
2017 ADAPTATION FORUM WORKSHOPS: FOUR CORNERS AND UPPER RIO GRANDE GEOGRAPHIC FOCUS AREAS

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The following report summarizes the results of the 2017 Adaptation Forums held in Durango, CO, and Taos, NM. This workshop was held as part of an effort to assess vulnerability of focal resources within Southern Rockies Landscape Conservation Cooperative. This work was supported by agreements between Rocky Mountain Research Station (RMRS) and the Southern Rockies Landscape Conservation Cooperative (SRLCC: FWS #15-IA-011221632-164 and BOR #15-IA-11221632-163).

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Abbreviations

SRLCC= Southern Rockies Landscape Conservation Cooperative

RMRS= Rocky Mountain Research Station

BLM=Bureau of Land Management

FWS= Fish and Wildlife Service

BOR= Bureau of Reclamation

LCD= Landscape Conservation Design

CPA= Conservation Planning Atlas

PJ =Pinyon- Juniper

FC= Four Corners

URG= Upper Rio Grande

Introduction

Background

Southern Rockies Landscape Conservation Cooperative (SRLCC) partners and staff identified three geographic areas for developing Landscape Conservation Designs (LCD): Green River Basin, Four Corners, and Upper Rio Grande (Figure 1). The Green River Basin became the focus of its own LCD (see https://southernrockieslcc.org/geographical_area/green-river-basin). Vulnerability assessments and Adaptation Forum Workshops were developed for the Four Corners and Upper Rio Grande areas to gather information to support future landscape conservation designs. Vulnerability assessments initially targeted 5 SRLCC focal resources: Cultural Resources, Elk/Mule Deer, Sagebrush Ecosystems, Native Fish and Streamflow. Information about these focal resources and the process of selecting them can be found on the SRLCC website: <http://southernrockies.org>. Discussion and feedback given during Adaptation Forums held in 2016 within each focal area refocused the assessment targets to include Elk/Mule Deer, Sagebrush Ecosystems, Pinyon Juniper Woodlands, Coldwater Fish and Riparian Corridors.

In 2017, the SRLCC hosted a second round of Adaptation Forum workshops for the Four Corners (August 28-29th in Durango, CO) and the Upper Rio Grande (September 6-7, in Taos, NM). During each workshop, participants broke into one of four groups: Elk/Mule Deer, Pinyon Juniper, Cold Water Fish and Riparian Corridors. Because the distribution of sagebrush and sagebrush obligate species is limited in the region of interests, resource experts in both focal areas indicated that sagebrush steppe is not a priority (Adaptation Forum Report 2016). The goals of the workshops were to:

1. To review assessment inputs and results; become familiar with the data and format; identify strengths and needs of analysis.
2. Provide feedback and guidance on vulnerability analyses the SRLCC should undertake to help inform LCDs, vulnerability assessments, and future adaptation strategies.
3. Deliver relevant science and information from recent and ongoing science projects supported by the SRLCC and its partners.

At each workshop, participants engaged a variety of exercises to increase user familiarity with several vulnerability assessment products and set the stage to collaboratively develop conservation strategies. This report presents the results of these efforts by providing workshop notes, materials, flip chart activities and report out tables.

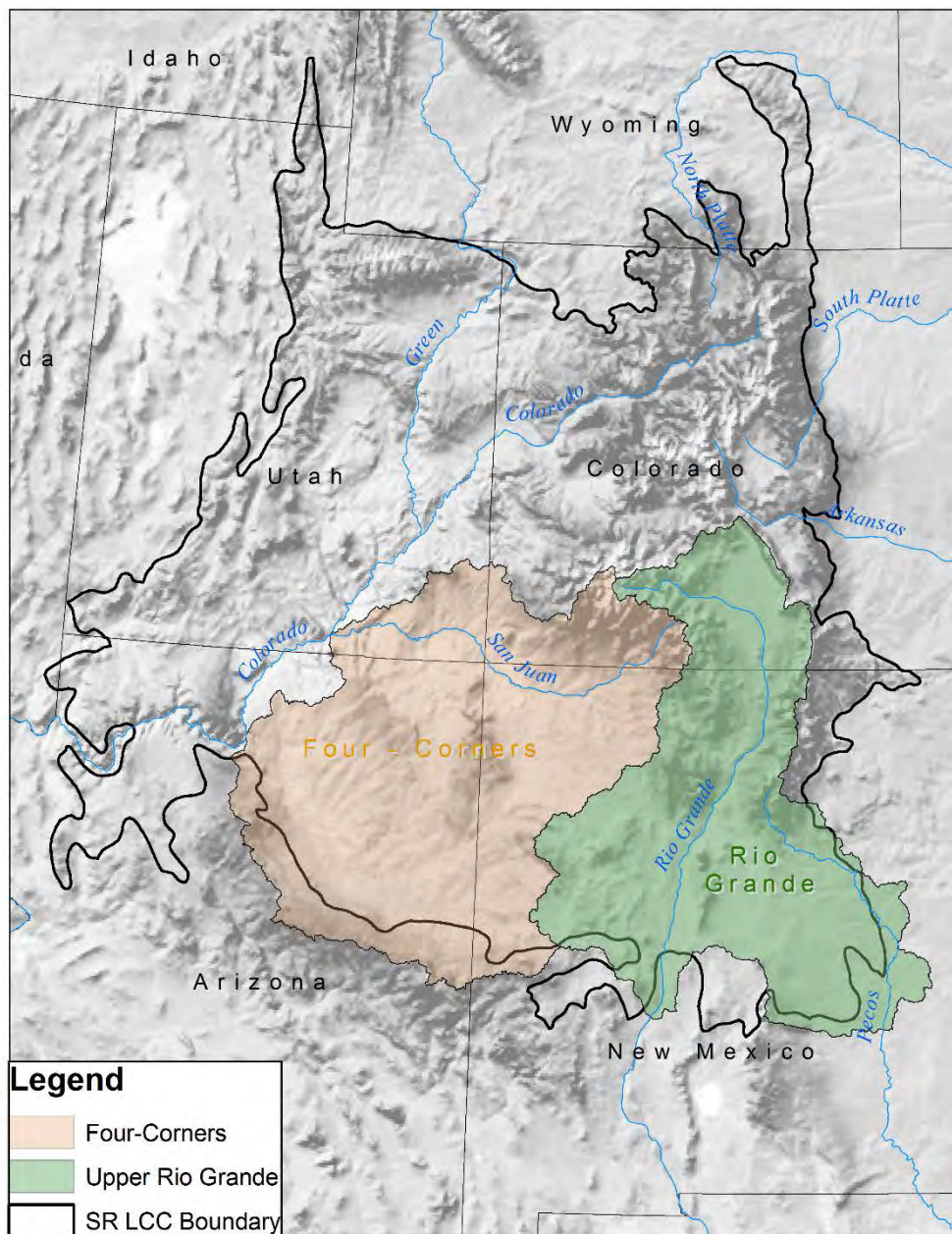


Figure 1. Geographic focal areas.

Adaptation Forum Structure and Outcome

Each workshop opened with a morning presentation series (Appendix 1). Kevin Johnson, FWS and SRLCC coordinator, began with a presentation that reviewed the principles of Landscape Conservation Design (LCD) and related activities within the SRLCC. The second presentation, given by Molly Cross, World Wildlife Federation, set the stage for the next step in the process by describing how we move from vulnerability assessment to the development of adaptation options. Finally, Megan Friggens gave a presentation to introduce the vulnerability assessments and the objectives for the workshop. For the remainder of the first day, participants broke into groups associated with each of the focal resources to explore assessment results and components and to discuss management and conservation priorities for each resource. The second day continued discussions within breakout groups to identify the top conservation priorities or needs for focal resources. All participant then engaged in a brainstorming exercise to generate ideas on actions and strategies to achieve those priority goals. Finally, from these brainstorms, breakout groups were asked to select the top three actions for their focal resource. These were presented to the entire group during a final close-out session.

This report presents the results of breakout group discussions, flip chart exercises and final report out tables. In this section we summarize key points from both workshops. Many of these points were chosen because they were discussed by multiple groups or were common to both adaptation forums. Each of the four breakout sessions, are addressed in the remaining sections. First, in **Assessing the Assessments: Indicators** we provide a brief recap of the discussions of the data and framework used to generate vulnerability maps. In the next section, **Needs and Priorities for Focal Resources**, we present the result of breakout group brainstorming sessions on what and where management action are needed. The next sections **Conservation Action for Top Three Priorities** identifies the top three priorities and lists actions and activities that address those management priorities. Finally, in the last section, **Final Three Actions**, we present the results of the final workshop task to identify and describe the top three actions. Workshop materials can be found in Appendix 1, 2. Attendees list can be found in Appendix 3 and the original unedited notes in Appendix 4. Appendix 5 contains exercises and presentation regarding uncertainty. Due to time constraints, we were unable to complete this exercise but it is presented here for documentation's sake.

Overview

This report outlines and summarizes a diverse set of discussions regarding four focal resources, Elk and Mule Deer (Elk/Mule Deer), Pinyon Juniper Ecosystems (PJ), Cold Water Fish (Fish), and Riparian Corridors (Riparian) in two focal landscapes, Four Corners (FC) and Upper Rio Grande (URG). Each group was given opportunities for open discussion as well as a series of more structured activities on specific topics. Comments and suggestions presented during these discussions were used to improve final vulnerability assessment products and provide a window on how SRLCC stakeholders may move forward and build upon these efforts. Each of the following sections provides the results of discussions as reported out in tables and exercises (Appendix 2) and sometime supplemented with discussion notes (Appendix 4). For the most part, this information is presented with minimal editing.

A few common themes were present across multiple group discussions. Issues of scale and application of assessments to real world situations were brought up during sessions that were critiquing the assessment products. During discussions of priority needs, groups considered the variety of ways in which these assessments may be used. A common theme among groups during discussions of top conservation actions regarded the need for improved outreach. Finally, many groups noted gaps in manager and other stakeholder representation at the Adaptation Forums. These themes are discussed in greater detail below.

