WUI, including the adoption of a comprehensive plan with a chapter on hazard mitigation that includes wildfire policies and a CWPP that includes an action to adopt a WUI code and provide more guidance to builders (Colfax 2022). However, no current local hazard mitigation plan was identified, and the county has not yet adopted WUI regulations.

More broadly, there are other activities in place to support fire adaptation. These include efforts being undertaken by the Fire Adapted New Mexico Learning Network, neighborhood and community participation in the Firewise USA and Ready, Set, Go! programs, and ongoing work through the New Mexico Prescribed Fire Council.

Chapter 11: Central Oregon Landscape

Physical and Social Characteristics

The Central Oregon landscape spans substantial parts of four counties on the east side of the Cascade Range in central Oregon, largely within the basin of the Deschutes River, which flows northward to the Columbia River.

The vegetation varies with elevation and precipitation, ranging from mountain hemlock (*Tsuga mertensiana* (Bong.) Carrière) and subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.) forests in the upper elevations to ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) in the mid-elevations and western juniper (*Juniperus occidentalis* Hook.) in the lower elevations and eastern portions of the landscape. The sage steppe and grasslands consist of sagebrush (*Artemisia* L.), rabbitbrush (*Chrysothamnus* Nutt.), mountain mahogany (*Cercocarpus* Kunth) and grasses and forbs down to sagebrush shrublands in the mid- and lower elevations.

The Central Oregon landscape is composed of more than 2.6 million total acres, including much of the Deschutes National Forest (1.4 million acres in the Central Oregon landscape boundary) as well as parts of several other national forests (Fremont-Winema, Ochoco, Umpqua, and Willamette) for a total of 1.7 million acres of National Forest System (NFS) lands. The landscape also includes more than 900,000 acres of non-NFS lands, which include the urban areas in and around Bend and Redmond, Oregon (in Deschutes County), as well as other substantial areas of wildland-urban interface (WUI) along the U.S. Route 97 corridor southwest of Bend (fig. 11.1). The four counties associated with the Central Oregon landscape had a total population of more than 300,000 as of 2021 (table 11.1). Other major urban areas in these counties (but outside of the Central Oregon landscape) include Klamath Falls, Oregon (Klamath County).

The Central Oregon landscape footprint does not have overlapping or adjacent tribal lands (USDA FS 2024d). The Confederated Tribes of Warm Springs were identified as having connections to the landscape in the initial landscape description (USDA FS 2022d).

Landscape at a Glance

- The Central Oregon landscape includes 2.6 million acres, three-fourths of which consist of National Forest System (NFS) lands on the Deschutes National Forest.
- The counties associated with the Central Oregon landscape have a total population of a little more than 300,000, with 200,000 falling within Deschutes County (county seat of Bend).
- The Central Oregon landscape has experienced rapid growth in housing and population, particularly in Jefferson and Deschutes Counties.
- Deschutes County residents tend to have higher incomes and are less likely to live in mobile or manufactured housing compared to the other three counties. These other counties are less populous but have more racial and ethnic diversity.
- Over the past decade, 9 percent of the NFS lands in the landscape have had fuel treatment, up to 11 percent in Deschutes County.
- Deschutes and Jefferson Counties have also taken the most active approaches in wildland-urban interface (WUI) planning and regulatory adaptations. Both were in the consolidating Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk, and the state of Oregon is increasingly playing a role in land-use planning and regulation to reduce risk.

The four counties associated with the Central Oregon landscape are representative of many of the general trends in the Western United States (hereafter, the West) (table 11.2). These include the following:

- Rapid population growth (even faster than the West), more than tripling from 1970 through 2021.
- Accompanying rapid growth in personal income (600 percent increase over the same period).
- Despite this growth, overall income remains slightly below the national average, at about \$66,000 per capita.
- Low racial diversity (less than either the United States or the West), although American Indian residents represent a higher-than-average proportion of some counties (Klamath and Lake).
- A high proportion of federally managed lands (except for Jefferson County) (fig. 11.2).

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Central Oregon landscape is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

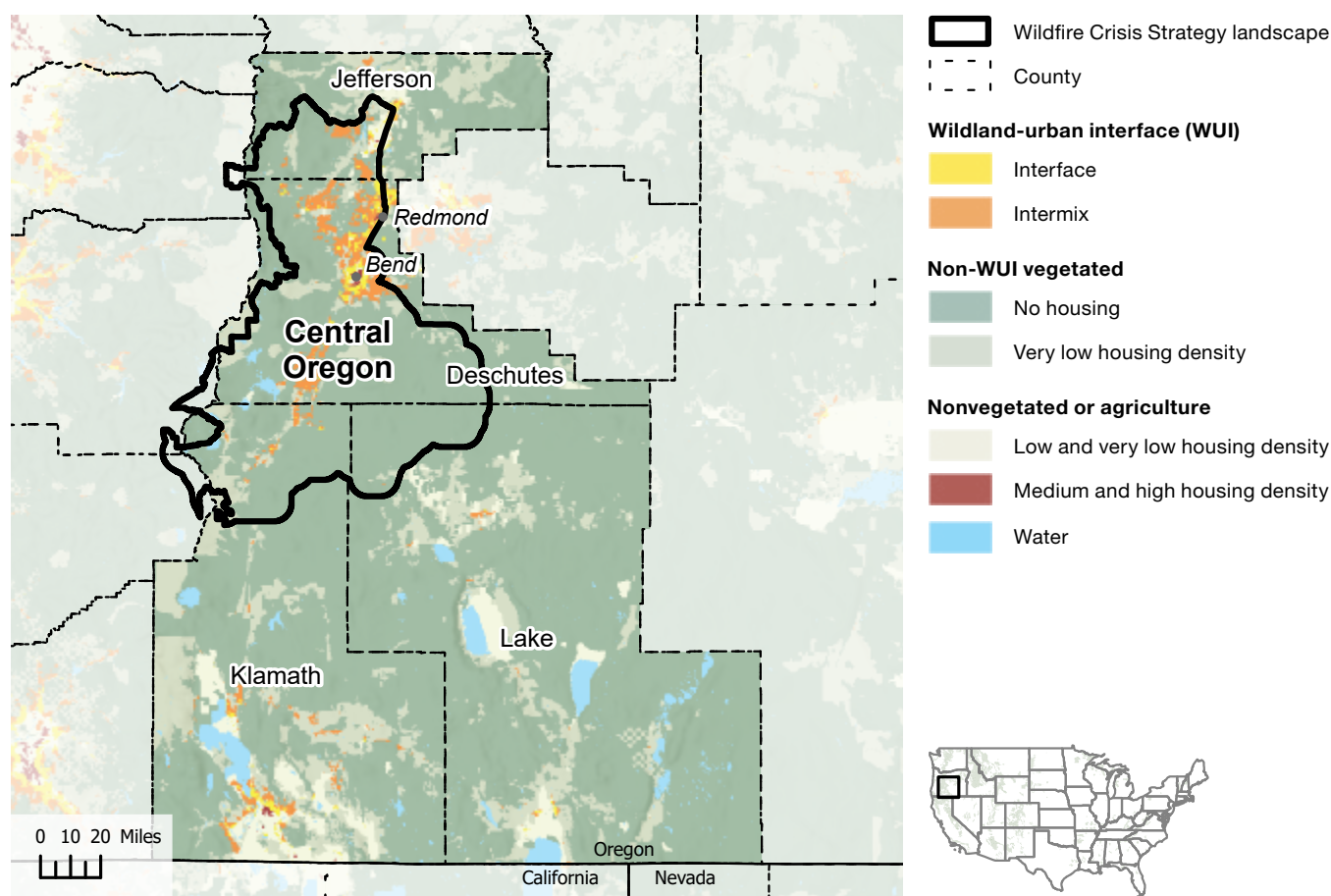


Figure 11.1—Wildland-urban interface (WUI) in the counties associated with the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credit: Rob Anderson and Kathryn Hixson.

- Despite a low proportion of WUI (3 percent), a substantial proportion (80 percent) of all housing is in the WUI.
- Rapid growth in housing in the WUI (111 percent increase from 1990 through 2020).

These socioeconomic and demographic characteristics, however, are highly variable across the counties represented in this landscape. Population and personal income growth are primarily in the more urban areas, such as Deschutes County (563 percent population increase from 1970 through 2021), and Jefferson County to a lesser extent, as is growth in WUI housing. Deschutes County residents tend to have higher incomes and are less likely to live in mobile or manufactured housing in comparison to the other three counties. Klamath and Lake Counties have grown slowly and have much lower per capita income by comparison. The less populous counties also have more racial and ethnic diversity (Hispanic/Latino in Jefferson County, American Indian in Klamath and Lake Counties).

Table 11.1—Counties associated with the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Deschutes	70.7	204,801
Jefferson	25.7	25,068
Klamath	13.6	70,164
Lake	5.9	8,276
Total		308,309

Table 11.2—Physical and social characteristics of counties associated with the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
Central Oregon counties	308,309	220.6	65,563	31.9	64.2	8.8	80.6	5.7	10.6	20.8
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Deschutes, Jefferson, Klamath, and Lake Counties are associated with the Central Oregon landscape. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

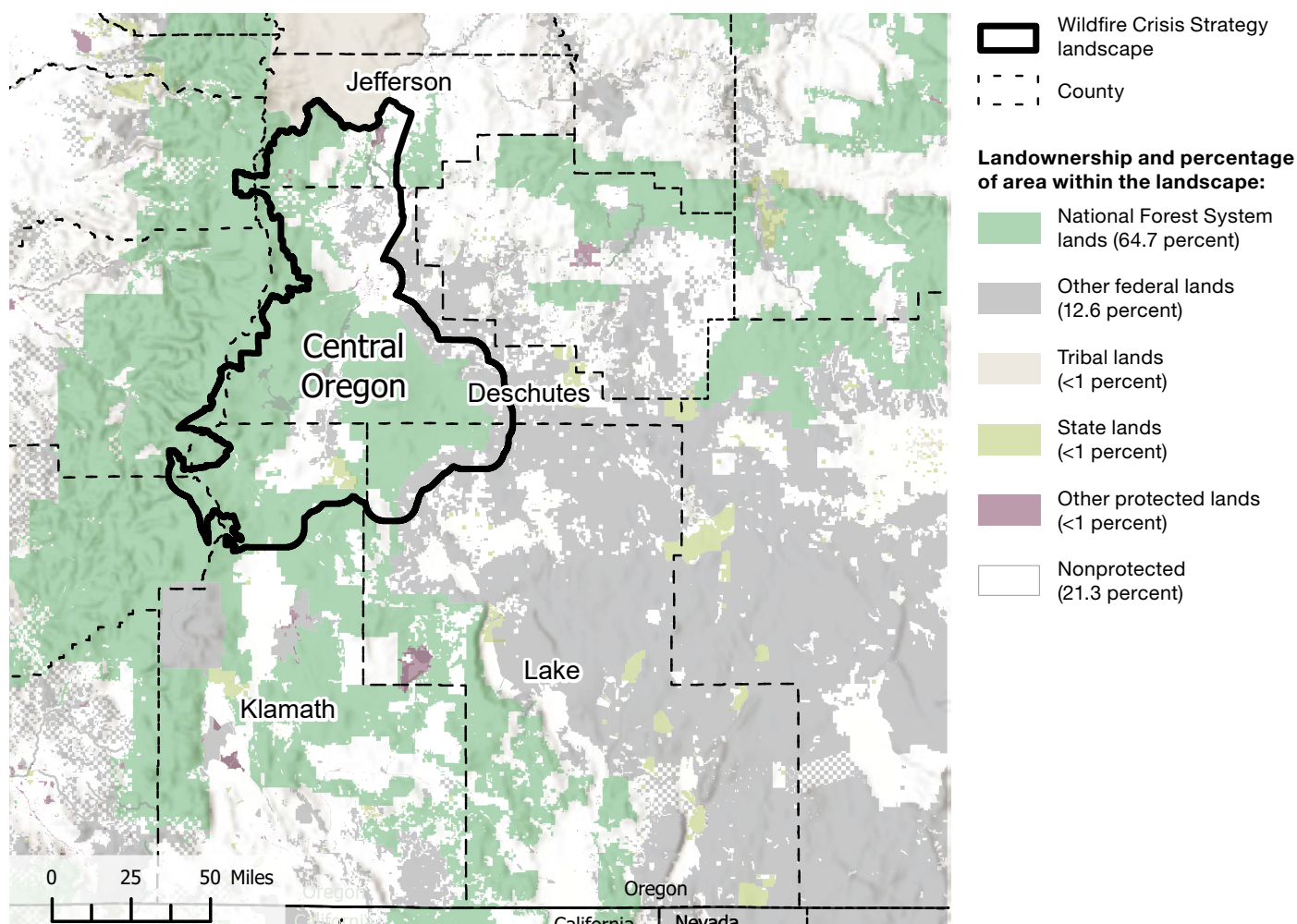


Figure 11.2—Land management and protection status of and around the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

Fire History and Fuel Treatments

Before European settlement, fire was a primary natural disturbance in maintaining most of these ecosystems. Fire suppression has resulted in substantial juniper encroachment in the shrub ecosystems at the lower elevations and a substantial increase in fuel loading in the forested ecosystems. This change, along with the climate change effects of drought conditions, has resulted in an increasing frequency of large fires on the landscape. The growth in development has resulted in an increase in structures and infrastructure in the interface.