Scale- Though the scale used for the SRLCC assessments compliments landscape scale planning, feedback given by participants at these forums point to a potential need for additional assessment products and/or forums that drill down into individual watersheds. As stated by one group, “These assessments, like other landscape products (e.g. LANDFIRE), may fall short when trying to identify local actions”. Another group said “Assessments such as these can help identify where to focus attention but do not necessarily provide actionable information because management is not implemented at this scale”. A few of the suggestions/comments made with respect to this issue include:

- The PJ-FC group suggested a potential need to ‘ground truth’ low/high vulnerability watersheds with the land managers of those watersheds.
- The Riparian-FC group suggestions included dividing up assessment areas further into core areas (e.g. define preservation actions for a certain area), perhaps using geology (e.g. how the 4-Corners area is divided up into two regions) as a basis.

Within the Fish-FC group, scale was also at issue though more from the perspective of the selection of indicator variables used to represent aspects of vulnerability. Trout Unlimited recently sponsored a vulnerability assessment within the Upper Dolores watershed (available here: <http://coloradotu.org/wp-content/uploads/2017/10/CAMF.Merged-Final.pdf>) using a larger set of measures than that applied to the SRLCC assessments. However, it was acknowledged that this comparison might not be applicable because the scale of the Dolores assessment was smaller and much more specific and it is unclear whether the results from one specific stream could be applied to the watershed as a whole. Still, the Fish-FC group concluded there was an increased need for smaller scale reach specific assessments and/or research. They also suggested the development of a separate decision support tool to address this issue (Action 1 see Final Three Actions Section).

Participants at the 2016 Adaptation Forums also considered issues of scale to be important. An excerpt from the associated report: “For some, focus on landscape-scale habitats and connectivity made more sense than focus on species. Most land management agencies and private landowners with large holdings (e.g., ranches) manage habitats and ecological processes, as opposed to individual species. Issues surrounding connectivity were most clearly expressed in relation to pinyon-juniper, migration corridors for deer and elk, and native fish in the Four Corners area, and in relation to flyways, migratory corridors, and habitat connectivity in general in the Upper Rio Grande. However, for some management questions, scales that are too broad may not be directly applicable. One participant summarized the question of scale like this: “We need to find the sweet spot where we can apply science that is tangible.”

Interpreting Data Products- Several groups noted that the underlying datasets used to generate vulnerability scores and the final mapped products could be interpreted in multiple ways. Specifically, some datasets used to measure exposure, sensitivity, and adaptive capacity could be interpreted as having both positive and negative effects. For example, wildfire impacts on forested systems can vary because the effects of fire depends on other factors such as drought, snowpack, location, slope, vegetation and fire severity. Similarly, roads and dams could be interpreted as having a negative impact through increased fragmentation or positive impacts where they act as barriers or buffers to other threats. The relative influence of these types of indicators often varied depending on elevation or other environmental factors. As a result of these observations, some indicator datasets were dropped from the final assessment analyses.

Several groups also noted both benefits and potential obstacles to the interpretation of map products. The Riparian-FC group cautioned that there is some risk with taking maps at face value and maps must come with sufficient detail to reduce misinterpretation. More than one group concluded that management actions or planning should focus not on the most or least vulnerable areas but areas with an indication for intermediate impacts. For instance, the Riparian-FC group identified several areas of intermediate (yellow on maps) vulnerability (see Needs and Priorities) as a focus. Their reasoning was that a lot of headway can be made in these areas versus in areas of high vulnerability. Similarly, the Fish-URG group focused their discussions on areas shaded in green or yellow (low-to intermediate levels of vulnerability) in vulnerability maps, identifying these areas as the best for management work to improve habitats. Further, they considered areas of high vulnerability (red) as probably too degraded for management changes to be successful and areas of low vulnerability (blue) as already sufficiently protected and not likely to degrade significantly.

Application- A repeating theme among groups regarded the challenge of how to move forward once a vulnerability assessments is produced. One participant noted “Too much information! Where do you begin?” Other concerns or comments regarded the challenges of implementing actions on the ground and integrating assessment information into plans as they are being created. As noted earlier, it was commonly agreed upon that these assessments can help identify where to focus but may fall short of providing actionable information because of mismatch in scales. Still, groups were able to identify several direct strategies for using vulnerability assessments to inform management planning at more local scales.

- The PJ-FC group thought that multi-resource assessments like this can help land managers to think about watersheds and stressors within more ecosystem-based frameworks and potentially identify management interventions to help multiple resources. Both this group and the Riparian-FC group suggested overlaying maps from multiple focal resources to find coincident high vulnerability watersheds. Other suggested applications include:
- Several groups suggested that the assessment results were useful for identifying research priorities regarding data gaps. Several suggestions for research needs came up in during workshop discussions (see discussion on Follow-up Activities: Research Needs).

- Many suggested using these assessments to identify the key vulnerabilities (sensitivities, exposures) and areas with adaptive capacity in the two geographies. This strategy was apparent in many of the group's final prioritized list of actions (see Section: Final Three Actions).

Outreach-Stakeholder and partner buy-in and public perception were mentioned as barriers to implementing conservation actions within multiple groups. Outreach activities were suggested as a way to promote analyses like the SRLCC assessments and identify partnerships to address needs and opportunities. One group called for specific stakeholder engagement to respond to adaptive management. Another noted that any engagement efforts need to recognize the site specific nature of various activities and user groups in order to facilitate the development of partnerships. A specific suggestion from the riparian groups identified the need to promote better cooperation among water users. For example, demonstrate to cattlemen the value of how improving riparian areas and wet meadows will benefit them in the long run.

Representation- There were notable gaps in representation among breakout groups at each adaptation forum. For example, the PJ group noted they were missing key representatives from BLM, Coconino NF, etc. that manage large areas shown to be highly vulnerability in the Four Corner's assessment. Other groups noted a lack of resource managers. Participant numbers were low for some groups due in part to a high absentee rate; of those who signed up to attend, approximately 30% did not show up. Low numbers may have affected some groups and in particular, the fish and elk/mule deer sessions. For instance, low turnout led to the cancelation of an elk/mule deer breakout session during the upper Rio Grande Forum.

In summary, many of the themes discussed among groups identified the challenges and issues inherent in an attempt to measure impacts of climate and related disturbances. They mirror to some extent the challenges faced by natural resource managers who must deal with dynamic environmental and political settings. Overall, the 2017 Adaptation Forums were very productive and participant feedback helped to refine vulnerability assessment products and initiated conversations about what and how we need information to conserve these resources. As demonstrated in the next few sections, these discussion led to a substantial amount of information regarding key priorities and actions for resources within the SRLCC boundary. It is our hope that this summary report will help to continue the process of developing landscape conservation design within the Four Corners or Upper Rio Grande landscapes.

Follow-up Activities: Research Needs

Many groups identified follow-up activities related to research needs over the course of their two-day discussions. Participants were asked to prioritize needs and actions and present to the larger group their top three priorities. This section presents suggestions that did not make it to a final report out table. More complete information on focal resource needs can be found in the discussion notes in Appendix 4. The following are presented in no particular order of importance.

Pinyon Juniper Needs

- o Better information on wildfire and other disturbance risks within different types of PJ habitats to provide a way to talk about departure and fire return intervals, fire scars, etc
- o Assessment to provide more information on fire regime with relation to the various forest types and fire regime history
- o More information on Mistletoe threats
- o Natural Range of Variation and relationship to stand structure
- o Delineation between persistent PJ and savannah PJ
- o Maps of PJ types – stand structure, fire ecology, etc.
- o Projections of how PJ forests will respond to climate change
- o Research on regeneration of PJ
- o Ecological Site Descriptions in this region
- o Nest Locations of Piñon Jay

Riparian Needs

- o Develop hydrograph for native vegetation, sediment transport and aquatic/riparian ecosystems
- o More smaller scale reach specific assessments/research-Separate decision support tool to address this
- o More holistic watershed scale approach for managing riparian area

Native Cold Water Fish Needs

- o Identify current strongholds of native fish and improve the diversity of habitat and connectivity of fish populations.
- o A better understanding of hydrology and the effects of shading cover. Modelling for this is fairly well understood a large-scale level, but additional information is needed on smaller scales.
- o Addition information on the effects of fire and grazing on vegetation cover.
- o More monitoring of wetlands, fens and springs to provide more information on water quality, current status (flowing) of springs, etc.
- o More information on land classification and ownership, particularly as it relates to connectivity of habitats.
- o A better understanding of the impacts of the different types of roads and road crossings.
- o Improved information databases.

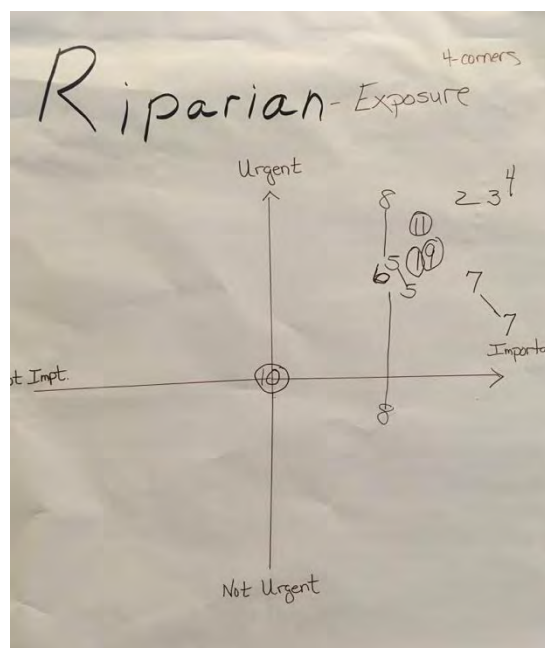
Assessing the Assessments: Indicators

Each Adaptation Forum began with a discussion of the indicators used for each preliminary assessment (Appendix 2. Workshop materials). Feedback from this session was used to edit and finalize each assessment. This section contains information compiled from both discussion notes and, where available, urgent-importance charting exercises to describe this feedback (see Figure 2). The presentation of these discussions varies among the different focal groups and adaptation forums reflecting the unique dynamics of each group. Further information on the development of final assessment products can be found in the individual assessment reports located [here](#) and [here](#) (Four Corners and Upper Rio Grande, respectively).

Figure 2. An example of urgent-importance chart used during discussions of vulnerability assessment indicators.

Key:

- 1-Projected change in mean annual flow
- 2-Projected change in mean summer flow
- 3-change in center of flow mass timing
- 4-riparian vegetation departure
- 5-ag cover in riparian buffers
- 6-urban development
- 7-dams
- 8-non-agriculture nonnative introduced or managed vegetation
- 9-erosion/extreme events (new)
- 10-precip/flooding/drought (new)



Elk/Mule Deer

Four Corners

The elk and mule deer group met only during the Four Corners Meeting. During their discussions, participants identified several additional datasets of potential relevance to these assessments (Table 1).

Table 1. Suggested additional datasets for use in spatially explicit mule deer and elk assessments.

Crash data/Road Mortality

Disturbance Events data (e.g. high intensity fire)

Recreational data (not specified)

Snow pack data on a year to year basis #8

Migration routes/movement data

Survival data

Tribal land indicator that identifies areas with specific land protection measures

In addition, this group discussed alternative thresholds to determine whether subwatershed was considered affected or not by an indicator variable. For instance, participants noted a potential need to identify a more meaningful threshold for the well data used as part of the Energy Development exposure layer. Currently, the Energy development layer considers a subwatershed affected if at least one well present (Range of 1-750, could be segmented). There were some concerns that using summer, winter and year round ranges could skew the results if they were all additive. For instance, FC has year round range (specifically AZ). Winter range was also considered more important than summer and should perhaps should be favored as a metric. Participants noted a need to investigate imperviousness indicator, specifically with respect to potential redundancy with other data. Finally, participants noted that some indicators may not be relevant because of policy related barriers. For instance, some areas are 100% leased for oil and gas. It is unclear how we, with priority and valid existing leases, interpret impacts to deer/elk from oil and gas development. Leases are already purchased and, therefore, implementing new restrictions on them are almost impossible.

Pinyon-Juniper Ecosystems

The Pinyon-Juniper groups met at both adaptation forums. Each group identified different priority indicators and issues (Table 2). Most variables listed in the “keep” category were considered both urgent and important with a tendency for these variables to end up in the upper right hand quadrant of the charts (e.g. see Figure 2). The following summarizes the key similarities and differences in the perspectives of each breakout group. A summary of urgent-importance charts follows this discussion.

- The FC and URG groups differed most in their opinions on the relevance of mechanical disturbance and wildfire as indicators of PJ vulnerability. These differences may reflect the different management needs in each focal area. The FC group did not think mechanical disturbance was appropriate as generated because this indicator represented thinning and tree removal, which can benefit PJ habitats. The URG group thought change in mechanical disturbance could reflect habitat conversion and fragmentation but were curious about data sets used to create this data layer. However, the URG group felt that there is an increase in mechanical treatment within this focal area, especially within Northern NM where “very heavy thinning” in PJ was preferred over ponderosa. They also noted, “once land is disturbed – very difficult to heal”. The FC group considered Wildfire Potential a good indicator when considering wildfire can result in state changes especially where there is poor post-fire recruitment of PJ. However, there was real debate within the URG group discussions about historical fire regime of PJ and whether or not high fire risk was really an indicator for PJ. Ultimately, URG considered Wildfire Potential importance largely restricted to WUI areas and suggested modifying fire data to only count watersheds with fire in WUI areas. PJ has a lot of uncertainty in fire regime – very little understory, potential for cheatgrass takeover.
- The FC group was less positive than URG about the potential information conveyed in road density measures. Roads can be associated with direct impacts but also lead to other impacts and there was some concern that a few of the indicators may be redundant for a given class. In addition, roads can also be useful for firebreaks and management access.
- Both groups questioned the use of the indicator representing wildlife associated species and, specifically, the inclusion of meadow jumping mouse and Mexican spotted owl. The former is associated with riparian areas both inside and outside of PJ habitat and the latter is associated with mesic canyons/cliffs, which has more relevance in some parts of range than others. However, these species are not solely associated with PJ and are not directly dependent on PJ for nesting or foraging. The role of PJ in non-associated species dispersal and fire risk was considered relevant but for the most part debate centered around how good or important this type of indicator for estimating vulnerability. The URG group suggested additions to make this measure more appropriate including: Piñon jay, songbirds, black-throated grey warbler, and the gray flycatcher.
- The URG group questioned whether the cover threshold for PJ occurrence useful as a measure and decided it wasn’t a great indicator for sensitivity as currently formulated. They suggested this analysis consider some creating a lower threshold to indicate potential good future habitat.
- URG suggested a synthesis between insect and disease and climate change/drought citing the relationship between Piñon lpps outbreaks and drought and stand density. They did question the threshold used for the analysis but there was likely confusion as to what was used. The Insect and

Disease designations were pre-formulated by the Forest to Faucet project to assign a score of impacted to any HUC12 with at least 25% expected loss due to disturbance. The discussion notes do not reflect this understanding.

Table 2. Summary of indicator discussions for Pinyon-Juniper habitat in the Four Corners and Upper Rio Grande Focal Areas. E, S, and AC indicate exposure, sensitivity and adaptive capacity variable, respectively.

	Drop	Add	Keep	Change/Assess
FC	1. Mechanical disturbance (E) 2. Impervious surfaces (S)	1. Energy Development (E) 2. ID areas where proactive post-disturbance restoration has a higher probability of success (AD) 3. Probability of suppression success (AD) converse of fire risk	1. Development (E) 2. Loss of GB woodland (E) 3. Insect and disease (E) 4. Wildfire Risk (E) 5. Water capacity (S) 6. Current Intensity Development (S) 7. Gain in GB woodland (AD) 8. PJ cover (AD)	1. Road density 2. Mean max temp (E) 3. Presence of associated wildlife species (S) 4. Mechanical disturbance (S) 5. PJ cover(S)
URG	1. Fish and Wildlife Service Critical Habitat (S)	1. How far departed is it from its “natural” (S) 2. Syro-stage (S or AD) 3. Winter precipitation (E) 4. Piñon Jay Nest Colony Presence (S)	1. Change in Mechanical Disturbance(E) 2. Change in Development(E) 3. Insect and Disease Risk (E) 4. Road Density (E) 5. Mean Max Temperature of Warmest Month (E) 6. Low Available Water Capacity (S) 7. Current Intensity Development (S) 8. Impervious Surfaces (S) 9. Mechanical Disturbances (S) 10. Percent PJ (AD) 11. Protected Areas (AD) 12. Gain in GB Woodland 2030 (AD)	1. Change in Development (E) 2. Loss of GB Woodland Climates (E) 3. Wildfire Risk (E) 4. Presence of Associated Species (S) 5. PJ Cover (AD)

Summary of Urgent-Importance Rankings taken from flipcharts:

PJ- Four Corners

Exposure

All variables were ranked as “Important and urgent”, except for “Change in Mech. Disturbance 2040”, which was not put on the chart. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Mean Max Temperature of Warmest Month.
2. Wildfire Risk
3. Insect and Disease Risk
4. Change in Development 2040
5. Loss of Great Basin Conifer Woodland Climates 2030
6. Road Density

Sensitivity

All variables were ranked as “Important and urgent”, except “% P-J” which was rated as “not urgent, not important”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Low Available Water Capacity
2. Medium/High Intensity Development

The following were bunched close together:

3. FWS Critical Habitat
4. Mechanical disturbance 2005
5. Impervious surfaces
6. Presence of obligate species

Adaptive Capacity

All variables were ranked as “Important and urgent”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Gain in GB Conifer Woodland 2030
2. PJ Cover
3. Protected Areas

PJ- Upper Rio Grande

Exposure

All variables were ranked as “Important and Urgent”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Wildfire Risk was listed twice as (now) and (wvi), with “wvi” as the highest variable listed.
2. Variable 8 was a new variable
3. Change in Mech. Disturbance 2040

4. Mean Max Temperature of Warmest Month
5. Loss of Great Basin Conifer Woodland Climates 2030
6. Insect and Disease Risk
7. Road Density
8. Wildfire Risk (now)
9. Change in Development 2040

Sensitivity

All variables were ranked as “Important and Urgent”, except “FWS Critical Habitat” which was rated as “not urgent, not important”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least-All about equally far apart):

1. Mechanical disturbance 2005
2. Presence of Obligate Species
3. Percent PJ
4. Medium/High Intensity Development
5. Low Available Water Capacity
6. Impervious surfaces

Adaptive Capacity

All variables were ranked as “Important and Urgent”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Variable 4, which was a new variable (Table 2).
2. Gain in GB Conifer Woodland 2030
3. Protected Areas
4. PJ Cover

Native Cold Water Fish

The following section summarized input from each focal region separately as each group took a very different approach during their discussions. Each region expressed both similarities and differences regarding whether each variable represented an important and urgent issue or aspect of cold water fish conservation (Table 3).

Table 3. Comparison of indicator ranks between FC and URG breakout groups for coldwater fish. Indicators refer to data used to estimate vulnerability measures relating to resource exposure, sensitivity and adaptive capacity. No indicators were considered Urgent but not Important.

	Urgent and Important	Not as Urgent, Important	Not Urgent, Not Important
Four Corners			
<u>Exposure</u>	all other exposure variables		pollution sources, nitrate/ammonium deposition
<u>Sensitivity</u>	wildfire hazard, riparian departure	elevation, dam density	number of dams, all fish related variables
<u>Adaptive Capacity</u>	water temperature predictions, riparian departure, riparian shading		
Upper Rio Grande			
<u>Exposure</u>	streamflows, low streamflows, and, water temperature (especially changes), wildfire		pollution, roads, nitrate deposition, and kf erosion factor
<u>Sensitivity</u>	wildfire potential and presence of native trout	native sensitive fish, riparian departure, and elevation	number of dams
<u>Adaptive Capacity</u>	temperature change, beaver capacity, herbaceous wetland cover, public land ownership, protected land ownership	slope and density of springs	riparian vegetation departure, riparian shading, and water storage capacity

Fish- Four Corners

There was considerable debate, discussion, controversy, among the FC group as to which indicators and factors are most important to coldwater fish. Participants felt other factors that weren't considered could also be important. In their recently completed similar project on the Dolores River, participants from Trout Unlimited included many other variables to do their modeling. They were uncertain, however, if the results from one specific stream could be applied to the watershed as a whole. Some felt that depending on what variables were chosen, the results would vary accordingly. They also felt the binary scoring system might not be the best choice on the theory that some variables are more important than others. They felt more important variables should be given greater weight (e. g., some

variables might be scored as 1, 2 or 3 points, for example). Specific rankings of each indicator variable are discussed below.