The five largest wildfires in the Central Oregon landscape since 1984 (table 11.3) occurred between 2002 and 2017, and the five most destructive wildfires in terms of structure losses occurred between 1990 and 2020 (table 11.4). One wildfire is included both in the five largest and five most destructive wildfires. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 258,000 acres, or about 10 percent of the landscape.

Table 11.3—Five largest wildfires in the counties overlapping the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	Counties
ACRES			
B&B Complex	91,281	2003	Jefferson, Linn
Pole Creek Fire	26,982	2012	Deschutes
Milli 0843 CS Fire	24,074	2017	Deschutes, Lane
Eyerly Complex	22,358	2002	Jefferson
Davis Fire	20,683	2003	Deschutes, Klamath

Note: Deschutes, Jefferson, and Klamath Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 11.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	Counties
NUMBER			
Lionshead Fire	280	2020	Clackamas, Jefferson, Linn, Marion, Wasco
Two Four Two Fire	48	2020	Klamath
Eyerly Complex	37	2002	Jefferson
Moccasin Hill Fire	35	2014	Klamath
Awbrey Hall Fire	22	1990	Deschutes

Note: Deschutes, Jefferson, and Klamath Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Sources: USGS et al. (2024), except the Awbrey Hall Fire: Project Wildfire (2016).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 146,000 acres of NFS lands in the Central Oregon landscape (USDA FS 2024b). This represents 8.7 percent of the NFS lands in the landscape (NFS lands compose about 65 percent of the landscape) (fig. 11.3).

Fuel treatments included the following:

- More than 50,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 53,000 acres of treatments via commercial sales
- More than 115,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

Over the same period, the Central Oregon landscape had more than 4,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire). Including these wildfires, the total treatment area was more than 151,000 acres, or 9 percent of the NFS lands in the landscape.

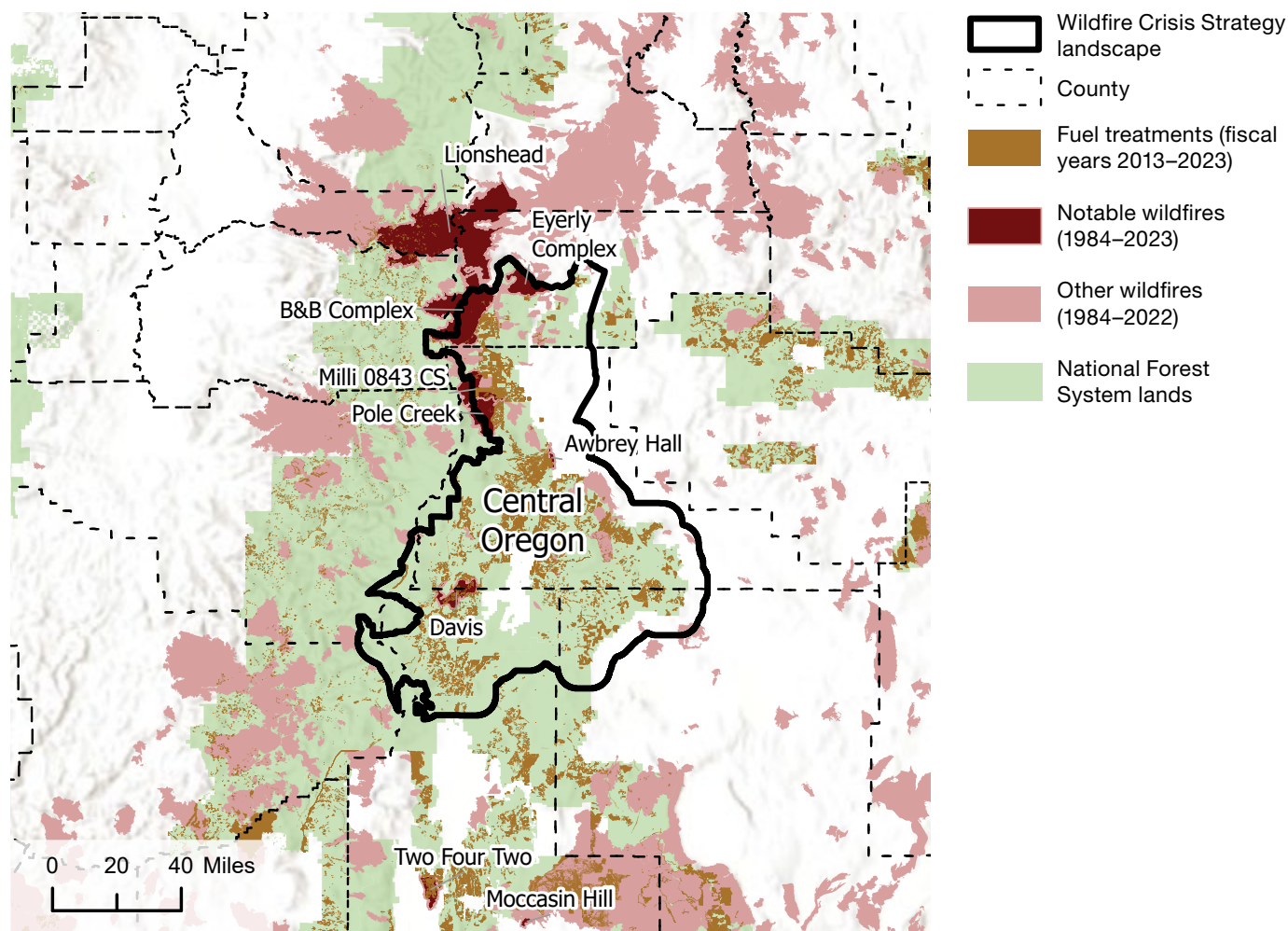


Figure 11.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, Central Oregon landscape. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

In 2024, the Walker Range Fire Protection Association in Klamath County received funding for vegetation management through the Community Wildfire Defense Grant (\$2.7 million) (USDA FS 2024c).

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Central Oregon landscape indicates that counties are primarily in the consolidating category of planning and regulatory efforts to address the WUI. FLUPE results are shown in table 11.5 with other WUI development trends for reference.

Deschutes and Jefferson Counties' WUI planning and regulatory adaptations both include wildfire risk reduction policies in their comprehensive plans (Deschutes 2011, Jefferson 2007); community wildfire protection plans and local hazard mitigation plans adopted in the last 5 years (Deschutes 2018, 2021; Jefferson 2022a, 2022b); and locally adopted WUI regulations. Deschutes County, for example, has adopted a Westside Transect Zone that includes a wildfire prevention mitigation plan requirement for residential subdivisions. Both Jefferson and Klamath Counties have adopted fire safety standards that address building construction, access, water supply, and landscaping and fuel breaks.

In addition to locally adopted planning and regulatory mechanisms, Oregon has state-wide requirements intended to reduce wildfire risk near homes and properties. The Oregon

Table 11.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Central Oregon landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Deschutes	20—Consolidating	10.3	78,004	82.9	177.6	11.0	11.0
Jefferson	21—Consolidating	3.5	8,243	80.4	70.6	4.6	7.1
Klamath	15—Consolidating	2.3	23,530	71.9	29.2	6.7	6.7
Lake	8—Emerging	0.2	2,610	62.2	16.4	8.9	8.9
Combined four counties above	N/A	2.8	112,387 ^a	79.5	110.5	8.7	9.0
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the emerging category (8–14) indicate counties that are in the process of becoming more fire adapted via WUI planning adaptation tools; scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for all counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

Forestland-Urban Interface Fire Protection Act (1997), administered by the Oregon Department of Forestry, requires property owners within designated forest land areas to reduce excess vegetation around structures and along driveways. Comprehensive state legislation passed in 2021 (Oregon Senate Bills 762 and 80) are intended to create a statewide approach for fire-hardening building code standards for new dwellings and accessory structures in areas of the state mapped as high hazard zones in the WUI. Many elements of its implementation are currently underway.

Other local adaptations in the Central Oregon landscape are in place to supplement or implement local planning and regulatory adaptations. For example, through County Ordinance 8.24.010, Deschutes County created a long-standing wildfire program, Project Wildfire, that coordinates local mitigation work, educational opportunities, grant funding, and other activities. Many communities in the Central Oregon landscape are also recognized by the national Firewise USA program and participate in the Ready, Set, Go! program. Other efforts, such as a collaboration between the Central Oregon Intergovernmental Council and Jefferson County fire chiefs, provided funding to residents to treat land around their home to increase defensible space to help implement the goals of the county's CWPP.

Chapter 12: Central Washington Initiative Landscape

Physical and Social Characteristics

The Central Washington Initiative landscape spans substantial parts of five counties on the east side of the Cascade Range in central Washington. The landscape includes more than 2.4 million acres and contains almost 1.4 million acres of National Forest System (NFS) lands on the Okanogan-Wenatchee National Forest, mostly at higher elevation nearer the Cascade crest (i.e., toward the western side of the landscape), and more than 1 million acres of non-NFS lands (including other federal, state, and private lands) mostly at lower elevation, in the basins associated with several rivers flowing eastward from the Cascade Range into the Columbia River.

The natural vegetation in the Central Washington Initiative landscape ranges from semiarid shrub ecosystems to alpine tundra. This variation is primarily due to elevation. The highest elevation consists of alpine and subalpine meadows and forest stands of whitebark pine (*Pinus albicaulis* Engelm.), lodgepole pine (*Pinus contorta* Douglas ex Loudon), and subalpine larch (*Larix lyallii* Parl.). With decreasing elevation, the vegetation transitions to Engelmann spruce (*Picea engelmannii* Parry ex Engelm.) and subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), then ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), western larch (*Larix occidentalis* Nutt.), western white pine (*Pinus monticola* Douglas ex D. Don), and quaking aspen (*Populus tremuloides* Michx.), and finally to semiarid, open bunchgrass and sage vegetation at the lowest elevations.

The five counties associated with the Central Washington Initiative landscape had a total population of more than 450,000 as of 2021 (table 12.1). The Central Washington Initiative landscape includes the urban area in and around Wenatchee (southern Chelan County) as well as other substantial areas of wildland-urban interface (WUI) in and around Cle Elum (western Kittitas County) and the Methow Valley (Okanogan County) (fig. 12.1). Other major urban areas in these counties (but outside of the Central Washington Initiative landscape) include Yakima (Yakima County) and Ellensburg (Kittitas County).

Landscape at a Glance

- The Central Washington Initiative landscape runs north-south over 250 miles along the east side of the Cascade Range, encompassing more than 2.4 million acres in five different counties.
- These counties have a total population of more than 450,000, and the landscape includes developed areas in and around Wenatchee, Washington (in Chelan County).
- Wildland-urban interface (WUI) expansion has been particularly rapid in Kittitas, Douglas, and Chelan Counties.
- The population is more ethnically diverse than many of the other Wildfire Crisis Strategy landscapes.
- A total of 10 percent of the National Forest System lands in the landscape have had fuel treatments in the past decade, up to 14 percent in Chelan County.
- Wildfire planning and regulation investments range from the emerging Fire and Land Use Planning Evaluation Tool category for addressing the WUI and associated wildfire risk in Douglas County to the consolidating category in the other counties.
- Kittitas and Yakima Counties are notable for their planning efforts and their adoption of the international WUI code.
- WUI regulation efforts may expand with state-level adoption of WUI codes in 2024.

Table 12.1—Counties associated with the Central Washington Initiative landscape, a priority of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

County	Proportion of the county in the landscape	Total county population
	PERCENT	NUMBER
Chelan	48.1	79,646
Douglas	9.6	43,696
Kittitas	32.6	45,499
Okanogan	17.7	42,634
Yakima	11.4	256,035
Total		467,510