Exposure

All exposure variables were listed in the “Important and Urgent” category, except for Pollution Sources in Catchment and Nitrate/Ammonium deposition, which was rated as “Not Urgent/ Not important” (Table 3). In addition, participants indicated:

- Pollution (such as leaking mines) could be important in specific cases, but only in the stream affected, not for the watershed as a whole.
- Nitrate/Ammonium deposition would largely affect lower elevation warmer stream segments, not coldwater fisheries. However, some measure of water quality could be important.
- Change in summer flow was the most important variable among those listed. A better descriptor variable might be change in low flow, as summer flow may not be the lowest flow of the year.
- Road density by itself isn’t as critical as what types of roads; how far they are from the river, etc. Perhaps a more refined road indicator would work better. Road density is also likely underestimated by datasets.

Sensitivity

Wildfire Hazard and Riparian departure were the only sensitivity indicators listed as “Urgent and Important” (Table 3). Wildfire was considered to have two important potential impacts: reducing shade cover and increasing erosion/sedimentation. Elevation and Dam Density were rated as “Important not Urgent”, since generally there is not much that can be done to alter either of these conditions. Active water diversions rather the number of dams was suggested as a better descriptor because it would include additional barriers to fish movement. All of the fish variables used to indicate sensitivity were rated “Not Important/Not Urgent”. It was noted that the other sensitive, endangered and threatened native fish are generally in lower, warmer waters than coldwater fish. However, native fish could be move to new areas where habitat conditions are (or become) suitable.

Adaptive Capacity

Water temperature predictions, riparian departure and shading were considered to be “Urgent and Important” (Table 3). Also considered “Urgent and Important” were the related issues of stream flow and timing of peak flows. Reservoir storage was rated “Important, not Urgent” because additional water supplies could be useful for protecting fish in those cases where they are available. Finally, Beaver capacity was considered “Important, not Urgent” as they are very helpful in restoring streams to natural conditions.

Fish- Upper Rio Grande

Exposure

Fish exposure variables considered “Urgent and Important” included: streamflows, low streamflows, and, water temperature (especially changes) (Table 3). Fire was also believed to be a very important exposure indicator. Indicators rated as “Not Urgent and Not Important” included, pollution, roads, nitrate deposition, and K erosion Factor.

Sensitivity

Sensitivity Indicators rated as “Urgent and Important” included wildfire potential and presence of native trout (Table 3). Indicators rated as “Not Urgent, but Important” were native sensitive fish, riparian departure, and elevation. Number of dams was rated as “Not Urgent, Not Important”. Additional comments regarding these indicators include:

1. Native trout presence is a critical factor. It’s most important to protect current populations. The Inland Cutthroat Database has the most up-to-date information on the current status of the various populations.
2. Native fish of other species are not as useful an indicator as native trout.
3. Beavers are very useful for improving vegetation departure. They can be used to help restore natural conditions. Regulations on returning beavers to streams are generally less strict than regulations for other types of habitat improvements might require.
4. There are many more road crossings and culverts than dams, so these are more important to consider when assessing sensitivity. Their greater numbers increase the chances for affecting runoff into streams (affecting water quality) and reducing or restricting movement of fish.
5. The effects of fire are highly variable depending on other factors (drought, snowpack, etc.). Fire impacts also vary greatly by location, depending on fire severity, slope, vegetation, etc.

Adaptive Capacity

Indicators rated as “Urgent and Important” were temperature change, beaver capacity, herbaceous wetland cover, public land ownership, and protected land ownership (Table 3). Indicators rated as “Not Urgent, but Important” were slope and density of springs. Indicators rated as “Not Urgent, Not Important” were riparian vegetation departure, riparian shading, and water storage capacity.

Additional points made during the discussion of adaptive capacity indicators included:

1. The most important factor in judging adaptive capacity is the presence of non-native trout. Several participants felt that should be added as an indicator.
2. Water storage may be helpful for maintaining stream flows, but overall is not significant due to limited number of dams.
3. Slope is very important as it can provide barriers to fish movement. It is important to consider when management decisions are made as to where to place fish, etc.
4. Beaver capacity is very important as beavers can affect other factors (such as slope and vegetation cover). There are some policy/political issues to consider when reintroducing beavers. Some landowners or water districts may oppose them over fears over flooding, restricting water deliveries, etc.

5. Both amount of public land and amount of protected land are important. Amount of public land is more important as there are any more options for management on public lands. Protected lands are important as refugia for native fish.
6. Springs are important as refugia for native fish. “7A Spring” (*not legible*) has good data on the location and status of springs.

Riparian Corridors

Breakout group discussions regarding indicators used to measure riparian corridor vulnerability are organized by focal region to maintain the integrity of the information recorded at each meeting. First, we summarize general discussions about indicators and missing data and then we summarize the results of the urgent-importance charts.

Riparian- Four Corners

Participants discussed the data at length and identified several alternative sources of information that may be important for predicting riparian threats and sensitivity. Full discussion and images of the Importance/Urgent rankings can be found in Appendix 4.

Exposure (threats)

Projected change in mean annual flow, mean summer flow and change in flow mass timing were considered the most important and urgent indicators of exposure. A lot of variation existed among participant opinion about the importance of non-agriculture nonnative introduced or managed vegetation and dams. Suggested additions to exposure measures included erosion/extreme events, precipitation/flooding/drought indicators, and water diversions/consumptive use. Participants also suggested including precipitation/drought measures that might not be otherwise captured in mean flow. In particular, they noted it may be best to look at long-term low flow.

Sensitivity

All variables were considered important and urgent indicators. Most important and urgent were newly suggested variables: land use impacts, group water/surface flows, regenerative/reproductive capacity for native vegetation and impervious surfaces (already considered). T&E species and deciduous or wetland riparian vegetation were deemed the most important of the indicators used in the preliminary assessment. Participants thought that development should be considered though its impacts might be more site specific (versus at landscape scale). Participants agreed that groundwater/surface water flows should be included and thought they might also fall within the adaptive capacity category.

Adaptive capacity-

Again, the most important variable were new suggestions: Groundwater surface flows, riparian connectivity, associated springs, public perception/water rights/consumption. Mean catchment elevation and protected land designations were preferred over other indicators. Reservoir storage was considered least urgent and important. Participants noted that mean catchment elevation (surrogate for condition) might be a more appropriate measure of sensitivity.

Summary of Urgent-Importance Rankings taken from flip chart exercises (see Appendix 4 for images)

Exposure

All variables were considered “important and urgent”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Riparian change departure
2. Change in center of mass flow timing
3. Projected change in mean summer flow

Grouped together below those in urgency and importance were:

1. Water diversions/consumptive use
2. Erosion/extreme events
3. Projected change in mean annual flow
4. Ag cover in riparian buffers
5. Urban development

“Dams” were rated as important as group #1 above, but less urgent than any of the above

“Non-agriculture nonnative introduced vegetation” was rated as less important than any of the above and rated as both “urgent” and “not urgent”, apparently depending on the circumstances.

“Precipitation/flooding/drought” was placed right on the “0,0” point of the graph

Sensitivity

All variables were ranked as “Important and urgent”. Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. groundwater/surface flows
2. T&E species
3. Land use impacts

Grouped together below those in urgency and importance were:

1. Deciduous or wetland riparian vegetation
2. Impervious surfaces
3. Wildlife hazard

Rated least urgent & important

1. Regenerative/reproductive capacity for native vegetation

Adaptive Capacity

All variables except for “Reservoir storage in watershed” were rated as “Important and urgent”.

Given the position of each variable on the chart, we rank each roughly in this order (most urgent and important to least):

1. Water rights/consumption
2. Public perception
3. Protected land designation
4. Groundwater surface flow

5. Riparian connectivity
6. Associated springs
7. Mean catchment elevation

Grouped together as less urgent and important than the group above were:

1. Regenerative/reproductive capacity for native vegetation
2. Public land ownership (Listed at three different spots on the graph, apparently depending on the circumstances.)

Rated as neutral (right on the 0,0 point) to “slightly not important, slightly not very urgent” was reservoir storage in watershed (marked at two points on the graph)

Riparian- Upper Rio Grande

Exposure

- *Mean Annual Flow Volume* was considered useful, but not as important as low flow and peak flow indicators because similar mean flows can represent different events. For main stem Rio Grande, a very high spring runoff flow and very low summer flow can have the same annual mean flow as an average runoff and average summer low flow, yet the scenario with very high spring runoff has the potential to be much more beneficial to the riparian corridor.
- *Mean Summer Flow Volume* should be replaced with an estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years as it is a better indicator than mean summer flow.
- *Center of Flow Mass Timing* is a very important indicator as long as it captures all of the magnitude, duration, and timing components related to mass flow events.
- *Riparian Vegetation Departure*, while not the best measure, particularly for lower elevation main stem sites, should be included to measure exposure. Participants noted that a better measure would compare what riparian vegetation should be there vs. what riparian vegetation is there now. However, they also acknowledged that it is difficult to define baseline historical conditions. There was also some question of the threshold value used as a cutoff for this variable.
- *Agriculture Cover* was considered important but not a good indicator of exposure. Agricultural lands may actually provide a buffer from urban effects within the lower elevation main stem Rio Grande and may be important to include in adaptive capacity.
- *Urban Development* was considered important and urgent where urbanization occurs. In addition, participants suggested adding variables related to exposure to water infrastructure such as acequias, canals, low head diversion dams.
- *Dams* were not considered the best indicator because the way they are treated in this assessment system considers effects only in stream segment whereas effects are also far downstream.
- *Nonagricultural Nonnative vegetation* was considered urgent and important to both high and lower elevation segments.

Sensitivity

- *Wildfire Hazard* generated discussion about the results and methodology. Participants felt that the upper Rio Grande watershed and higher elevation segments shown in map should be much more

sensitive. Participants felt the reported value of 10% affected areas was too low and therefore true fire potential/risk was not accurately captured.

- *Threatened and Endangered Species* was not considered the most useful indicator as presented. In part, participants felt that T&E species are already addressed significantly in other forms and may be redundant here. Participants also had these suggestions/comments:
 1. Should also include fish and other “species of concern”
 2. Could also include indicator for Critical Habitat
 3. Presence threshold might be more meaningful if >3 instead of 0-3, for example.
 4. Biodiversity would be a better metric
- *Vegetation Cover* was considered important but not as urgent as wildfire and T&E.