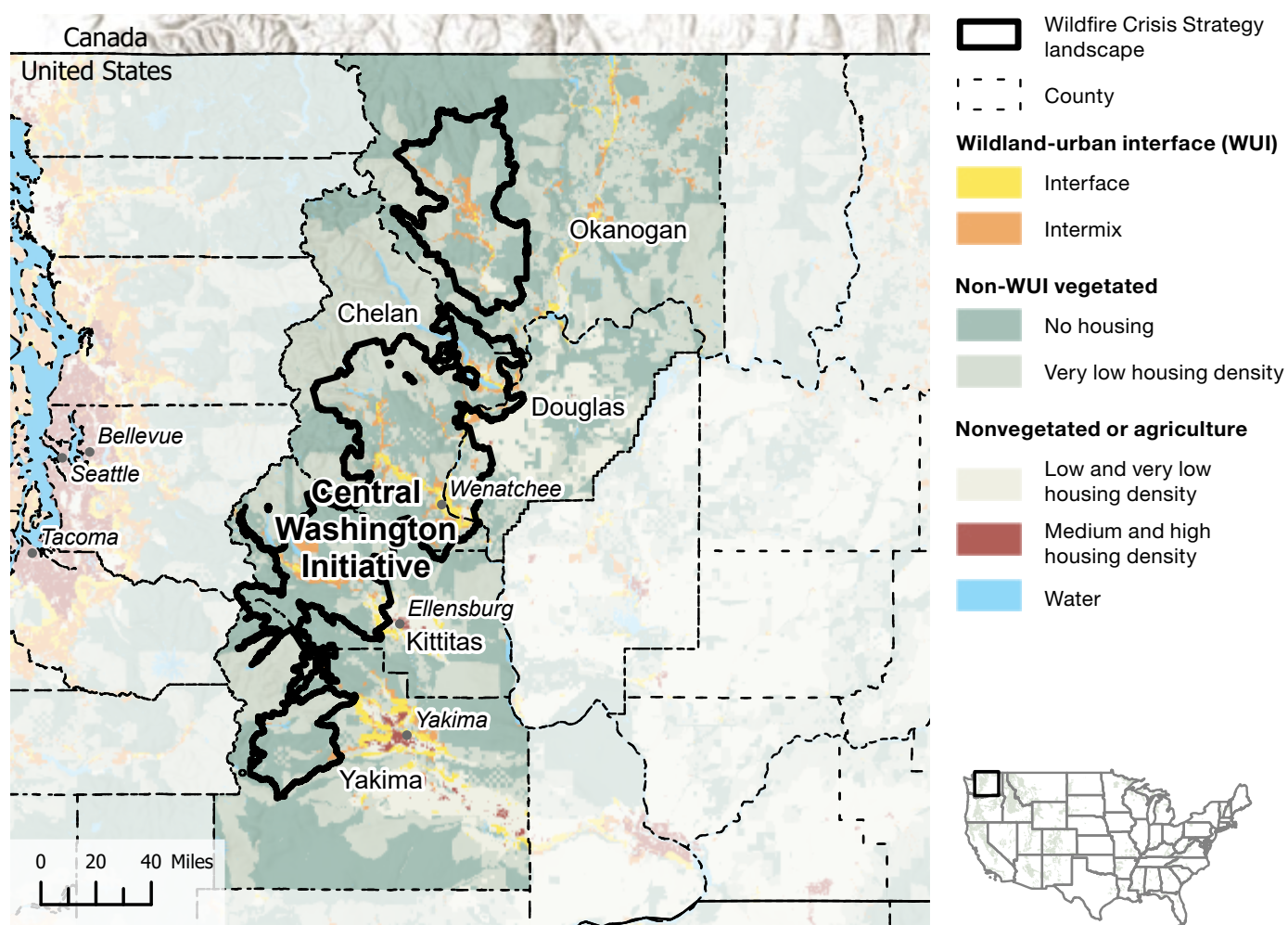


Figure 12.1—Wildland-urban interface (WUI) in the counties associated with the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Intermix refers to housing intermingled with wildland vegetation; interface is housing adjacent to wildland vegetation. Source: Radeloff et al. (2023b). Map credit: Rob Anderson and Kathryn Hixson.

The Central Washington Initiative landscape footprint overlaps with the Colville Reservation and Off-Reservation Trust Land and the Yakama Nation Reservation and Off-Reservation Trust Land (USDA FS 2024d). The Confederated Tribes and Bands of the Yakama Nation and Confederated Tribes of the Colville Reservation were identified as having connections to the landscape in the initial landscape description (USDA FS 2022d).

The five counties associated with the Central Washington Initiative are representative of many of the general trends in the Western United States (hereafter, the West) (table 12.2). These include the following:

- A high proportion of federally managed lands (except for Douglas County, which is primarily agricultural, and contains no NFS lands) (fig. 12.2).
- Income remains below the national average for all counties.
- A substantial proportion (54 percent) of all housing is in the WUI (and much higher in some areas; e.g., 88 percent in Chelan County).
- Rapid growth in housing in the WUI (albeit unevenly, most pronounced in Kittitas and Douglas Counties).

Although this area has also seen population growth (84 percent increase from 1970 through 2021) and increase in personal income (282 percent increase over the same period), the rates of change are lower here than elsewhere in the West (126 percent increase in population and a 390 percent change in per capita income across the West from 1970 through 2021). The Central Washington Initiative landscape is also more ethnically diverse than

The Wildfire Crisis Strategy is a U.S. Department of Agriculture, Forest Service effort to enhance the pace and scale of fuel treatments to reduce wildfire risk to communities and enhance forest resilience. The Central Washington Initiative landscape is 1 of 10 priority landscapes that was identified in 2022. This profile contains information on physical and social characteristics, fire history, fuel treatments, and wildland-urban interface plans and regulations, drawing from county-level data and local documents.

Table 12.2—Physical and social characteristics of counties associated with the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 2021

Geographic region	Population	Population change, 1970–2021	Per capita income ^a	Private lands ^b	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d
	NUMBER	PERCENT	DOLLARS	PERCENT						
Central Washington Initiative landscape counties	467,510	83.7	57,184	29.1	42.0	11.9	52.8	6.9	38.5	16.4
Western states (for comparison)	75,948,483	125.7	75,379	39.6	47.1	5.0	59.4	4.2	30.9	15.1

Notes: Chelan, Douglas, Kittitas, Okanogan, and Yakima Counties are associated with the Central Washington Initiative landscape. For county-by-county data, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Source: Headwaters Economics (n.d.).

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations. These categories are combined in U.S. Census data.

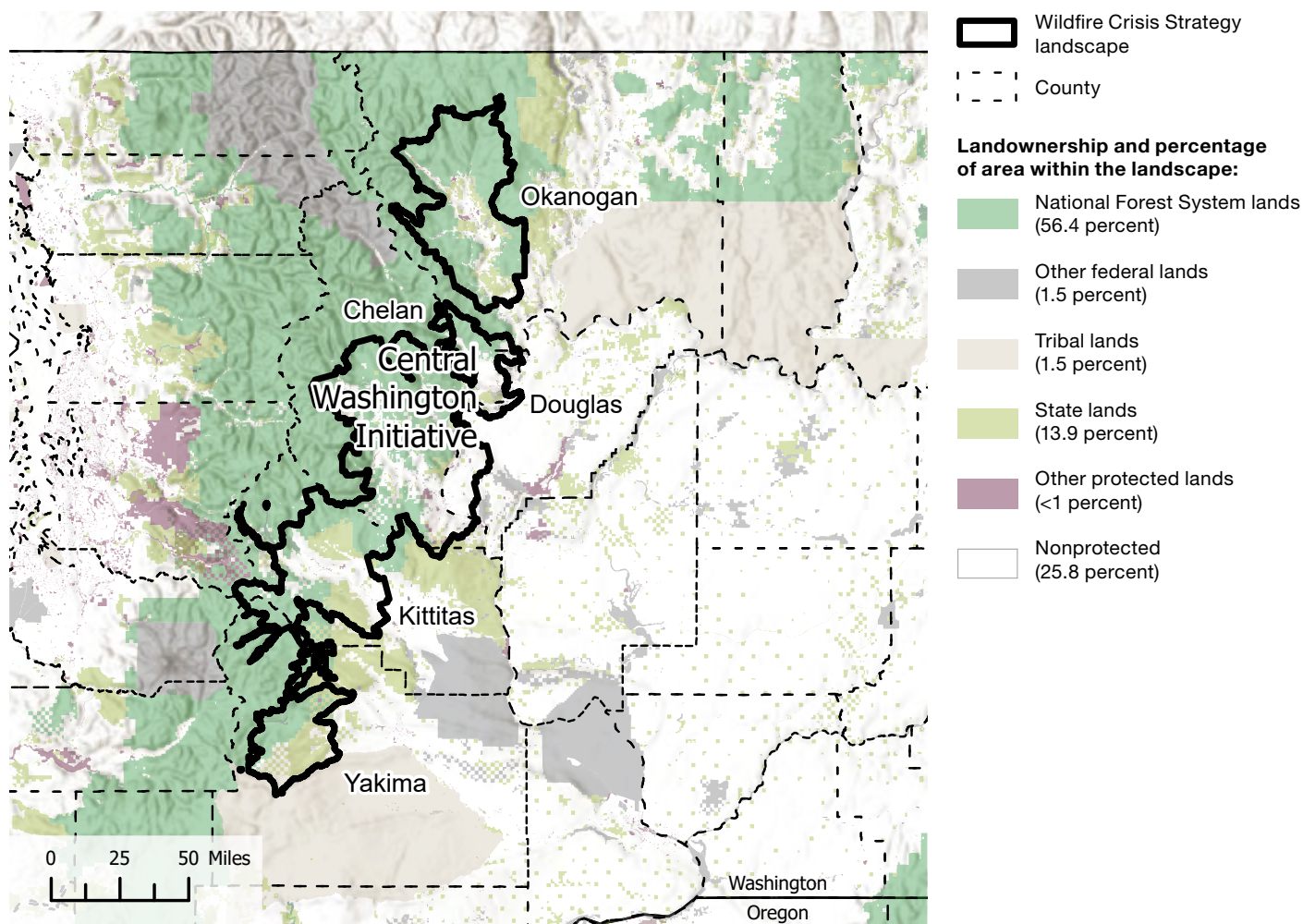


Figure 12.2—Land management and protection status of and around the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Source: USGS (2022). Map credit: Kathryn Hixson.

many of the other Wildfire Crisis Strategy landscapes, with a substantial Hispanic/Latino population (39 percent overall; highest in Yakima County at 51 percent but lower in Kittitas County at 9 percent).

Fire History and Fuel Treatments

Historically, fire was a primary disturbance type in all these vegetation types, with the regular occurrence of high-frequency/low-intensity fires in the ponderosa pine and sage steppe ecosystems, transitioning to lower frequency, but higher intensity (typically stand replacement) fires in the higher elevation lodgepole pine and spruce vegetation.

Active fire suppression and forest management practices over the past century have significantly changed many of these ecosystems, creating conditions of encroachment into the grasslands and high-density, continuous forested stands, with a reduction in landscape-level diversity and a general increase in forest fuel loading. This, combined with the prolonged droughts and extended fire seasons, has resulted in an increase in the occurrence of high-intensity, stand-replacing large fires. The increased presence of humans and communities on the landscape has also resulted in a higher frequency of wildfires that result in structure loss across the landscape.

The five largest wildfires in the Central Washington Initiative landscape since 1984 (table 12.3) occurred between 1994 and 2021, and the five most destructive wildfires in terms of structure losses occurred between 2012 and 2020 (table 12.4). One wildfire, the Carlton Complex, is included both in the five largest and five most destructive wildfires. The area that all known fires burned in the landscape from 1984 through 2023 totaled more than 893,000 acres, or more than 36 percent of the landscape.

Table 12.3—Five largest wildfires in the counties overlapping the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Area burned	Year	County
ACRES			
Carlton Complex	276,091	2014	Okanogan
Tyee Creek Fire	123,618	1994	Chelan
Diamond Creek Fire	117,527	2017	Okanogan
Tripod Complex (Spur Peak)	115,123	2006	Okanogan
Schneider Springs Fire	114,743	2021	Yakima

Note: Chelan, Okanogan, and Yakima Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

Table 12.4—Five most destructive wildfires by number of structures destroyed in the counties overlapping the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy, 1984–2023

Wildfire	Structures destroyed	Year	County
NUMBER			
Carlton Complex	471	2014	Okanogan
Taylor Bridge Fire	272	2012	Kittitas
Tunk Block Fire	145	2015	Okanogan
Cold Springs Fire	138	2020	Okanogan
Okanogan Complex	127	2015	Okanogan

Note: Okanogan and Kittitas Counties have substantial overlap with the landscape and were included in our broader analysis (see page 7).

Source: USGS et al. (2024).

From October 2013 through September 2023, the Forest Service conducted and reported treatments of hazardous fuel conditions on more than 78,000 acres of NFS lands in the Central Washington Initiative landscape (USDA FS 2024b). This represents 5.7 percent of the NFS lands in the landscape (NFS lands compose about 56 percent of the landscape) (fig. 12.3).

Fuel treatments included the following:

- More than 30,000 acres of prescribed fire treatment (excluding burning of piled fuels)
- More than 6,000 acres of treatments via commercial sales
- More than 51,000 acres of mechanical and other treatments (noncommercial, including thinning, mechanical surface treatments, chipping of fuels, piling of fuels, burning of piled material, and others)

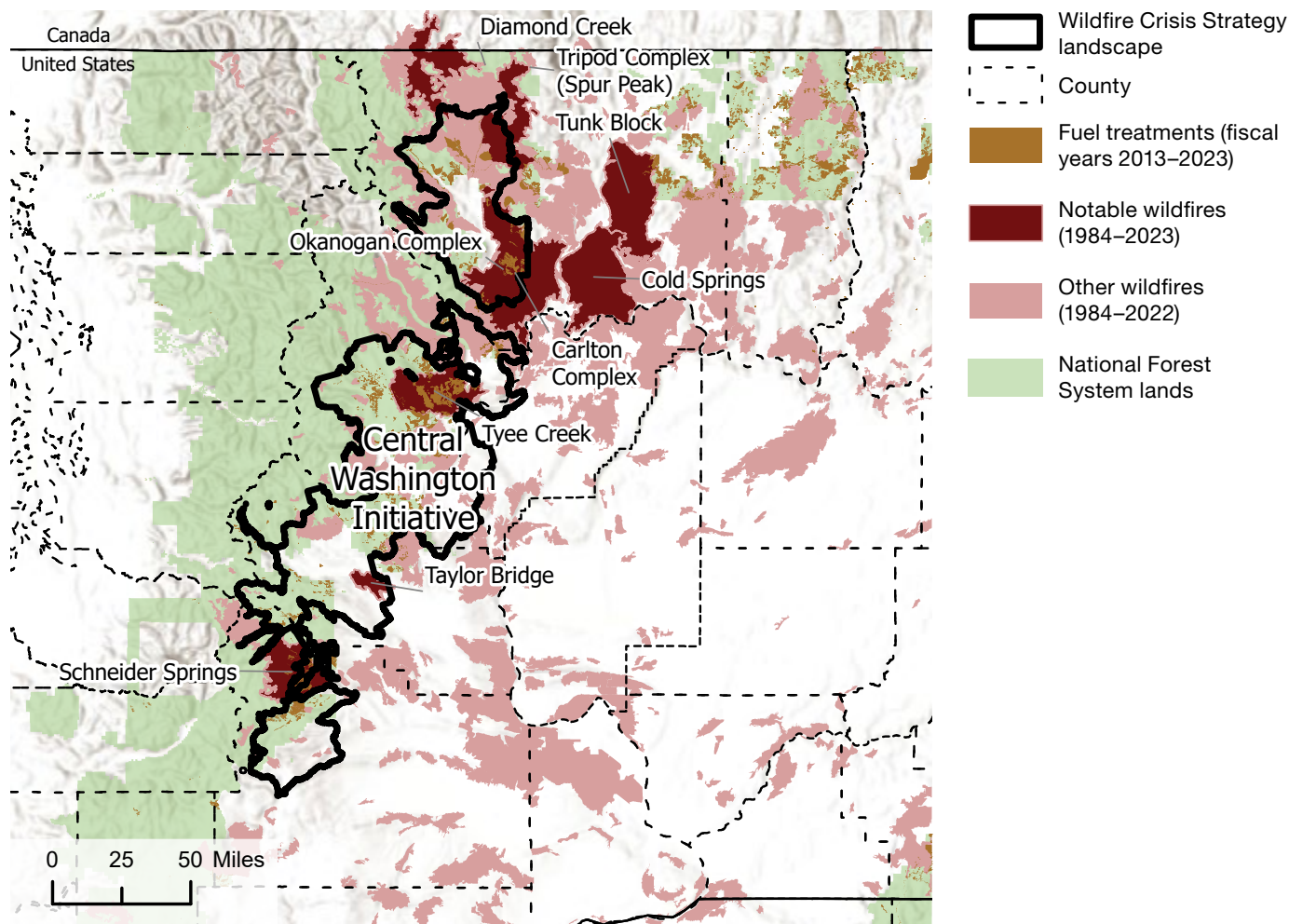


Figure 12.3—Historical wildfires (1984–2023) and fuel treatments (fiscal years 2013–2023) associated with the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy. Wildfires are deemed “notable” for their overall size, or effects to communities in terms of structures lost. Fuel treatments are based on the Forest Activity Tracking System; wildfires are based on the Monitoring Trends in Burn Severity project. Sources: USDA FS (2024b), USGS et al. (2024). Map credit: Kathryn Hixson.

Over the same period, the Central Washington Initiative landscape had more than 58,000 acres of wildfire that were counted as hazardous fuel reduction (including natural ignition fires that benefitted fuel conditions and planned fuel treatment areas burned in wildfire). Including these wildfires, the total treatment area was more than 134,000 acres, or 9.8 percent of the NFS lands in the landscape.

These categories may overlap (e.g., prescribed fire conducted on acres that were previously treated mechanically, or wildfire in previously treated areas); as a result, the sum of these different treatment categories is greater than the total treatment area. In the total treatment area, each acre is counted only once, regardless of receiving multiple treatment types.

From 2023 through 2024, multiple organizations/agencies working in the landscape received Community Wildfire Defense Grants, including funding for fuels mitigation work in Kittitas County through the Kittitas County Resilient Landscapes project; funding for fuels reduction around the town of Cle Elum in Kittitas County; and funding to the Chelan County Natural Resource Department for the Stemilt-Squilchuck Forest Resilience Project (USDA FS 2024c). Funding in 2024 is also supporting the development of a Kittitas County community wildfire protection plan (CWPP).

This section summarizes countywide plans and regulations that focus on wildland-urban interface (WUI) development and related wildfire risk reduction activities. These findings are based on the Fire and Land Use Planning Evaluation Tool (FLUPE) (CWPC, n.d.). The FLUPE assesses the extent to which a community is incorporating wildfire into its land-use planning and regulatory approaches, as described in chapter 2.

WUI Plans and Regulations

A high-level evaluation of applicable county plans and regulations associated with the Central Washington Initiative landscape indicates that counties are primarily in the consolidating category for their approaches to using these tools as adaptations to address the WUI. FLUPE results are shown in table 12.5 with other WUI development trends for reference.

Both Kittitas and Yakima Counties' higher FLUPE scores reflect multiple planning and regulatory adaptation tools in place. For example, these counties have comprehensive plans with policies for wildfire and have recently adopted or updated CWPPs and local hazard mitigation plans (Kittitas 2018, 2019, 2021). Both counties have also adopted the international WUI code, with local amendments, to designate the WUI and regulate access, water supply, building construction, hazardous vegetation and fuels, and other features of potential risk to wildfire.

Other counties, such as Okanogan and Chelan Counties, have many planning efforts in place but have yet to adopt WUI regulations. For example, Okanogan County has an

Table 12.5—Wildland-urban interface (WUI) planning and regulatory adaptations and development trends for counties associated with the Central Washington Initiative landscape, a priority landscape of the U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy

County/geographic region	FLUPE score	WUI development				NFS lands in the landscape with fuel treatment, fiscal years 2014–2023	
		Area in the WUI, 2020	Housing units in the WUI, 2020	Growth in WUI housing, 1990–2020		Active treatment only	Including wildfires with fuel-reduction benefits
		PERCENT	NUMBER			PERCENT	
Chelan	16—Consolidating	5.4	32,659	87.6	50.5	7.5	14.0
Douglas	10—Emerging	2.7	15,319	88.5	72.4	N/A	N/A
Kittitas	19—Consolidating	5.5	10,753	45.3	103.3	3.0	3.0
Okanogan	15—Consolidating	3.3	16,235	74.7	31.6	4.6	8.8
Yakima	19—Consolidating	4.3	28,111	31.1	41.4	6.3	6.3
Combined five counties above	N/A	4.2	103,077 ^a	54.1	51.4	5.7	9.8
Western states (for comparison)	N/A	3.1	N/A	39.8	61.9	N/A	N/A

N/A = not applicable, NFS = National Forest System.

Notes: Fire and Land Use Planning Evaluation Tool (FLUPE) scores in the emerging category (8–14) indicate counties that are in the process of becoming more fire adapted via WUI planning adaptation tools; scores in the consolidating category (15–21) indicate counties that are in the process of combining several WUI planning adaptation tools to address wildfire risk. See table 2.2 for a full description of FLUPE score categories. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aTotal for all counties.

Sources: Radeloff et al. (2023a), USDA FS (2024b).

extensive set of wildfire policies in their comprehensive plan (Okanogan 2021). Wildfire objectives include encouraging cluster developments to reduce WUI areas, reviewing county road standards for safer access for emergency vehicles, encouraging the undergrounding of utilities, supporting programs for fire safe communities, and promoting postfire rehabilitation and flood mitigation.

WUI regulatory adaptations may expand across the state in the future. The Washington State Legislature previously adopted the International Wildland-Urban Interface Code (International Code Council 2021) as part of its required codes, but they put the effort on hold until the Washington State Department of Natural Resources updates statewide WUI maps. Some jurisdictions, such as Douglas County, however, have already adopted the state's model WUI code (Washington State Building Code Council 2023) despite having a limited number of planning adaptations in place.

The Washington State Fire Adapted Communities Learning Network and local partners, including Kittitas Fire Adapted Communities Coalition, Nuestra Casa, Community Advancement for Family Education, Cascadia Conservation District, and the Chumstick Wildfire Stewardship Coalition support many more fire adaptation efforts in the Central Washington Initiative landscape. The adaptation activities are wide-ranging and include delivering educational, outreach, and training events; implementing community fuel treatments; and conducting wildfire risk assessments on properties.

Chapter 13: Comparison of Landscapes

Introduction

The preceding chapters gave an overview of the physical and social characteristics and key wildfire adaptations for the 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS) landscapes individually. In this chapter, we holistically examine the variety of settings and conditions across all 10 landscapes, and when relevant, the 40 counties that we analyzed as part of this research. We first review variations and patterns in socioeconomic and demographic trends, followed by variations and patterns in adaptation efforts, focusing on fuel treatments and wildland-urban interface (WUI) planning and regulatory tools. We synthesize these adaptations (fuel treatments and land-use planning) with the extent of WUI housing to demonstrate the variety of places and adaptation efforts in these WCS landscapes. We conclude with a discussion of opportunities for further research.

Social Characteristics

The initial WCS landscapes were all selected because of shared characteristics, namely, high wildfire risk and past work on landscape-level risk reduction. However, the landscapes vary in size (total area and number of associated counties), location, population, ownership (e.g., National Forest System [NFS] versus private lands), and other socioeconomic factors. Understanding this variation in social settings helps inform the need for wildfire risk reduction, potential vulnerabilities of residents, and potential challenges of reducing wildfire risk.

Much of the variation in socioeconomic characteristics reflects how WCS landscapes extend in different ways across a range of urban and rural areas and mirror broader trends of urban/rural difference in the Western United States (hereafter, the West). Four of the ten initial WCS landscapes are predominantly rural or micropolitan (North Yuba, California; Stanislaus, California; Enchanted Circle, New Mexico; and Kootenai Complex, Montana/Idaho), with total populations for all associated counties of less than 100,000 and in some cases, much less (table 13.1). These landscapes are all smaller in physical area (each less than 1.5 million acres) and span only one or two counties. These smaller landscapes (less populated and smaller in area) are representative of rural places in the West and have typically had slower population growth and WUI expansion over past decades. The Prescott landscape also has a smaller land area and is located entirely within Yavapai County, Arizona, but because this county is more populous and includes a portion of the adjacent Four Forest Restoration Initiative landscape, these landscapes represent overlapping human populations and are best considered together.

The other five landscapes span four or more counties each, are larger in physical area (greater than 1.5 million acres), and include or are near urban population centers, giving them total populations of more than 300,000 each. These bigger landscapes (more populated and larger in area) capture major urbanizing areas, including the Four Forest Restoration Initiative (associated with 6 counties), Colorado Front Range (associated with 12 counties), Southwest Idaho (associated with 6 counties), Central Oregon (associated with 4 counties), and Central Washington Initiative (associated with 5 counties). These landscapes have experienced more rapid population growth in recent decades, as well as substantial growth in per capita income and are often anchored by nationally notable locations for in-migration, such as Flagstaff, Arizona; Boulder, Colorado; Boise, Idaho; and Bend, Oregon. The rapid

Table 13.1—Physical and social characteristics of all 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscapes, 2021

Wildfire Crisis Strategy landscape	Associated counties	Population	Population change, 1970–2021	Per capita income ^a	Federal lands ^b	Mobile homes ^c	White (non-Hispanic and no other race) ^d	American Indian/Alaska Native (only or with two or more races) ^d	Hispanic/Latino (of any race) ^d	Age ≥ 65 ^d	Housing units in the WUI, 2020 ^e	Growth in WUI housing, 1990–2020 ^f
		NUMBER	PERCENT	DOLLARS	PERCENT							
Colorado Front Range	12	3,852,503	170.9	83,182	36.3	1.6	68.6	3.2	18.1	13.9	40.9	102.0
Four Forest Restoration Initiative	6	624,068	200.2	53,146	32.2	18.0	57.8	25.7	14.3	22.7	90.1	74.8
Southwest Idaho	6	567,581	309.9	66,110	66.1	4.2	83.7	2.8	8.7	15.7	39.8	99.1
Central Washington Initiative	5	467,510	83.7	57,184	42.0	11.9	52.8	6.9	38.5	16.4	54.1	51.4
Central Oregon	4	308,309	220.6	65,563	64.2	8.8	80.6	5.7	10.6	20.8	79.5	110.5
Prescott	1	242,253	544.8	52,985	49.8	17.5	79.4	4.2	15.0	31.9	94.4	127.7
North Yuba	2	86,704	83.1	52,827	48.6	7.4	53.9	6.6	28.8	13.0	23.9	17.5
Stanislaus	1	55,810	149.6	56,490	74.8	10.8	79.1	5.5	12.9	26.2	96.3	26.2
Enchanted Circle	2	46,992	57.7	49,097	22.3	16.8	38.3	8.2	54.8	26.9	92.2	53.7
Kootenai Complex	2	33,086	40.3	47,456	70.9	12.8	90.4	4.0	4.1	26.6	83.3	58.3
Western states (for comparison)			125.7	75,379	47.1	5.0	59.4	4.2	30.9	15.1	39.8	61.9

Notes: For county-by-county statistics, see appendix 2. The combined 11 Western states presented for comparison are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^aIn 2022 U.S. dollars.

^bPercentage of total area.

^cPercentage of total occupied housing units.

^dPercentage of total population. These categories are combined in U.S. Census data. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations.

^ePercentage of total housing units in the wildland-urban interface.

^fPercentage change in the number of housing units in the wildland-urban interface.

Source: Headwaters Economics (n.d.).

population growth seen on these landscapes also contributed to substantial growth in WUI housing. For example, the number of WUI housing units more than doubled from 1990 through 2020 in the Central Oregon, Colorado Front Range, and Southwest Idaho landscapes, as well as in Yavapai County, Arizona, which includes a portion of the Four Forest Restoration Initiative landscape and the entire Prescott landscape. In contrast, among the bigger landscapes, population and WUI growth have been somewhat slower in the Central Washington Initiative landscape.

However, below the landscape level, growth is often concentrated in some counties around population centers. For example, Deschutes and Jefferson Counties are growing much more rapidly than the other counties in the Central Oregon landscape, as are Ada, Boise, and Valley Counties in Southwest Idaho. The larger landscapes with four or more counties include a mix of counties along the rural-urban continuum. Thirteen counties in these landscapes had a population of 100,000 or more, while six counties had populations of less than 10,000. Community engagement and risk reduction work in these landscapes therefore requires bridging more dispersed populations and spans a range of urban and rural settings, often across several hundred miles.