Adaptive Capacity

- *Mean Catchment Elevation* was considered to represent differences in temperature and therefore not as important of an indicator as a precipitation based indicator.
- *Reservoir Storage in Watershed* was considered important in lower elevation main stem Rio Grande from an infrastructure perspective. It is also likely to be important in high elevation watersheds from a landscape storage perspective, e.g., wetlands, beavers, etc.
- *Public Land Ownership* was thought to be somewhat important but not as urgent. Specific comments noted that this measure is less useful for the Rio Grande as there are fewer larger tracts of private ranches. This group suggested that public land does provide increased adaptive capacity.
- *Protected Land Designation* was also not considered the best indicator though participants label it as somewhat important (but not too urgent).

Summary of Urgent-Importance Rankings taken from flip chart exercises:

Exposure

Rated as “Important and urgent” were:

1. Urban development in riparian buffers
2. Change in center of flow mass timing
3. < S-10(??) – *Unsure of meaning (minimum summer flow, maybe?). A note next to it says “replace mean summer volume”*
4. Nonagricultural, Non-native, introduced or managed vegetation

Also rated as “Important and urgent”, but listed well below the four above were:

1. Agricultural cover in riparian corridor
2. Changes in mean annual flow volume

“Dams in Watershed” were listed as “important” and placed right on the axis between urgent and non-urgent.

“Riparian vegetation departure” was listed as “not urgent”, but both important and not important. It appears not everyone agreed on where it should be placed.

Sensitivity

Rated as “Important and urgent” were:

1. Wildfire Hazard Potential
2. T&E Species Present

Rated as “Important, but not urgent” was:

1. Deciduous or riparian veg. cover

Adaptive Capacity

Rated as “Important and urgent” was:

1. Reservoir storage

Rated as “slightly important” (just above the y-axis), but not urgent

1. Public land ownership

Rated as “slightly important” (just above the y-axis), and right on the x-axis

1. Protected land designation

“Mean catchment elevation” was placed right on the “0,0” point of the graph

Needs and Priorities for Focal Resources

The first day culminated in the development of a list of top needs and priorities as identified through exploration of the vulnerability assessments (see Appendix 1 for agenda and Appendix 2 for worksheets describing exercises) and associated discussion. For each of the priorities outlined during this discussion, participants were asked to describe the associated benefits, barriers and opportunities. Some groups chose priorities after considering vulnerability assessment results whereas others chose priorities based on conversations regarding data gaps and indicator selection. The following section lists the needs and priorities as reported out by individual groups and with minimal editing.

Elk/Mule Deer

Elk/Mule Deer-Four Corners

Need/Priority

1. Road management and traffic reduction (especially on the Carson NF Jicarilla District)

Benefits: Reduce Sensitivity

Barriers: Cost, maintenance, O&G leases, unwillingness from Roads Committee

Opportunities: Coordinate with Game and Fish to look at migration trends and corridors – work with Road Committee

2. Reduce distance to water on the Carson NF Jicarilla District – more free standing water sources (water structures – small retention dams for erosion control)

Benefits: Increase Adaptive Capacity

Barriers: Cost, maintenance, keeping grazers out

Opportunities: Reassess management plan, working with State's HSP program

3. PJ protection on the Carson NF Jicarilla District

Benefits: Increase Adaptive Capacity

Barriers: Cost, maintenance, O&G leases

Opportunities: Reassess management plan

4. Increase winter range in Carson NF Jicarilla District

Benefits: Reduce Sensitivity

Barriers: O&G leases

Opportunities: Well reclamation? Timing of well use etc.

Elk/Mule Deer-Upper Rio Grande

There was no break out group for this focal resource at this forum.

Pinyon-Juniper Ecosystems

PJ-Four Corners

Need/Priority

1. *Forest thinning*

Benefits: Reduce risk of fire, drought stress, insects, disease outside of HRV

Barriers: Costs/lack of incentives, scale, timber products markets (e.g. utilization, guaranteed supply, ID ecologically appropriate management activities for PJ, WUI issues)

Opportunities: Create markets for thinning materials (e.g. forest products, biomass utilization, biofuels)

2. *Reduce impacts of land development and use*

Benefits: Reduce habitat loss, fragmentation, degradation (e.g. invasives, groundwater withdrawal, disturbance to wildlife)

Barriers: Political realities both within agencies (e.g. multiple use mandates) and external stakeholders, mixed ownership & management

Opportunities: Engaging as stakeholders in planning processes (e.g. BLM Master Planning Processes), developing partnerships with NGOs etc. that can lobby for conservation w/ political reps, get broader participation in and expand scope of PJ working groups

3. *Mitigation and restoration of impacted sites*

Benefits: Maintain current PJ distribution/processes (more cost effective to maintain vs creating new habitat)

Barriers: Less available research/agreement on suitable management practices, genetic variability etc.; natural regen limited- takes long time to grow, spread of invasives, more collateral impacts from management activities in PJ vs other forest types (e.g. spread of cheat grass, impacts to bio soil crusts/erosion)

Opportunities: Synthesize research on PJ VAs, management strategies etc., assisted migration to new areas/post-disturbance (e.g. preempt conversion to PJ vs other veg types like oak scrub), consider genetic variability re adaptive capacity (more focus to date on other veg types e.g. riparian/PIPO), increase science/manager partnerships to do effectiveness monitoring (some success via CESU, but more needed)

4. *Prioritize/triage sites most suitable for future PJ*

Benefits: Improve management success (i.e. not wasting resources on sites unlikely to support PJ into the future)

Barriers: Less research/consensus on PJ vs PIPO management

Opportunities: Synthesize/develop info on climate suitability (e.g. next step from Romme et al. paper incl. Edwards research at USU Coop Unit)

PJ-Upper Rio Grande

Need/Priority

1. ***Need for synthesis on the role of fire and Natural Range of Variation in relation to PJ forest structure – landscape scale view, need for Ecological Site Description in the region***

Benefits: Knowledge of how to manage system and ability to differentiate expectations for these systems

Barriers: PJ is an ignored system (lack of previous study etc. as it is not a big economic driver in timber industries)

Opportunities: PJ Symposium in ABQ (occurred in 2016), Romme Paper, Birds in a Sagebrush Sea publication (PJ specific)

2. ***Targeted mapping effort on where the various types of PJ structure and age exist within the region***

Benefits: Ability to prioritize landscape for management practices

Barriers: Funding, low priority setting

Opportunities: Information sharing with Tribes/BIA – existing work on Fire Management Unites, USGS LIDAR

3. ***Increasing cooperation between various landowning entities (BLM, Forest Service, Tribes, States, private entities) as forests move up in elevation with Climate Change - Identifying data gaps and pursuing funding to help fill in those gaps***

Benefits: Tech transfer, sharing of knowledge Benefits:landscape at watershed scale, economic efficiencies

Barriers: Political, bureaucracy, LCC funding in question

Opportunities: Continued LCC engagement, Cooperative Weed Management Areas (CWMA), Tribal FMUs and FMPs

4. ***Implement management strategies to help cope with insect and disease (ex: dropping diseased trees) Specific challenges: tip beetle, mistletoe, ips beetle***

Benefits: Promoting greater forest health(?), on the ground solutions

Barriers: Lack of funding (especially on tribal lands), lack of knowledge to make informed decisions

Opportunities: Grant funding for on the ground implementation activities, collaboration with outside actors

5. ***Assessing the current migration patterns and potential range shifts of key species in PJ forests and PJ itself – landscape metrics***

Benefits: Address management across ownerships and boundaries, economically efficient

Barriers: Lack of science? – claimed not always actual.

Opportunities:

Native Cold Water Fish

Fish- Four Corners

Action 1 – Develop an appropriately sized tool, between the regional (4 Corners) and reach (CAMF) scale, to identify and prioritize clusters of native fish “strongholds”

Action 2 – Define mutually beneficial upland management for native fish, watershed health, water quality, and other resource concerns.

Action 3 – Monitoring – Develop a plan to monitor the effects of management actions.

Fish-Upper Rio Grande

Need/Priority

1. ***Maintain and restore riparian shading vegetation cover related to grazing, fire, and other land uses***

Benefits: Targeted restoration and protection of stream segments

Barriers: Field-intensive monitoring is necessary; remote sensing is difficult

Opportunities: Field work for graduate; timber and fire groups are already on the ground so priorities can be integrated with other disciplines

2. ***Protect native fish populations from wildfire***

Benefits: Proactive effort to make population more resilient, prevent listing of the species

Barriers: Terrain can hamper restoration efforts; public/partner buy-in with prescribed fire/ fuel reduction

Opportunities: Tie-in with protection of water supply and other ecosystem services; economic benefits from timber harvest

3. ***Develop capacity for beaver reintroduction***

Benefits: Numerous, well-documented ecosystem health benefits; extremely cost-effective; self sustaining effects

Barriers: Current regulations and policies; public perception of introduction and active management; damage to infrastructure

Opportunities: Nuisance beaver translocation; cooperation with APHIS and other agencies; public support for flow devices that protect infrastructure

Riparian Corridors

Riparian-Four Corners

The four corners riparian team identified three geographies based on the vulnerability assessment maps. Here are their priority areas, within which they address primary need, benefits, barriers and opportunities.

1. *Protect San Juan Mountains/upper elevation*

Benefits: Headwaters that support hydrological drivers further down the system

Barriers: Gravel mining; Legacy mining; Dispersed recreation

Opportunities: Great opportunity to build public perception and understanding of conservation needs/benefits. Already have restoration activities that can be built upon or expanded

2. *Focus Area 2: Tribes below Navajo Dam*

Need: Reduce exposure and increase adaptive capacity for free-flowing San Juan tributaries below Navajo Dam

Benefits: Enhancement actions could benefit Navajo Nation. Provides buffer and allows transition between cold and warm water fisheries. Free flowing part and provides for peak hydrograph. Ongoing restoration activities. Better water quality and quantity (better temps and less sediment).

Barriers: Water rights appropriation. Some poorly used ag waters. Jurisdictional boundaries (multiple states, tribes). Permitting.