Despite these variations between landscapes in the number of counties and recent growth trajectories, populations in these landscapes share many of the same potential vulnerabilities typical of rural settings in the West. For example, in comparison to the West, most of the WCS landscapes have lower per capita incomes (the more urban Colorado Front Range is an exception)¹ and mobile homes represent a larger proportion of housing (more urban Colorado Front Range and Southwest Idaho are exceptions). Many landscapes also have an older population (more people age 65 and older) (table 13.1).

Although rapid WUI expansion is most pronounced in the more populated and larger landscapes, all the landscapes include substantial WUI housing. Every WCS landscape we considered includes at least one county in which the overall percentage of housing in the WUI is 80 percent or higher, with several counties at 90 percent or higher (for comparison, 32 percent of housing units are in the WUI across the United States and 40 percent across the West).

The WCS landscapes also tend to be less racially and ethnically diverse than the West: the median proportion of populations identifying as white non-Hispanic/Latino in these counties was 78 percent, compared to 70 percent in the nonmetropolitan (rural) counties in the West, and 49 percent in the West including metropolitan areas. Meanwhile, the median proportion of the population identifying as Hispanic/Latino was 13 percent, compared to 31 percent in the West and 19 percent in the United States.

However, in these WCS landscapes, there are places with more diversity, requiring engagement by the Forest Service and other partners with diverse or vulnerable populations. Landscapes with a higher proportion of Latino populations included the Enchanted Circle (55 percent), Central Washington Initiative (39 percent), and North Yuba (29 percent) (table 13.1). Outside these landscapes, Denver County in the Colorado Front Range and Greenlee County in the Four Forest Restoration Initiative landscape had higher proportions of Latino residents (see appendix 2 for more details).

¹ However, per capita income data does not necessarily indicate overall wealth. For example, areas with in-migration by retirees may see an influx in wealth that is not reflected in per capita income data. Detailed analysis of migration and socioeconomic patterns is beyond the scope of this analysis.

The median percentage of American Indian population for the counties in our analysis was 3.9 percent, roughly on par with the West, but this percentage varied substantially by county. The Enchanted Circle landscape is the only initial WCS landscape in our analysis with a substantial area of tribal lands in the landscape. Other landscapes are in counties that include tribal lands and have substantial American Indian populations: the Four Forest Restoration Initiative, Central Washington Initiative, Stanislaus, and North Yuba landscapes had relatively high proportions of American Indian residents (table 13.1). Outside of these landscapes, Jefferson County in the Colorado Front Range landscape and Klamath and Lake Counties in the Central Oregon landscape also had higher proportions of American Indian populations (from 7 to 17 percent).

Taken together, this analysis demonstrates that although the social settings of these WCS landscapes vary substantially, many of the landscapes do have similar potential vulnerabilities, such as having older populations, lower per capita incomes, and having housing concentrated in the WUI, with mobile homes representing a larger proportion of housing. Sharing knowledge across and within landscapes can help further understand the similarities and differences in community conditions and engagement strategies.

Adaptations

There are many different adaptations that communities and federal land managers may be pursuing to reduce wildfire risk. For this report, we compiled available information on two commonly pursued efforts: (1) fuel treatments on NFS lands in the landscape and (2) land-use planning and regulatory efforts at the county level aimed at reducing wildfire risk. Below we present information on each to highlight the variety of investments in these two adaptation efforts. Just as the socioeconomic settings in these landscapes can be highly variable, so are the adaptation contexts and histories.

Fuel Treatments

As noted in chapter 2, our analysis of hazardous fuel treatments conducted on the WCS landscapes includes only those treatments reported through the Forest Service's Forest Activity Tracking System (FACTS) database, which are predominantly on NFS lands. We therefore first report the percentage of NFS lands in the landscapes (table 13.2). This ranges across the 10 initial WCS landscapes from a low of 35 percent (the Enchanted Circle landscape) to a high of 94 percent (the Four Forest Restoration Initiative landscape). We then report the percentage of those NFS lands that have had fuel treatments, including separately totaling each of the categories of prescribed fire, commercial sales, other fuel treatment activities, and areas where wildfires were determined to have fuels reduction benefits, and summarize these combined categories, both exclusive and inclusive of the wildfire fuel reduction category (table 13.2).

The percentage of the NFS lands in the landscape that have had hazardous fuels treatments within the past 10 years ranged from about 4 percent in the North Yuba, Colorado Front Range, and Enchanted Circle landscapes to about 20 percent in the Four Forest Restoration Initiative landscape (table 13.2). However, a substantial proportion of the treatments on the Four Forest Restoration Initiative landscape were wildfires with fuels reduction benefits (as noted in FACTS). Excluding the wildfire category, this value was about 11 percent, on par with several other landscapes; the Prescott, Southwest Idaho, and Stanislaus landscapes are all in the range of 11 to 13 percent.

Table 13.2—Fuel treatments on all 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscapes, fiscal years 2014–2023

Wildfire Crisis Strategy landscape	Proportion of the landscape that is National Forest System (NFS) lands	Proportion of NFS lands in the landscape with prescribed fire treatment	Proportion of NFS lands in the landscape with fuel treatments conducted via commercial activities	Proportion of NFS lands in the landscape with other (noncommercial) hazardous fuel treatment activities	Proportion of NFS lands in the landscape with natural ignition wildfire with fuels benefit, or planned treatment burned in wildfire, or both	Proportion of NFS lands in the landscape with nonwildfire fuel treatments ^a	Proportion of NFS lands in the landscape with hazardous fuels reduction ^b
PERCENT							
Four Forest Restoration Initiative	94.1	7.1	1.4	4.1	9.8	11.0	19.9
Central Oregon	64.7	3.0	3.2	6.9	0.3	8.7	9.0
Central Washington Initiative	56.4	2.2	0.4	3.7	4.2	5.7	9.8
Colorado Front Range	42.7	1.0	0.2	3.4	0.0	4.3	4.3
Enchanted Circle	34.6	3.6	0.2	0.3	0.6	4.0	4.5
Kootenai Complex	67.7	1.8	2.5	2.5	3.7	5.7	9.0
North Yuba	73.8	0.7	1.4	2.9	0.0	3.9	3.9
Prescott	58.6	7.1	0.5	5.1	2.0	11.4	13.3
Southwest Idaho	54.0	6.8	2.0	6.8	1.6	12.2	13.7
Stanislaus	58.6	2.5	3.0	10.2	0.1	12.4	12.5

^aInclusive of NFS lands in the landscape with prescribed fire treatment, with fuel treatments conducted via commercial activities, and with other (noncommercial) hazardous fuel treatment activities.

^bInclusive of NFS lands in the landscape with prescribed fire treatment, with fuel treatments conducted via commercial activities, with other (noncommercial) hazardous fuel treatment activities and with natural ignition wildfire with fuels benefit, or planned treatment burned in wildfire, or both.

To examine the variation in fuel treatments at a smaller scale, we also measured the percentage of NFS lands treated in the landscapes at the county scale (fig. 13.1). We included 36 counties in this analysis (4 counties have no NFS lands). Across these 36 counties, the percentage of the NFS lands in the landscape that have had fuel treatments ranged from 0 to 26 percent, with a median of 6.5 percent if including wildfires with fuels reduction benefits. Including wildfires, 14 of the counties that we considered had 10 percent or more of NFS lands treated, with another 12 that had 5 to 10 percent of NFS lands treated, and 11 that had less than 5 percent treated (fig. 13.1).

This analysis also reveals patterns within and across landscapes. In the Southwest Idaho, Central Washington Initiative, North Yuba, and Enchanted Circle landscapes, counties varied in the proportion of NFS lands treated. In contrast, this proportion was more similar in the Colorado Front Range counties (consistently lower values) and the Four Forest Restoration Initiative counties (mostly higher values). Four of the landscapes had at least one county where 15 percent or more of NFS lands were treated, while five of the landscapes had at least one county where less than 5 percent of the NFS lands had been treated.

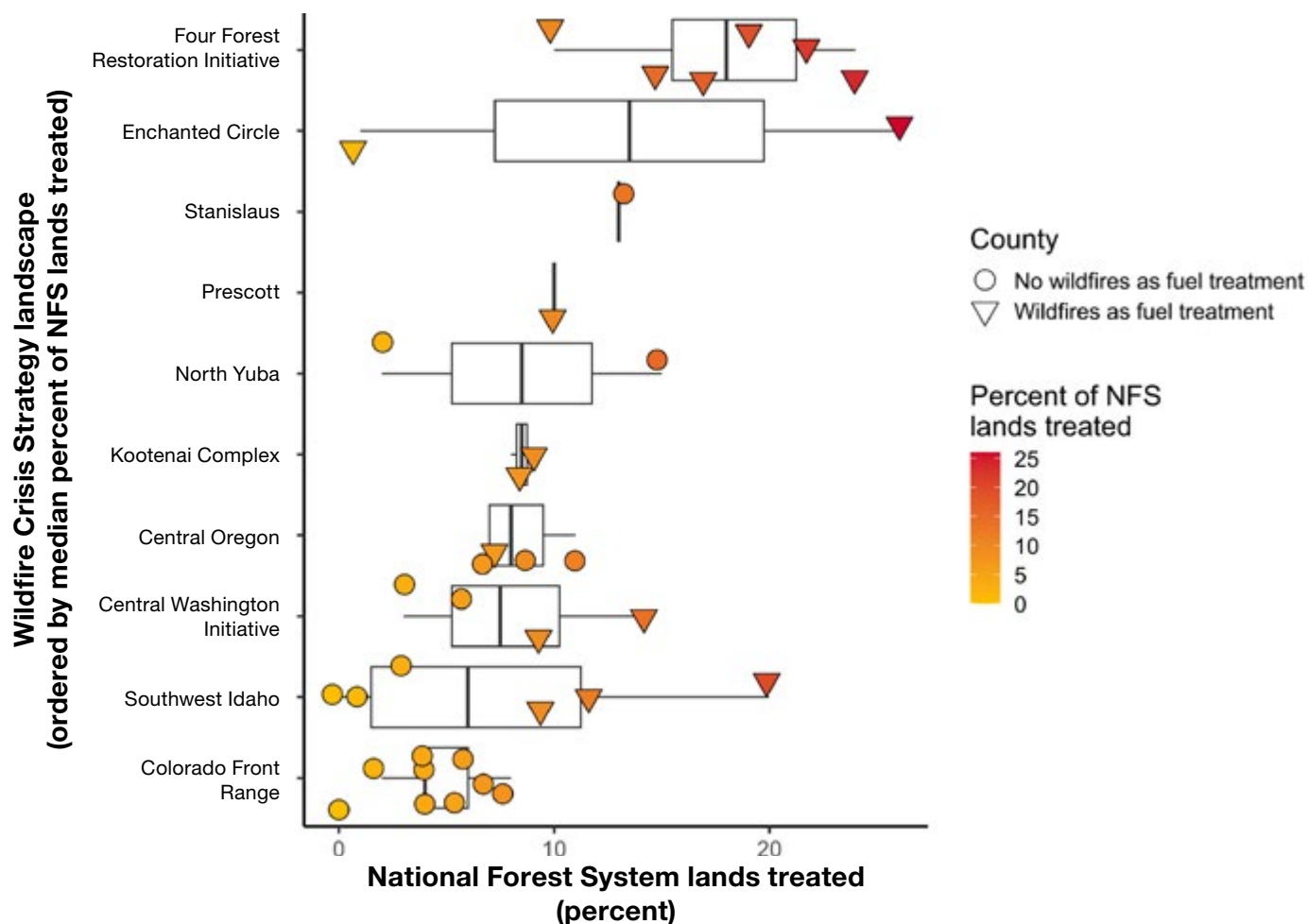


Figure 13.1—Fuel treatments in counties associated with each of the 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscapes (calculated as the percentage of National Forest System (NFS) lands on the landscape within a county with fuel treatments in the past decade, including fuel reduction by wildfire where recorded). Note: Four counties have no NFS land and are not shown (three on the Colorado Front Range landscape and one on the Central Washington Initiative landscape). Yavapai County, Arizona, overlaps both the Four Forest Restoration Initiative and Prescott landscapes.

These estimates are only one metric for hazardous fuels treatment and should not be interpreted broadly to represent the effect these fuel treatments may have had for risk reduction. Our measurement of the proportion of the landscape treated does not account for many factors that affect if and how fuel treatments can be implemented, such as wildfires that may have occurred (beyond those included as hazardous fuels reduction in the FACTS data), ecological conditions, relative wildfire risk, the relative cost of treatments on rugged or difficult-to-access terrain, and past investment in landscape-level collaboratives and risk reduction, among others. These metrics also do not account for the role of fuel treatments in particular areas for addressing wildfire risk to human communities and thus, that some treated acres may be of substantially greater effect than others. For these reasons and others, target levels for fuel treatment may vary substantially from place to place. Moreover, fuel treatments require maintenance for the long term, although our analysis focuses on the total area treated and does not reflect the extent of re-treatment of the same acreage. We acknowledge that WCS implementation and research teams are actively working on performance measures and metrics that go beyond acres of fuel treatments to include a better understanding of what risk-reduction outcomes are being achieved and where (Dillon 2020).

WUI Plans and Regulations

We divided the 40 counties in the 10 initial WCS landscapes by Fire and Land Use Planning Evaluation Tool (FLUPE) category. Of the counties that have taken more actions using WUI planning or regulatory tools to reduce wildfire risk, 7 (18 percent) were in the comprehensive category, and 17 (43 percent) were in the consolidating category. Of those with less investment in such efforts, 12 (30 percent) were in the emerging category, and 4 (10 percent) were in the initializing category (fig. 13.2).