Opportunity: Ag lands provide opportunities to improve water use practices to maintain/enhance riparian buffers. Also, excellent opportunity to further build/enhance public perceptions of conservation (esp. rec groups using waterways). Lots of opportunity to engage rec users and sportsman's' groups

3. *Focus Area 3: Little Colorado River, near Springerville (tributaries south Eagar, inclusive of west and south forks of Little Colorado River, Apache-Sitgreaves NF)*

Benefits: Support hydro drivers. Public land and neighboring tribal land. Protection for endangered species. 4FRI (Four Forests Restoration Initiative) landscape. Potential increase of focus on spring ecosystems

Barriers: Resource extraction. Recreation pressures. Wildlife severity (erosion impacts from extreme events/streamflows). Susceptible to changes in snow pack (changes in mean summer flow).

Groundwater pumping not regulated. Salt River Project (SRP) pumping station could have potential impacts. Hopi and Navajo haven't finished their water rights adjudication (could be some potential opportunities during negotiations). Infrastructure needs (specifically Navajo water resources/water hauling). Deep groundwater levels

Opportunity: 4FRI driven/expanded restoration. Increased partnership, funding opportunities. Installation of grade and erosion control structures to benefit water supplies, water resources

Riparian-Upper Rio Grande

1. *Enhance our capacity to manage magnitude, duration, timing flow*

Benefits: improves broad ecosystem function, improves fuels (reduces), native vegetation, potential partnerships and collaborations water users/managers, improve geomorphology, low flow

Barriers water rights and current laws, uncertainties in future conditions, infrastructure constraints, aging infrastructure, funding

Opportunities Basin Round Table , water rights, Chama watershed congress, Rio Grande water fund, Conservation districts,

2. ***Maintain or restore cover of woody vegetation***

Benefits: reduce stream temperatures, reduce sedimentation, bank stabilization, provides wildlife habitat, can act as wildfire buffer (high elevations), flycatcher habitat

Barriers disruption wildfires, grazing (wildlife and livestock), not enough management of undesirable conifer species that encroach into riparian areas, limiting baseline conditions (e.g. lack of overbank floods), funding, permitting, NEPA, TnE species

Opportunities Rx or other fire, partnerships and mutually beneficial outcomes for multiple users, compensatory mitigation (Coca Cola), payment for ecosystem services, work with municipalities

3. ***Increase upstream storage capacity***

Benefits: Water quality, quantity and temperature (landscape), flow timing, increased flexibility of water management for environmental and water user purposes (infrastructure), increases capacity to get through periods of drought

Barriers: Infrastructure: water rights and current laws, political will, Landscape: political will, education, buy in, funding

Opportunities Comanche Creek, Coca Cola, Similar collaboration ideas from previous entries

4. ***Smaller-scale reach-specific assessments/research***

Benefits: Managers decision-making and project prioritization, can use/access more specific higher quality data

Barriers: Site specific climate change projections, lack of information of riparian conditions at reach scale, lack of resources to complete

Opportunities: Hydrology data, geomorphology data, LCC and similar organizations, agency planning processes,

5. ***Reduce uncharacteristic wildfire***

Benefits: Riparian vegetation, wildlife, water users, municipalities,

Barriers: Funding, management of river flows that exacerbate issues leading to uncharacteristic fire, TnE, baseline conditions, political will, lawsuits

Opportunities: Broad support exists, existing programs that address fuels management, agency initiatives

Conservation Actions for Top Three Priorities

The following summarizes notes recorded on flip charts during discussions. During these discussions, breakout group participants were asked to focus on three priorities, which they then posted onto flip charts sheets. The entire group was then rotated through these posted priorities and asked to add ideas for potential actions for each priority. Where we were unable to decipher handwriting, we have inserted a tentative guess in italics and brackets.

Elk/Mule Deer

Conservation Actions were not recorded for this group. Please see Discussion notes for details of discussion.

Pinyon-Juniper Ecosystems

PJ-Four Corners

Priority #1 - Reduce fire risk and enhance resilience to drought, insects and disease

- Use selective thinning to reduce fuels
- Invasive species management (especially for cheatgrass)
- Implement BMP's (e.g. sanitation, timing, location)
- Develop forest (by)-products markets and incentives
- Implement more adaptive management experiments
- Improve protocols by matching scientists to ongoing treatments (leverage resources)
- Use low-intensity fire as a management tool
- Use landscape collaboratives to [*prioritize??*]
- Make sure management is not counter-productive
- Manage [*travel??*] during droughts/dry periods to reduce risk
- Pinyon-juniper does [*have??*] catastrophic fires, adapt to [*prescribe??*] major fires
- Move it upslope
- Identify refugia for warm and cold species
- Expand seed sources for fire recovery plans/response
- Reseed post-fire with climate resistant genotypes

Priority #2 - Reduce impacts of land development and use

- Synthesize and implement restoration BMP's
- Collaborate to coordinate development
- Optimize existing infrastructure to minimize fragmentation and reduce impervious cover
- Install grade control structures to mitigate land degeneration
- Create land buffers around vulnerable areas
- Promote management-research partnerships
- Create conservation easements (find conservation-minded buyers)
- Identify a desired condition of pinyon-juniper at a landscape scale: e.g., How much and where?

- Grazing management
- Administrative protections and policies
- Education on the ecological importance and impact of pinyon-juniper woodlands
- Change policies regarding extractive industries to reduce their footprint (i.e., directional drilling and shared well pads)
- Discourage mining/resource extraction

Priority #3 - Prioritize/triage sites most suitable for future Pinyon-junipers forests

- Identify “climate envelope” for Pinyon-Juniper
- Identify key determinants of Pinyon-Juniper distribution
- Project relevant factors to the future
- Map and distribute [*Map distribution??*]
- Identify refugia areas
- Identify and map key soil/climate metrics that define suitability to project into the future
- Pinyon-Juniper will likely disassociate into separate Pinyon and Juniper habitats - so there will be a need to find suitable refugia for Pinyons
- Identify and protect “DNA arks” of sub-cultivars with different resilience/resistance characteristics for use as breeding stock (Looking for those stocks that thrive in dry/drought conditions and/or at higher elevations)
- Identify post-fire forests likely to transition to Pinyon-Juniper
- Facilitate upslope movement of Pinyon-Juniper
- Identify areas and populations not affected by insects or pathogens
- Manage for Pinyon and Juniper separately as they do not have the same life history or regeneration adaptations

PJ-Upper Rio Grande

Priority #1 - Identify management strategies for the conservation of Pinyon-Juniper communities to minimize the detrimental impacts of fire, insects, disease and drought

- Remove dead and downed fuel wood
- Extract mistletoe and tip beetle trees to prevent the spread
- Cut fire lines into the landscape
- Conduct a research synthesis of management strategies
- Conduct a research synthesis of wildlife habitat associations in Pinyon-Juniper habitat
- Investigate road networks as conduits for exotic species introductions and forest fragmentation
- Improve ground cover to increase soil complexity/productivity and to protect soils during management activities
- Reducing gullying and improve sheet flows
- Induce stream meandering
- Investigate strategies to create productive fire

Priority #2 – Define and map desired future conditions for P-J based on natural range of variation (NRV's), stand structure, disturbance regime, and landscape patterns as informed by the best science available

- Utilize LIDAR or similar tools to identify stand and landscape metrics such as structure, canopy closure, etc.
- Identify fire refugia sites, as applicable
- Identify species of conservation concern / sensitive species (both plants and animals)
- Compare the NASA remote sensing database with Ecological Site descriptions
- Conduct a research synthesis of NRV, fire and drought patterns in P-J
- Study current and potential range shifts and migration pathways
- Use GPS telemetry to track species movements
- Develop a demonstration location to show desired outcome
- Consider climate change to plan for long-term landscape changes in P-J distribution
- Look for and apply localized future climate change scenarios
- Use ILAP data to characterize stand structure

Priority #3 - Increase cross-entity and cross-jurisdictional communication to encourage knowledge and sharing and collaboration

- Create a Pinyon-Juniper communication network (See the SageWest Network as a potential model)
- Develop watershed partnerships
- Partner with local colleges and universities
- Develop forums (1-2 day meetings) to bring land managers together
- Pinyon Jay t-shirts and education materials on ecology, etc.
- Create citizen science web networks
- Partner with LCC's
- Identify shared values across stakeholders

Coldwater Native Fish

Fish-Four Corners

Priority #1 - Develop a framework / tool between the regional and reach scale to identify and prioritize clusters of stronghold of native fish

- Use line assessment tools across scales:
 - Big - Landscape / Four Corners vulnerability assessment
 - Medium - [Half??] watershed / first RD
 - Small - [CAMF type targeting??]
 - Micro - Citizen science / agency / academic research at the reach level (Ground truthing)
- Identify and map factors that make a stronghold - what is the role of riparian vegetation
- Map current conditions and projected changes
- Develop a tool so as to ensure buy-in and use
- Identify BMP's for strongholds - create a database and include stakeholder input

- Monitoring

Priority #2 - Define mutually beneficial upland management practices for native fish, watershed health, water quality and other resource concerns

- Develop forest restoration / fire mitigation plans; including improved grazing plans
- Make enhancements to improve water detention and retention
- Make enhancements to reduce stream velocity
- Make enhancements to refugia
- Increase integrated management of upland across agencies
- Increase integrated management among major water users and stakeholders
- Develop and implement a communication / education program to expand the awareness of the public of the importance of uplands to native trout
- Engage citizen scientists in watershed health monitoring of various kinds
- Identify, assess, and protect spring ecosystems as they contribute to watershed health, and may contribute to in-stream flows
- Identify, assess, and protect spring upland coldwater streams
- Don't build more dams
- Explore water rights - determine who owns what and how this ownership might change
- Identify sediment sources such as from wildfire
- Work collaboratively across boundaries and disciplines

Priority #3 - Define mutually beneficial in-stream and near-stream management practices for native fish, watershed health, water quality and other resource concerns.