Given the range of county sizes and populations as well as land-use planning efforts, we did not average or combine FLUPE scores across counties, but we examined the range of

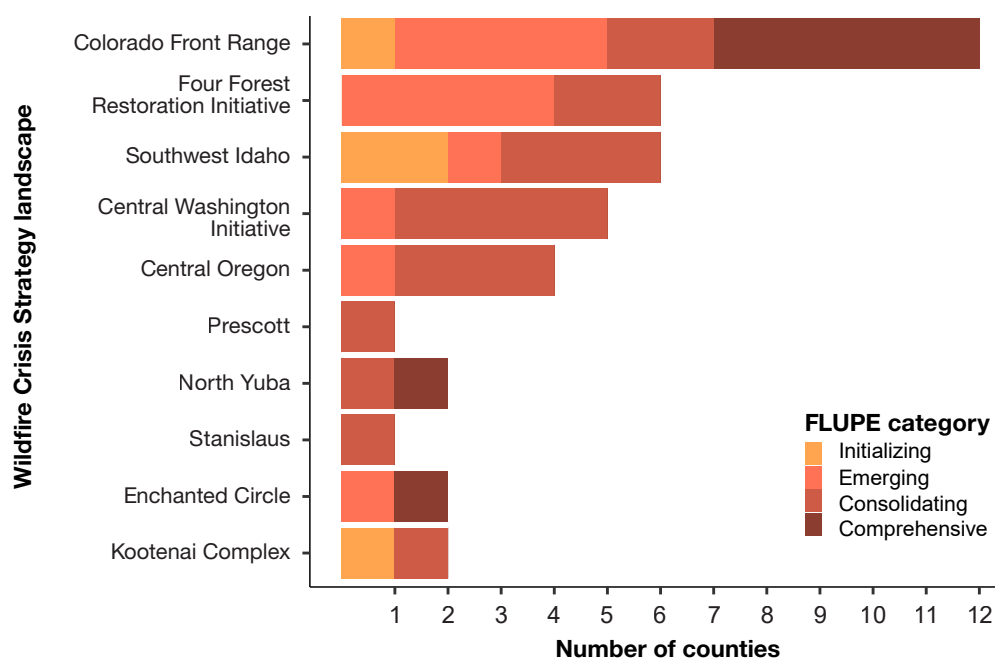


Figure 13.2—Number of counties associated with each U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscape (by population size) in each Fire and Land Use Planning Evaluation Tool (FLUPE) category. Note: Yavapai County, Arizona, is included in both the Four Forest Restoration Initiative and Prescott landscapes.

county-level categories within each landscape. Similar to the fuel treatments, most of the landscapes with more than one county had a range of FLUPE categories. In the Four Forest Restoration Initiative, Central Oregon, and Central Washington Initiative landscapes, counties ranged in the middle categories of emerging and consolidating scores. The Colorado Front Range and Southwest Idaho landscapes had more variation (all four categories were found in Colorado Front Range counties and all but comprehensive in Southwest Idaho counties). In cases where landscapes had only two counties, they could still be quite different (e.g., Kootenai Complex and Enchanted Circle); across these cases, the more populous county of the pair consistently scored higher.

The range of county scores highlights places with the most investment in land-use planning and regulations as an adaptation for wildfire (comprehensive), which included some counties that are frequently cited as leaders in this approach (e.g., Boulder and Larimer Counties in the Colorado Front Range landscape). Notably, some smaller and more rural counties have also made major planning and regulatory efforts, such as Taos County, New Mexico, and Jefferson County, Oregon. Similarly, those with less investment in land-use planning and regulations for wildfire (initializing) included both rural counties, such as those in the Southwest Idaho and Kootenai Complex landscapes, and highly urbanized areas, such as Denver County.

FLUPE scores also reflect a range of potential activities within each category, which we further examined to determine the types of efforts most used in these WCS landscapes. Across all counties, the most common planning and regulatory efforts were to map wildfire hazard or risk or prepare plans that support wildfire-risk reduction activities. Nearly all—38 of 40 counties (95 percent)—had a wildfire risk or WUI map, and 29 of 40 counties (72.5 percent) had multiple references to wildfire topics in their comprehensive plan/general plan (with another 8 counties, or 20 percent, having limited references to wildfire). Nearly all counties had a community wildfire protection plan (CWPP) or local hazard mitigation plan (LHMP) of some age, and no county lacked both.

The prevalence of comprehensive plan/general plan policies and adoption of LHMPs can likely be attributed to several factors. As previously noted, LHMPs are a requirement for federal funding eligibility, which incentivizes counties to adopt them and update them every 5 years. State laws may also require counties to adopt a comprehensive plan, a general plan, or both, which may include requirements to address hazards. In addition, these policies and plans can be politically easier to adopt than codes or regulations because the latter requires systems or processes (and resources) for their enforcement. For a more detailed discussion of the range of policy and planning tools for the WUI, refer to appendix 1.

Although many counties have plans, they vary in year of adoption or last update. Of the 37 counties where wildfire was incorporated into comprehensive plans, general plans, or both, 28 had updated their comprehensive plan, general plan, or both in the past decade. Of the 37 counties with LHMPs, 33 had updated their LHMP within the past 5 years. Of the 35 counties with CWPPs, 8 had updated their CWPP within the past 5 years, 14 had updated their CWPP more than 5 years ago but within the past decade, and 13 had a CWPP older than a decade.

Plans also varied in the approaches taken to risk reduction. One potential approach that CWPPs and LHMPs can take is to integrate or promote other mitigation strategies related to land use, including regulations or codes. Of the 35 counties with CWPPs, only 14 had multiple references and actions included for mitigation strategies related to land use

(advocating for adoption of codes), while 13 counties had limited references to land-use plans and codes, and 8 counties had CWPPs but did not refer to land-use strategies for risk reduction. Similarly, of the 37 counties with LHMPs, 14 had multiple references and actions included for mitigation strategies related to land use, while 19 had limited references to land-use plans and codes, and 4 had LHMPs but did not refer to land-use planning efforts to reduce risk. This may reflect that land-use strategies are not as common as other mitigation strategies to address wildfire, or it may also reflect that in some cases, this approach may not be relevant if robust codes are already in place.

CWPPs can be variable in their contents and recommendations. Possible reasons for this variation include the following: CWPPs are voluntary planning instruments (although required for specific funding programs); minimum requirements by the Healthy Forests Restoration Act (2003) are broad and leave much open for local customization; and inclusion or exclusion of land-use planning activities as a wildfire-risk reduction strategy in a CWPP may reflect the authors' knowledge and expertise of plans, codes, and ordinances more than the importance of these tools as a potential adaptation.

Wildfire hazard, risk, and WUI maps were the most widespread adaptation tools, with 38 counties having adopted a local wildfire hazard, risk, and WUI map, or referencing a state map in local documents. The degree to which these maps are used to inform land-use planning decisions varies, however. Fifteen counties had a clear linkage between one or more wildfire maps and land-use plans, such as using the wildfire hazard or risk map to inform future growth and development decisions within their comprehensive plan. Another 11 counties had limited connections between maps and land-use plans, while 12 counties did not have any such connections or references.

The least common planning and regulatory effort undertaken by counties was the adoption of WUI regulations. Comprehensive regulations focused on WUI building construction regulations, such as a requirement for ignition-resistant construction materials for new development, were present in 12 of 40 counties, with another 5 counties having limited building construction regulations in place. Comprehensive regulations focused on vegetation management around homes and buildings were present in 14 of 40 counties, with another 8 counties having limited regulations focused on vegetation. Subdivision regulations may address wildfire through fire protection considerations (e.g., water supply and emergency access), consider vegetation management and maintenance, or alter the siting and location of new housing units away from hazardous terrain. Of the 40 counties, 14 had comprehensive subdivision regulations to reduce wildfire risk, while another 9 counties had limited subdivision regulations focused on wildfire risk. Considering all three main categories (vegetation management, subdivision, building construction), 7 of 40 counties had comprehensive regulations in all three categories, while 13 had no regulations at all.

Understanding the effective degree of risk reduction achieved through these codes is beyond the scope of a FLUPE analysis because it would require a detailed understanding of where they apply (and when; codes typically affect only housing built after enactment). However, for those counties that had adopted WUI regulations, the FLUPE analysis revealed there is no single approach to which regulations are adopted. Different regulatory tools can be used to achieve similar results. For example, either a WUI code or subdivision regulations can be used to address access and water supply requirements for fire protection in wildland areas.

Notably, communities may also follow different paths in adopting policies and regulations. In many cases, the development of wildfire- or WUI-related policies in a comprehensive plan or general plan is a first step that lays the groundwork for the adoption of regulations. However, some counties show this is not necessarily an essential path. For example, Douglas County, Washington, does not mention wildfire in its comprehensive plan, but it has adopted the state's optional WUI code. Similarly, Klamath County, Oregon, has adopted regulations that address multiple WUI features, but its CWPP and LHMP have limited, if any, discussion of the significance of land use as a wildfire mitigation strategy.

FLUPE scores should be interpreted as fluid and subject to change because they reflect a specific moment of assessment in the context of ongoing processes of planning and regulation. At the time of our analysis, some counties were actively moving in the direction of more adaptations (e.g., those counties with CWPP updates in progress, such as Tuolumne County, California, or Boulder County, Colorado). State-level requirements or guidance may also change and influence the work undertaken by counties. At present, only California has a robust framework that requires local jurisdictions to adopt policies and regulations to reduce wildfire risk. However, several other Western states, including Oregon, Washington, and Colorado, have enacted state-level legislation that may shape jurisdictional approaches to land-use planning in the WUI.

Furthermore, the FLUPE analysis reflects information found in documentation available online; as such, it does not necessarily reveal if or how written plans and regulations are being implemented or enforced. Finally, in limited cases, some counties had dated materials (e.g., more than 20 years old) available online, and the quality of the documents made it difficult to search for the presence of keywords such as WUI, wildfire, and land use.

Synthesis

The WCS landscapes (and counties associated with each landscape) exhibit a range of socioeconomic conditions, trends in WUI growth, adoption of WUI planning and regulatory tools (i.e., FLUPE scores), and the level of fuel treatments conducted by the Forest Service. Although this stage of our analysis does not focus on **why** these investments may differ, we are able to examine the current combinations of select adaptations (i.e., fuel treatments and WUI planning and regulatory tools) to reveal potential patterns. These patterns offer insight into the possible relationships and dynamics between these interwoven efforts and will help inform future research, including potential drivers behind adaptation investments.

Figure 13.3 compares fuel treatments (both inclusive and exclusive of wildfire) against FLUPE scores at the county level. The size of the symbol for each county represents the number of WUI housing units in that county, which ranged from fewer than 2,000 (in Sierra County, California, and Adams County, Idaho) to more than 150,000 (El Paso County, Colorado), with a median of about 18,000. The number of WUI housing units is associated with both higher populations and higher per capita incomes overall. We note that counties with higher numbers of WUI housing are typically found at the higher end of the range of fuel treatments (i.e., greater than 10 percent of area treated), have more comprehensive land-use planning and regulations (FLUPE scores in consolidating and comprehensive categories), or both. For example, most of the Four Forest Restoration Initiative counties have a higher proportion of fuels treated (but lower FLUPE scores, except Coconino County), and the Colorado Front Range landscape counties have greater investments in land-use planning and regulations (but a lower proportion of fuels treated). A few counties have major

investments in both categories. Many of these are also counties with higher numbers of WUI homes, such as Deschutes County, Oregon (Central Oregon landscape), Coconino County, Arizona (Four Forest Restoration Initiative landscape), and Tuolumne County, California (Stanislaus landscape).

In contrast, counties with lower numbers of WUI homes (smaller plot points in fig. 13.3, which also tend to be lower in population in general) exhibited a wide range of combinations of FLUPE scores and fuel treatments. Several of these less populated and smaller counties have lower levels of investment in both dimensions of wildfire adaptation (lower left corner of fig. 13.3, where counties with higher numbers of WUI homes are notably absent). However, other counties with lower numbers of WUI homes demonstrate high levels of adaptation in one or both dimensions, such as Taos County, New Mexico, (highest of all

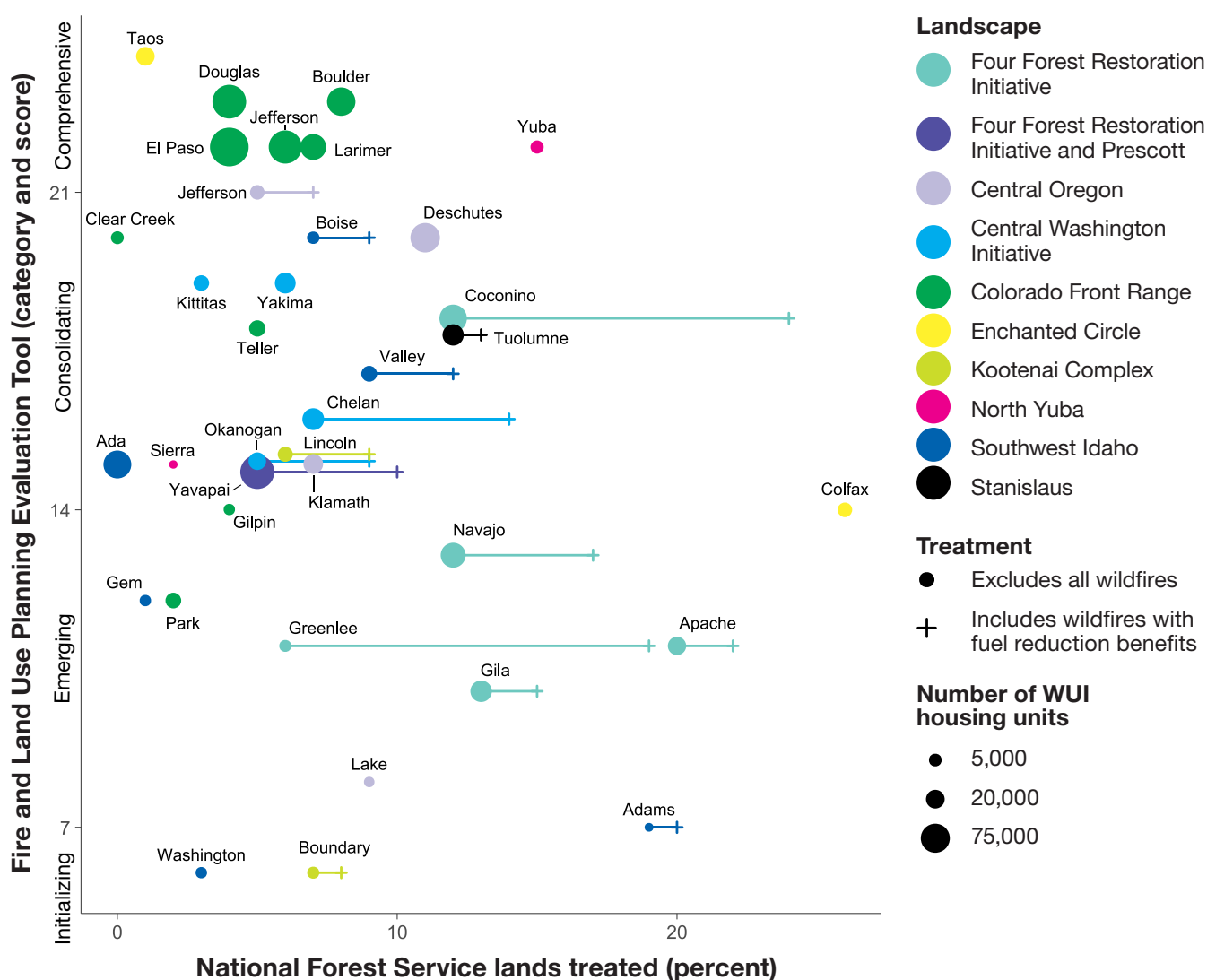


Figure 13.3—Fuel treatments on National Forest System lands (fiscal years 2014 through 2023) and Fire and Land Use Planning Evaluation Tool (FLUPE) categories and scores by county (plot points are scaled to county wildland-urban interface [WUI] housing quantities) associated with all 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy landscapes. Note: Initializing FLUPE scores (0–7) indicate the initial stage of WUI planning adaptation tool use; emerging (8–14) indicates becoming more adapted to tool use; consolidating (15–21) indicates combining several tool uses; and comprehensive (22–28) indicates near complete or complete use of tools. See table 2.2 for a full description of FLUPE score categories.

FLUPE scores); Colfax County, New Mexico, (highest of all percentages of fuel treatments); and Yuba County, California, (high on both dimensions); this demonstrates that the extent of WUI housing does not clearly associate with or predict the overall investment in these adaptation efforts.

Although many of the larger landscapes included counties with substantial variation in both FLUPE scores and treatment areas, at least two of our landscapes displayed similarities in the county patterns—the Colorado Front Range landscape tended to be grouped in higher investment in land-use planning but less fuels treatment work, while the Four Forest Restoration Initiative landscape tended to be grouped with more fuel treatment and lower investment in land-use planning and regulation, with the exception of Coconino County.

Figure 13.3 also shows which counties have had a substantial amount of wildfire contribute to fuel treatment total areas (represented by the connected + symbol to the right of their plot points). This is particularly the case in the counties associated with the Four Forest Restoration Initiative landscape, as well as some counties in the Central Washington Initiative and Southwest Idaho landscapes. The role of wildfire in advancing hazardous fuel reduction objectives, and thereby potentially reducing future wildfire risk to communities, is notable on these landscapes. This illustrates how living with wildfire can include recognizing the potential contribution of wildfires with risk reduction benefits, alongside prescribed fire and other forms of fuel treatment.

One possible explanation for why regulatory and land-use planning adaptation efforts are receiving more emphasis in some places than others is that places with higher population and housing densities (i.e., more urbanized areas) typically have a more comprehensive approach toward land-use planning to avoid land-use conflicts in general. As a result, many of these urbanized areas may be less averse to including WUI policies and regulations as part of their overall approach to land management and may have greater resources available with which to implement wildfire adaptation efforts (Mockrin et al. 2020). In some cases, adoption of adaptations such as WUI regulations may also be driven by state-level regulations. WUI codes and other regulatory adaptations may also occur at the municipal scale rather than the county scale, which was outside the scope of our analysis.

In summary, the WCS landscapes span a wide range of social contexts and exhibit a wide range of adaptation efforts. Levels of investment in the key adaptation techniques that we examined here (fuel treatments and planning and regulatory efforts) vary substantially across landscapes and counties and were not clearly associated with one another, although patterns in these investments did appear to be related to some extent to patterns in land use and WUI development. Further research might consider how these different approaches to wildfire risk reduction are interacting and prioritized by local communities and forest managers to better understand different pathways to wildfire risk reduction. Against the backdrop of changing climate and wildfire regimes, collaboration across actors and different types of risk reduction are increasingly recognized as critical for forests and communities alike.

Next Stages of Research

More indepth research with practitioners and managers in these landscapes is needed to better understand the range of local conditions and dynamics and examine the relationships that human population and development patterns and other social characteristics may have with wildfire adaptation efforts. Additional research is also needed to examine how county- and Forest Service-level investments are combining (in conjunction with other actors and efforts) to reduce wildfire risk. Given that the Forest Service intends to continue its investment in fuel treatments via the WCS over the next 10 years, relationships between local adaptations and federal investments on public land will continue to evolve.

This research aims to provide a baseline to ground future research examining wildfire adaptation in and beyond the WCS landscapes. For example, our analysis did not examine the spatial relationships between NFS lands and WUI areas within counties nor the geography of fuel treatments conducted by the Forest Service; our analysis also did not include fuel treatment work by other land managers outside of national forest boundaries. We also did not directly examine the relationship between wildfire history (e.g., large and destructive recent fires) and adaptation efforts, including fuel treatment and land-use planning and regulation. Finally, we did not undertake a comprehensive statistical analysis of correlations between existing land-use planning and regulations and social and economic variables (such as those presented here or others). These all represent important dimensions for future research and could contribute to a deeper understanding of how communities develop planning and regulatory responses to wildfire hazard, and how the Forest Service can best support and engage in such efforts through the Wildfire Crisis Strategy.

Future research that our team plans to conduct includes visits and interviews at select WCS landscape sites to better understand local approaches to WUI planning and regulatory tools, as well as how Forest Service investment (via the Wildfire Crisis Strategy) relates to other forms of wildfire adaptation. Topics of site visits and interviews with county-level planners and managers will include the drivers behind the WUI planning tools in use, approaches to enforcement of plans and regulations, and challenges and lessons learned from current or previous adaptation efforts. Complementary interviews with actors across a range of institutional settings (including Forest Service and other federal managers, state managers, nongovernmental organization personnel, and community organizations) will further examine the diverse range of wildfire adaptation efforts across these landscapes. This combined work will examine perceptions of how different approaches to wildfire adaptation complement one another across jurisdictions and scales. We expect this research to offer insights into the following:

- The relationship between WUI planning and coordinated planning for growth/development in urbanizing areas
- The role of changing state-level legislation as a driver of county-scale adaptation
- Interactions between local, county, state, and federal efforts to adapt to changing wildfire conditions, among other factors

A key objective of our research is to further explore the relationships between the presence and enforcement of WUI planning as a critical dimension of wildfire adaptation and the ongoing investment in landscape-scale fuel management activities derived from the WCS.

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Metric Equivalents

When you know:	Multiply by:	To find:
Miles	1.609	Kilometers
Acres	0.405	Hectares

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APPENDIX 1

Wildland-Urban Interface Planning Tools and Regulations Used for Fire Adaptation**Table A1.1—Wildland-urban interface (WUI) planning tools and regulations**

Tool	Description	Required or voluntary	Potential use for fire adaptation
Community wildfire protection plan	Identifies wildfire hazard, wildfire risk, and the WUI within a defined planning area as well as actions to reduce hazardous fuels and structural ignitability.	Voluntary; if adopted, plan must meet minimum requirements established by the Healthy Forests Restoration Act of 2003 and may be required to meet additional state or federal criteria for program/funding eligibility.	Provides a collaborative opportunity to develop detailed information on how wildfire hazard is being managed and addressed; actions typically span multiple topics of the fire adapted communities wheel, including landscape treatments, resident mitigation, prevention, regulations and policies, response, and others. Actions can reinforce and implement land use goals, policies, and objectives.
Comprehensive plan; also known as a general plan, growth policy, or master plan	Adopted by a local jurisdiction; sets forth a long-term vision for community growth based on local priorities and state/local requirements.	Required by many states/jurisdictions within WCS landscapes; specific requirements to address wildfire hazard vary.	Provides opportunities for communities to integrate wildfire hazard and WUI information into a broader planning process to inform goals, policies, and objectives related to public safety, housing, environment and natural resources, and other topics. Actions can be aligned with other plans to reference data and incorporate findings.
Local hazard mitigation plan; also known as a multijurisdictional hazard mitigation plan	Identifies hazards within an area; assesses risks to people, property, and other values; and provides goals and a long-term mitigation strategy to avoid or minimize effects.	Voluntary plan; if adopted, plan must meet certain requirements for eligibility to receive Federal Emergency Management Agency mitigation project assistance, as established by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (and amended by the Disaster Mitigation Act of 2000).	Provides information about if and how wildfire is identified and assessed at the local level; actions typically span multiple topics of the fire adapted communities wheel, including landscape treatments, resident mitigation, prevention, regulations and policies, response, and others. Actions can also reinforce and implement land use goals, policies, and objectives and align with planning for other/multiple hazards.
Building code	Establishes requirements for the construction and design of buildings to ensure structural integrity, safe exits, adequate ventilation, and lighting.	Required in many states/jurisdictions within WCS landscapes; specific requirements to address wildfire hazard vary.	May include additional requirements for the protection of life and property in WUI areas to reduce exposure from wildfire and prevent structure fires from spreading to wildlands, such as requirements for roofs, siding, exterior openings, and decks and other attachments.
Fire code	Code that establishes requirements for providing a reasonable level of life safety and property protection from the hazards of fire, explosion, panic, or dangerous conditions in new buildings and structures and a reasonable level of safety to firefighters and emergency responders during emergency operations.	Required in many states/jurisdictions on WCS landscapes; specific requirements to address wildfire hazard vary.	May include additional requirements for the protection of life and property in WUI areas, such as requirements for secondary/emergency access, adequate water supply for fire protection, regulation of hazardous operations and storage, requirements for public nuisances that include weeds and hazardous vegetation or other combustible materials.

Tool	Description	Required or voluntary	Potential use for fire adaptation
WUI code	Identifies the WUI and regulates a number of associated building, fire protection, land uses, vegetation, and other features at the site and subdivision scales.	Some WUI code provisions are required in several states/ jurisdictions within WCS landscapes; requirements vary greatly.	May include a range of requirements for homes/properties, subdivisions, and other values in the WUI to reduce exposure to wildfire and prevent structure fires from spreading to wildlands, such as vegetation management, building requirements, and regulation of hazardous uses.
Subdivision regulation	Governs the subdivision of lands into developable lots, tracts, parcels, or divisions and associated design requirements (minimum number of lots, arrangement of streets, utilities, open spaces, water supplies, etc.).	Required in all states/ jurisdictions within WCS landscapes, as per state statute; specific requirements to address wildfire hazard vary.	May include potential requirements for fire protection (e.g., access, circulation, water supply, and critical infrastructure), hazardous vegetation removal and management, site location and lot arrangement, housing density, and other features that affect how future housing and residents are exposed to wildfire risk and can or must manage the risk.
Zoning code; also known as a zoning ordinance, development regulation, or land use code	Controls and regulates land use and development (allowable uses within established zoning districts, requirements for parking, landscaping, and other site development standards).	Required in many states/ jurisdictions within WCS landscapes, as per state statute; specific requirements to address wildfire hazard vary.	May include potential requirements for removal and management of hazardous vegetation, plants, and other landscaping, fencing, setbacks and lot sizes, and other features that affect how land uses, people, and property are exposed to wildfire risk and can or must manage the risk.

Source: Mowery et al. (2019).