- Develop forest restoration / fire mitigation plans
- Make enhancements to improve water detention and retention
- Make enhancements to reduce stream velocity
- Make enhancements to refugia by increasing shading and decreasing water temperature
- Develop partnerships with interested parties including:
 - Grazing concerns
 - Timber interests
 - Water users including agricultural and municipal
 - Private landowners
 - Public land agencies
 - Native tribes
 - NGO's
 - Watershed groups such as the San Juan-Chama Watershed partnership
- Increase stream monitoring (factors such as flow, pH, turbidity, etc.)
- Enhance fishing regulations to reduce angling impacts on strongholds of native fish
- Establish riparian buffer zones by working with farmers and ranchers
- Improve fish habitat with in-stream structures

- Maintain riparian vegetation components
- Work with recreational interests to mitigate impacts

Fish- Upper Rio Grande

Priority #1 - Identify locations for beaver reintroductions to improve watershed function and resiliency

- P/A Monitoring
- Outreach to Users/Agencies/Counties to help them understand project
- Identify high-visibility projects
- Consider man-made beaver alternatives
- Provide/restore beaver habitat
- Rapid runoff due to increased temperature compared to past years with greater snow retention
- Map potential beaver habitat and work with municipalities to allow those areas to be conserved for beaver and natural hydrologic functions that promote water retention at local watersheds (groundwater replenishment)
- Conduct Level 2 stream surveys

Priority #2 - Maintain and establish healthy hydrologic connections between forests and streams

- Identify opportunities in priority watersheds
- Map fens, wetlands, springs
- Watershed forest treatments to includes snowpack retention
- Reduce impacts of ash and debris from post-fire runoff
- Connect disconnected streams to the floodplain
- Improve soil condition by increasing vegetative cover and increasing infiltration
- Improve meadow retention capacity
- Study and map groundwater levels and aquifers tied to land use and see where conservation of water use should be prioritized
- Identify species tolerances/thresholds to changing conditions
- DNA sampling - identify native/invasive species, including invertebrates to look at species interactions
- Bio-Remedial efforts: plant poplar trees and sunflowers to remove metals and pollutants

Priority #3 - Maintain and restore riparian shading in relation to fire and grazing and other land uses

- Map current condition
- Consider other methods to protect stream temperatures (such as groundwater storage)
- Manage grazing/browsing impacts (from both livestock and wildlife)
- Assimilate best available science to make recommendations or appropriate buffer zones for multiple use (recreation, transportation, livestock, etc.)
- Consider/map livestock grazing suitability in riparian areas - utilize exclosures, riparian pastures
- Identify target plant species and consider climate-adapted species

Riparian Corridors

Riparian- Four Corners

The four corners Riparian group recorded two sets of priorities and actions. The first set is transcribe here as it appeared in this groups' notes. The second set, generated during brainstorming sessions on flipcharts follows.

Priorities from Break-out Group discussion (Notes):

Priority #1. Protect headwater environments of the San Juan Mountains to maintain, enhance, and support hydrological drivers/ecosystem services now and into the future. (protection)

- Define BMPs for recreational use
 - Quantify recreation impacts
- Initiate campaign to enhance public understanding of protection and conservation needs
- Work with land management agencies to reduce catastrophic wildfire risks and improve rangeland conditions and reduce road densities
- Develop progressive forest and private management plan to allow natural fire to return to landscape while protecting private property and public infrastructure
- Identify dollar value of headwaters ecosystem services
- Prioritize project treatment areas to preserve ecosystem services
- Assess climate change impacts on snowpack and headwater hydrology
- Restoration treatments as a tool to protect headwaters
- Manage fugitive dust emissions to reduce dust on snow impacts

Priority #2. Reduce exposure and increase adaptive capacity of the free-flowing San Juan River tributaries below Navajo Dam to protect natural river functions (e.g. floodplain functionality) and to enhance native biodiversity. (enhancement/management)

- Monitor and evaluate restoration activity effectiveness in riparian corridors
- Minimize floodplain development and protect intact riparian habitat
- Identify biodiversity hotspots in riparian corridors
- Inventory hydrological flow/use in the system
- Increase gauging and monitoring to understand flow gains, losses, and returns in system
- Engage (strategically) users, esp. recreation and agricultural through education and outreach
- Increase understanding of forest health changes and water quantity (fire, bugs, crud) vs. water yield
- Assess potential future riparian extent under altered climate
 - Seasonal changes
- Enforce water rights/sustainable allocation
- Understand fluvial geomorphology
- Promote dryland agriculture

Priority #3. On the Little Colorado River tributaries, support and enhance riparian buffers via incremental water storage to strengthen and enhance local water resources.

- Restoration/enhancement of local water resources
 - Grade control structures, beaver mimicry, stormflow mitigation measures
 - Invasives management/reduction (tamarisk; define extent)
- Explore partnerships (who is doing what already, 4FRI and USFS, NAU (riparian restoration groups), tribes, White Mt. Apache, state wildlife agencies, SRP, APS)
- Post fire thinning erosion mitigation measures
- Monitoring post fire regen
- Connect with permittees/ranchers/sportsmen groups and public education campaign to understanding best practices with respect to riparian buffers
- Pursue and Active Management Area designation (AZ Dept. of Water Resources groundwater management)
- Develop adaptive management protocols with stakeholders
- Assisted migration/restoration of drought tolerant genotypes (e.g. riparian/uplands)
 - SRLCC funded project with Lindsay Reynolds
- Grazing BMPs (rotation, exclosures, water tanks)
- Restore meadow and spring recharge function

Results from brainstorming activity:

Priority #1 - Support and enhance riparian buffers, via incremental water storage to enhance local water resources and water recharge in the Little Colorado River region (particularly the lower LCR region)

- Restoration and enhancement of local water resources through:
 - Grade control structures
 - Beaver mimicry
 - Stormflow mitigation measures
 - Management of invasives
- Determine the extent of tamarisk
- Explore partnerships - determine who is doing what already? Current work being done by: [4Fri??], USFS; Northern Arizona U. riparian restoration; tribes (White Mountain Apache); state wildlife agencies; SRP; APS; sportsmen's groups
- Enact post-forest fire erosion mitigation measures
- Monitor post-fire regeneration (e.g., at the Rodeo-Chediski Fire)
- Connect with permittees, ranchers, and sportsmen's groups on a public education campaign to increase their understanding of best practices with respect to riparian buffers
- Pursue an Active Management Area designation [from??] (Arizona Department of Water Resources groundwater management)
- Develop adaptive management protocols with stakeholders
- Assist with migration or restoration of drought-tolerant genotypes - riparian and uplands (e.g., SRLCC funded project led by Lindsay Reynolds)
- Initiate grazing BMP's (rotational; exclosures; water tanks)
- Reduce or remove invasive species

- Restore meadow and spring recharge function

Priority #2 - Reduce exposure and increase adaptive capacity for free-flowing San Juan River tributaries to protect natural river functions (e.g., floodplain functionality) and to enhance native biodiversity

- Evaluate restoration activities and BMP's effectiveness in riparian corridors
- Minimize floodplain development and protect intact riparian habitat
- Identify riparian hotspots in riparian corridors
- Inventory hydrological flow and use in the system
- Increase gauging and monitoring to understand flow gains, losses and returns to the system
- Maintain existing gauges
- Strategically engage users, especially agricultural and recreational, through education and outreach
- Increase understanding of forest health changes and water quality (fire, bugs, [crud??] vs. water yield)
- Monitor and evaluate restoration outcomes
- Assess potential future riparian extent under altered climate
- Assess potential future seasonal changes in riparian areas under altered climate
- Enforce water rights / sustainable allocations
- Understand fluvial geomorphology
- Promote dryland agriculture

Priority #3 - Protect headwater environments of the San Juan Mountains to maintain/enhance for hydrological drivers / ecosystem services now and into the future.

- Define BMP's for recreational use
- Initiate campaign to enhance public understanding of protection and conservation needs
- Work with land management agencies to reduce catastrophic wildfire risks, improve rangeland conditions and reduce road densities
- Develop progressive forest and private management plans to allow natural fire to return to the landscape while protecting private property and public infrastructure
- Identify dollar values of headwater ecosystem services
- Prioritize project treatments areas to preserve ecoservices
- Assess climate change impacts on snowpack and headwater hydrology
- Quantify recreation impacts
- Use restoration treatments as a tool to protect headwaters
- Manage fugitive dust emissions to reduce impacts of dust on snowpack
- Identify management practices to promote water [retraction??] and detention

Riparian-Upper Rio Grande

Priority #1 - Conduct smaller scale reach specific assessments/research

- Monitor effects of restoration treatments on hydrology to gauge real world effects on irrigation and rural water supply
- Define the scale needed - watershed vs. reach
- Identify indicators such as geomorphology
- Learn local climate change projections
- Coordinate with existing groups and agencies for local buy-in
- Conduct Level 2 stream surveys for assessing in-stream habitat attributes and DFC's
- Synthesis of riparian management activities - buffers, restoration, etc.
- Use citizen science and academic grants to develop local capacity knowledge and skills to identify and address local issues

Priority #2 - Reduce uncharacteristic wildlife

- Fuel reduction in mainstem bosque
- Prioritize upland treatments strategically (to reduce post-fire erosion hazard)
- Reduce post-fire and post-fire forest treatment effects to improve riparian health
- Restore fire regime in frequent fire forests
- Rio Grande Water Fund [*this means provide funding for fuel reduction projects?*]
- Reintroduction of wolves and beavers to riparian areas
- Develop monitoring and adaptive management strategy/components
- Improve sediment control to minimize movement downstream - optimize sediment transport and deposition
- Develop citizen science and local firefighting capacity to identify local issues that connect to fire ecologists working at landscape scale metrics
- Identify priority treatment areas
- Introduce prescribed fire

Priority #3 - Increase upstream storage capacity

- All ideas listed under **Native Fish #1 (beaver reintroduction)**
- Improve infrastructure by:
 - Carry overstorage in reservoirs
 - Add supplemental water storage in addition to flood control
 - Allow for both native and imported water storage
 - Increase storage volume
 - Obtain additional Congressional authorization
- Characterize surface/groundwater interactions to identify storage capacity and prioritize specific projects
- Map hydrologic inputs
- Quantify the benefits of water storage (quantity, quality, water temperature)
- Coordination with private landowners and landowning entities
- Beavers! Mimicry [*assume this means man-made analogous structures*]
- Recognize the effects of future snowpack declines

- Assess livestock grazing suitability
- Develop natural basins and water holding basins to capture available snowfall

Final Three Actions: Benefits, Timeline, Barriers and Opportunities

This section presents tables and lists generated during the last session of the Adaptation Forum. Breakout groups were asked to identify the top three priority actions from the lists generated during previous brainstorming sessions. For each action, each group identified the probable timeline, benefits and barriers to implementation. In addition, participants discussed next steps for realizing these actions within the Four Corners and Upper Rio Grande Landscapes. Comments provided by breakout groups were organized into tables, which are presented here with minimal editing.