APPENDIX 2

Sociodemographics and Landownership by County

Table A2.1 — Sociodemographics and landownership for counties associated with the 10 initial U.S. Department of Agriculture, Forest Service, Wildfire Crisis Strategy (WCS) landscapes, 2021

Color key: Comparison of value to the median value for all counties on this table

Landscape	State	County	Urbanization: OMB statistical area definition and major city associated	Population	Population change, 1970–2021	Per capita income ^a	Mobile homes ^b	PERCENT					Private lands ^d	Federal lands ^d
								110%	120%	130%	140%	150% or higher		
50% or lower	60%	70%	80%	90%	100%									
Four Forest Restoration Initiative	Arizona	Coconino	Metro: Flagstaff	145,052	194.9	61,467	14.0	53.0	27.5	14.6	12.9	13.3	39.1	
Four Forest Restoration Initiative	Arizona	Navajo	Micro: Show Low	108,147	124.2	45,014	19.9	41.3	46.9	11.8	18.2	18.0	9.5	
Four Forest Restoration Initiative	Arizona	Apache	None (rural)	65,623	99.6	49,325	23.3	17.7	73.0	6.8	15.4	12.4	9.9	
Four Forest Restoration Initiative	Arizona	Gila	Micro: Payson	53,589	81.3	52,652	20.6	61.1	18.9	19.2	28.8	3.5	57.6	
Four Forest Restoration Initiative	Arizona	Greenlee	None (rural)	9,404	-10.2	51,926	25.1	45.4	6.4	47.9	12.9	8.3	77.0	
Four Forest Restoration Initiative and Prescott	Arizona	Yavapai	Metro: Prescott Valley–Prescott	242,253	544.8	52,985	17.5	79.4	4.2	15.0	31.9	25.5	49.8	
Central Oregon	Oregon	Deschutes	Metro: Bend	204,801	563.2	73,163	5.9	85.3	3.2	8.3	20.5	22.2	75.4	
Central Oregon	Oregon	Klamath	Micro: Klamath Falls	70,164	39.4	51,894	13.8	75.2	8.6	13.9	21.4	41.2	57.3	
Central Oregon	Oregon	Jefferson	None (rural)	25,068	191.6	46,597	17.2	57.6	3.4	20.6	19.5	50.0	27.6	
Central Oregon	Oregon	Lake	None (rural)	8,276	29.9	50,831	15.2	82.2	6.8	9.2	25.4	24.8	73.1	
Central Washington Initiative	Washington	Yakima	Metro: Yakima	256,035	75.8	54,942	12.1	40.8	7.7	50.6	14.0	21.2	25.3	

Landscape	State	County	Urbanization: OMB statistical area definition and major city associated	Population	Population change, 1970–2021	Per capita income ^a	Mobile homes ^b	White (non- Hispanic and no other race) ^c	American Indian or Alaska Native (only or with two or more races) ^c	Hispanic or Latino (of any race) ^c	Age ≥ 65 ^c	Private lands ^d	Federal lands ^d
Central Washington Initiative	Washington	Chelan	Metro: Wenatchee	79,646	94.0	67,815	9.5	66.4	3.1	28.5	19.9	17.0	79.1
Central Washington Initiative	Washington	Kittitas	Micro: Ellensburg	45,499	81.0	54,942	6.5	80.6	3.7	9.3	16.8	30.3	44.5
Central Washington Initiative	Washington	Douglas	Metro: Wenatchee	43,696	159.4	53,234	16.1	61.2	2.3	32.6	17.8	84.2	4.6
Central Washington Initiative	Washington	Okanogan	None (rural)	42,634	64.6	54,558	17.6	62.7	15.2	20.8	22.4	22.9	46.4
Colorado Front Range	Colorado	El Paso	Metro: Colorado Springs	737,867	209.8	63,317	2.7	67.7	3.8	17.9	12.9	70.2	15.1
Colorado Front Range	Colorado	Denver	Metro: Denver-Aurora-Lakewood	711,463	38.0	107,064	0.4	54.0	3.5	29.4	11.7	94.3	0.0
Colorado Front Range	Colorado	Arapahoe	Metro: Denver-Aurora-Lakewood	654,900	300.1	80,208	0.8	58.5	3.2	19.9	13.2	87.9	1.7
Colorado Front Range	Colorado	Jefferson	Metro: Denver-Aurora-Lakewood	579,581	143.7	80,808	0.9	77.0	17.1	15.7	16.5	58.4	22.6
Colorado Front Range	Colorado	Douglas	Metro: Denver-Aurora-Lakewood	368,990	4176.2	94,868	0.3	80.3	4.1	9.2	12.3	63.9	26.9
Colorado Front Range	Colorado	Larimer	Metro: Fort Collins	362,533	298.0	69,399	3.4	81.3	3.0	12.0	15.8	40.9	48.4
Colorado Front Range	Colorado	Boulder	Metro: Boulder	329,543	147.1	96,760	2.4	76.7	2.4	14.0	14.7	42.1	35.5
Colorado Front Range	Colorado	Fremont	Micro: Cañon City	49,661	124.5	44,299	12.7	78.3	4.4	13.6	21.5	46.5	46.6
Colorado Front Range	Colorado	Teller	Metro: Colorado Springs	24,926	634.4	66,923	6.5	85.7	3.7	7.4	22.4	51.3	43.2
Colorado Front Range	Colorado	Park	Metro: Denver-Aurora-Lakewood	17,720	695.0	61,697	4.8	88.0	3.7	6.6	21.1	41.3	50.8

				Urbanization: OMB statistical area definition and major city associated	Population	Population change, 1970–2021	Per capita income ^a	Mobile homes ^b	White (non- Hispanic and no other race) ^c	American Indian or Alaska Native (only or with two or more races) ^c	Hispanic or Latino (of any race) ^c	Age ≥ 65 ^c	Private lands ^d	Federal lands ^d	
Landscape	State	County			COUNT	PERCENT	DOLLARS		PERCENT						
Colorado Front Range	Colorado	Clear Creek	Metro: Denver- Aurora- Lakewood		9,446	89.8	83,421	5.0	87.1	3.2	7.5	20.7	26.7	68.9	
Colorado Front Range	Colorado	Gilpin	Metro: Denver- Aurora- Lakewood		5,873	352.5	69,089	0.7	85.4	4.0	9.8	17.3	45.3	44.6	
Enchanted Circle	New Mexico	Taos	Micro: Taos		34,623	96.0	48,286	15.2	35.4	9.5	56.8	26.8	31.8	55.0	
Enchanted Circle	New Mexico	Colfax	None (rural)		12,369	1.9	51,368	20.3	46.3	4.5	49.5	27.2	85.4	3.2	
Kootenai	Montana	Lincoln	None (rural)		20,525	13.6	47,284	14.5	91.3	4.1	3.4	29.0	22.5	74.5	
Kootenai	Idaho	Boundary	None (rural)		12,561	127.4	47,736	9.5	88.8	3.8	5.3	22.6	25.7	60.7	
North Yuba	California	Yuba	Metro: Yuba City		83,421	85.5	52,903	7.5	52.6	6.6	29.5	12.5	75.3	16.9	
North Yuba	California	Sierra	None (rural)		3,283	37.3	50,906	5.0	87.4	4.8	11.2	27.8	27.4	69.8	
Southwest Idaho	Idaho	Ada	Metro: Boise City		511,931	353.0	67,619	3.3	83.4	2.7	8.7	14.7	49.9	42.7	
Southwest Idaho	Idaho	Gem	Metro: Boise City		19,792	109.2	49,077	11.9	84.7	3.7	8.8	21.5	57.6	36.9	
Southwest Idaho	Idaho	Valley	None (rural)		12,241	237.8	62,527	8.2	94.0	2.8	4.8	27.3	11.2	86.0	
Southwest Idaho	Idaho	Washington	None (rural)		10,898	41.5	44,408	15.4	78.2	3.7	16.9	25.2	55.7	36.6	
Southwest Idaho	Idaho	Boise	Metro: Boise City		8,094	347.4	57,454	15.8	88.3	3.7	5.2	26.1	19.6	73.2	
Southwest Idaho	Idaho	Adams	None (rural)		4,625	60.6	47,802	10.0	90.9	3.6	4.1	29.8	31.4	64.0	
Stanislaus	California	Tuolumne	Micro: Sonora		55,810	149.6	56,490	10.8	79.1	5.5	12.9	26.2	24.6	74.8	
Median value of counties included in this table					47,580	124.4	54,750	10.4	78.3	3.9	13.3	20.6	31.6	45.5	

OMB = Office of Management and Budget

^aIn 2022 U.S. dollars.

^bPercentage of total occupied housing units.

^cPercentage of total population. These categories are combined in U.S. Census data. For the American Indian/Alaska Native column, these numbers likely primarily reflect American Indian populations.

^dPercentage of total area.

APPENDIX 3

Forest Activity Tracking System (FACTS) Codes Used in Fuel Treatments Analysis

Table A3.1—Forest Activity Tracking System (FACTS) codes used in fuel treatments analysis

Code	Treatment type	Total area included in FACTS data, all WCS landscapes, fiscal years 2014 through 2023	Category
		ACRES	
1111	Broadcast burning	456,179	Prescribed fire
1113	Underburn	147,649	Prescribed fire
6101	Wildlife habitat prescribed fire	11,936	Prescribed fire
1112	Jackpot burning	8,298	Prescribed fire
4541	Control of understory vegetation—burning	2,045	Prescribed fire
4471	Site preparation for planting—burning	927	Prescribed fire
4491	Site preparation for natural regeneration—burning	781	Prescribed fire
4220	Commercial thin	141,879	Commercial sale
4152	Group selection cut	25,995	Commercial sale
4151	Single-tree selection cut	14,210	Commercial sale
4210	Improvement cut	10,300	Commercial sale
4117	Stand clearcut (with leave trees)	4,899	Commercial sale
4183	Two-aged seed-tree seed and removal cut (with residual)	3,899	Commercial sale
4132	Seed-tree seed cut (with and without leave trees)	1,960	Commercial sale
4143	Overstory removal cut (from advanced regeneration)	1,830	Commercial sale
4193	Two-aged shelterwood establishment and removal cut (with residual)	1,237	Commercial sale
4111	Patch clearcut	711	Commercial sale
4113	Stand clearcut	634	Commercial sale
4145	Shelterwood removal cut (with leave trees)	567	Commercial sale
4142	Seed-tree final cut	185	Commercial sale
4521	Precommercial thin	202,961	Other fuels treatment
1130	Burning of piled material	193,505	Other fuels treatment
1153	Piling of fuels, hand or machine	115,300	Other fuels treatment
1150	Rearrangement of fuels	83,977	Other fuels treatment
1160	Thinning for hazardous fuels reduction	65,732	Other fuels treatment
4511	Tree release and weed	60,206	Other fuels treatment
1120	Yarding—removal of fuels by carrying or dragging	44,634	Other fuels treatment
1136	Pruning to raise canopy height and discourage crown fire	41,645	Other fuels treatment
1152	Compacting/crushing of fuels	38,275	Other fuels treatment
1154	Chipping of fuels	22,957	Other fuels treatment
2341	Range cover manipulation	22,733	Other fuels treatment
2360	Range control vegetation	16,741	Other fuels treatment

Code	Treatment type	Total area included in FACTS data, all WCS landscapes, fiscal years 2014 through 2023	Category
		ACRES	
4231	Salvage cut (intermediate treatment, not regeneration)	14,819	Other fuels treatment
4495	Site preparation for natural regeneration—manual	10,185	Other fuels treatment
2510	Invasives—pesticide application	9,696	Other fuels treatment
4530	Prune	5,639	Other fuels treatment
1180	Fuel break	2,869	Other fuels treatment
4232	Sanitation cut	2,272	Other fuels treatment
6107	Wildlife habitat mechanical treatment	1,375	Other fuels treatment
3132	Recreation removal of hazard trees and snags—area	1,319	Other fuels treatment
4242	Harvest without restocking	1,305	Other fuels treatment
6133	Wildlife habitat slash treatment	1,265	Other fuels treatment
4540	Control of understory vegetation	1,261	Other fuels treatment
4494	Site preparation for natural regeneration—mechanical	961	Other fuels treatment
4474	Site preparation for planting—mechanical	943	Other fuels treatment
4177	Two-aged stand clearcut (with restocking)	896	Other fuels treatment
4475	Site preparation for planting—manual	823	Other fuels treatment
4131	Shelterwood establishment cut (with or without leave trees)	609	Other fuels treatment
4241	Special products removal	600	Other fuels treatment
4146	Seed-tree removal cut (with leave trees)	543	Other fuels treatment
4270	Permanent land clearing	398	Other fuels treatment
3370	Precommercial thinning for visual	304	Other fuels treatment
4115	Patch clearcut (with leave trees)	174	Other fuels treatment
4196	Two-aged shelterwood final removal cut (with residual)	150	Other fuels treatment
4473	Site preparation for planting—other	148	Other fuels treatment
2530	Invasives—mechanical/physical	125	Other fuels treatment
4493	Site preparation for natural regeneration—other	120	Other fuels treatment
4455	Slashing—presite preparation	83	Other fuels treatment
6103	Wildlife habitat precommercial thinning	79	Other fuels treatment
4194	Two-aged shelterwood establishment cut (with residual)	73	Other fuels treatment
4211	Liberation cut	33	Other fuels treatment
4121	Shelterwood preparatory cut	17	Other fuels treatment
4192	Two-aged preparatory cut (with residual)	15	Other fuels treatment
9008	Road maintenance—vegetation reduction	15	Other fuels treatment
4102	Coppice cut (with leave trees)	14	Other fuels treatment
1117	Wildfire—natural ignition	554,319	Wildfire
1119	Planned treatment burned in wildfire	147,413	Wildfire

Notes: Definitions of treatment types are available in USDA FS (2024b). Acres of multiple treatment types may overlap.

Source: USDA FS (n.d.b).

APPENDIX 4

List of Acronyms

4FRI	Four Forest Restoration Initiative
CWPP	Community wildfire protection plan
FACTS	Forest Activity Tracking System
FLUPE	Fire and Land Use Planning Evaluation Tool
LHMP	Local hazard mitigation plan
NFS	National Forest System
USDA	United States Department of Agriculture
WCS	Wildfire Crisis Strategy
WUI	Wildland-urban interface

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