Figure 3. Wordcloud depicting frequency of words used to describe barriers to implementation of priority actions for all focal resources. Frequency is indicated by relative size. Produced using <https://www.wordclouds.com>

Elk/Mule Deer

Table 4. Top three actions for Elk and Mule Deer in the Four Corners. This group did not meet for the Upper Rio Grande Region.

	Action 1. Identify and maintain a mosaic of appropriate forage to cover ratios and connectivity between those priority areas.	Action 2. Identify existing water retention mechanisms and implement in relations to priority areas and corridors.	Action 3. Implement seasonal road closures on secondary roads (NF, State, BLM) and limit construction of new roads in core areas/important range.
Time-frame	Identification is short term. Maintenance more variable.	Identification short term. Implementation moderate term.	Long term planning required. Retroactive action more moderate.
Breadth of impact	Wide. Heavily influences the health of other resources.	Wide. Water does not just impact MD/E, other species benefit.	Wide. 63% of watersheds in the Four Corners region are in the >25 th percentile of road density.
Benefits	Greatly increases adaptive capacity of Mule Deer/Elk.	Greatly increases adaptive capacity of Mule Deer/Elk. Increases resilience to fire.	Greatly reduces the Sensitivity of Mule Deer/Elk populations.
Barriers	Cost, agreement between agencies, workforce capacity, interjurisdictional issue.	Cost, agreement between agencies, workforce, interjurisdictional issue, landowner buy in.	Cost, agreement between agencies, workforce, interjurisdictional issue, landowner buy in.
Next Steps	Look at these issues in context to other resource priority action items and identify overlap.	Same as action 1	Same as action 1

Pinyon-Juniper Ecosystems

Table 5. Top three actions for Pinyon-Juniper Woodlands in Four Corners and Upper Rio Grande.

	<u>Four Corners</u>			<u>Upper Rio Grande</u>		
	Action 1- Support peer-reviewed publication(s) to synthesize/review info on PJ restoration, environmental suitability, mechanical/Rx burn treatments & BMPs (consider mirroring Romme et al. framework)	Action 2- Develop stand- to landscape-scale current/desired conditions and spatially-explicit priority treatment areas leveraging PJ VA	Action 3- Increase scale and effectiveness of mechanical treatments (e.g. thinning, fuel reduction, fuel breaks ,etc.), incl. effectiveness monitoring	Action 1: Implementation. Identify management strategies for the conservation of PJ communities to minimize the detrimental impacts of fire, insects, disease, and drought.	Action 2: Planning. Map current and desired future conditions	Action 3: Coordination. LCC host annual meeting with URG stakeholders to increase communication to encourage knowledge sharing and collaboration
Time-frame	FY18-19	FY19-23 (contingent on Action 1)	FY23-100 (contingent on Action 2)	Annual treatments/projects; Ongoing	1-3 years	1-3 years
Breadth of impact	Needed for subsequent actions for PJ and other focal resources- contingent upon PJ type(s) and geographic focus	Can help inform resource planning and management across multiple jurisdictions	Ecosystem-level	Conservation of PJ. Industry. Research. Management (fire, grazing, wildlife, vegetation, insect, pests, invasives)	Conservation of PJ. Management (fire, grazing, wildlife, vegetation)	WUI; Public Health and Safety; Watershed Health; Landscape Integrity; Landowners; Social/Economic Relationships
Benefits	Relatively low cost and can be leveraged for other actions	Identifies cohesive, scientifically-based, shared vision and approach towards PJ conservation	Reduces fire risk, droughts stress, disease/insect impacts; benefits associated resources	Conservation of PJ. Improved forest health. Economic and Social benefits – fuel wood/timber industry.	Help prioritize management activities. Economic benefits	Multiple Sectors, Economic benefits

	<u>Four Corners</u>			<u>Upper Rio Grande</u>		
	Action 1- Support peer-reviewed publication(s) to synthesize/review info on PJ restoration, environmental suitability, mechanical/Rx burn treatments & BMPs (consider mirroring Romme et al. framework)	Action 2- Develop stand- to landscape-scale current/desired conditions and spatially-explicit priority treatment areas leveraging PJ VA	Action 3- Increase scale and effectiveness of mechanical treatments (e.g. thinning, fuel reduction, fuel breaks ,etc.), incl. effectiveness monitoring	Action 1: Implementation. Identify management strategies for the conservation of PJ communities to minimize the detrimental impacts of fire, insects, disease, and drought.	Action 2: Planning. Map current and desired future conditions	Action 3: Coordination. LCC host annual meeting with URG stakeholders to increase communication to encourage knowledge sharing and collaboration
Barriers	Information gaps, securing funding	Information gaps, lack of stakeholder engagement (states, private, etc.), desired conditions partially contingent upon qualitative/ value-based judgements, see next action	Funding, markets, planning/permitting / compliance, ownership	FUNDING. Lack of agreement. Capacity	Funding. Capacity. Uncertainties. Inappropriate application of data	Funding; Institutional barriers; Policies
Next Steps	Identify funding sources amongst agencies- possibly administer via CESU/IAGs	Engage LCCs to convene/lead, ID/engage most appropriate state agencies (e.g. forestry vs wildlife), BLM, etc.	Get funding, markets, planning/permitting /compliance in place	Develop a Clearinghouse/ Network for Funding Opportunities/RFPs. Collaborative, on-the-ground work party. Research Synthesis. Promote economic opportunities/ideas.	Research synthesis of NRV, stand structure, disturbance regime, landscape patterns; Lidar mapping of current conds; Explore available spatial data – FIA, ESD, AIM, USGS, Tribe	Develop a PJ Working Group/Task Force of interested entities; Communications Group; Communications Agreements; Generate Resource/User Tools

Coldwater Native Fish

The breakout group for Four Corners opted to present their report out to the larger group in an oral format and did not fill out a table for this exercise. They presented the following three actions:

Action 1 – Develop an appropriately sized tool, between the regional (4 Corners) and reach (CAMF) scale, to identify and prioritize clusters of native fish “strongholds”

Action 2 – Define mutually beneficial upland management for native fish, watershed health, water quality, and other resource concerns.

Action 3 – Monitoring – Develop a plan to monitor the effects of management actions.

Table 6. Priority actions for native cold water fish in the Upper Rio Grande Focal Area.

	Action 1. Presence/absence monitoring of beavers to inform outreach for reintroduction or implement non-beaver alternatives	Action 2. Identify priority watersheds and assess current hydrological condition/connections	Action 3. Ground-truth current riparian vegetation conditions and implement restoration (i.e. exclosures and drinkers)
Time-frame	Begin immediately, can complete most of the work within 5 years	Begin immediately, can complete most of the work within 5 years	Begin immediately to develop partnerships complete implementation in 7 to 10 years
Breadth of impact	If beaver are reintroduced or analogs are constructed, multiple watershed resources will benefit	Can be used to implement resource management in a holistic fashion	Immediate and broad impact to hydrology, fish and wildlife
Benefits	Monitoring will provide a good Science scientist opportunity, can apply iNaturalist	Existing analyses can be used to inform future efforts and develop priorities; integrated approach to watershed manage; results can be used a funding vehicle for watershed restoration	These activities complement beaver reintroduction, improvements in hydrological function, water quality, water security; improvements in livestock health

Barriers	Tree identification skills are necessary for monitoring; funding and organization necessary to coordinate volunteers; coordination with private landowners presents logistical challenges	It may be difficult to develop capacity among various managers and researchers; much of this work has been done, so there is a risk of redundancy	Funding is necessary for fieldwork and restoration; cooperation with permittees can be a challenge
Next Steps	Develop a strategic plan, protocols, and educational materials to share with landowner groups conservation organizations, and users; create and iNaturalist project	Organize the groups to build structured capacity; identify goals; develop a monitoring plan to ensure that cooperators are aware of the benefits	Develop partnerships; identify measurement indices and restoration goals; build shovel-ready project descriptions to obtain funding on short notice

Riparian Corridors

Table 7. Priority Actions for riparian corridors within the Four Corners and Upper Rio Grande Focal Areas.

Action	<u>Four Corners</u>			<u>Upper Rio Grande</u>		
	Action 1: Public Outreach: inform them of riparian importance to ecosystem services and the threats they face (impacts from recreation, roads, etc.)	Action 2: Restoration (riparian/river/springs restoration)	Action 3: Strengthen and Build Capacity of Stakeholders/Partnerships	Action 1. Identify measures of conditions that are appropriate to scale of concern that can be used to identify degraded riparian conditions at reach specific scales	Action 2. Identify priority treatment areas to reduce impacts of wildfire through assessments	Action 3. Implement treatments
Time-frame	Immediate & ongoing	Immediate & ongoing	Immediate & ongoing	Immediate (2017-2018)	Follows action 1 but begin conversations soon.	Follows action 2
Breadth of Impact	Both in the San Juan & Little Colorado River Basins; Benefits multiple resources within watersheds.	Depends on scale: local to watershed. Benefits many resources.	Benefits multiple resources	Broadly applicable to other resources & wildlife, benefits multiple stakeholders	Wholereach. Broadly applicable to other resources & wildlife, benefits multiple stakeholders	Whole-reach, broadly applicable to other resources & wildlife, benefits multiple stakeholders
Benefits	Provide educational materials to multiple parties, & engage these parties in protection & restoration efforts. Reduce I& degradation. Maintain & restore intact, long-term riparian corridors.	Focus on areas that are win-win, low hanging fruit	Improved communication; pooling resources; potential for developing adaptive management protocols; leveraging	Water users, managers, facilitates reach level assessments, applicable to on ground treatments, low risk, relatively low cost	Whole reach, water users, managers, local communities	Whole reach, water users, managers, local communities

Action	<u>Four Corners</u>			<u>Upper Rio Grande</u>		
	Action 1: Public Outreach: inform them of riparian importance to ecosystem services and the threats they face (impacts from recreation, roads, etc.)	Action 2: Restoration (riparian/river/springs restoration)	Action 3: Strengthen and Build Capacity of Stakeholders/Partnerships	Action 1. Identify measures of conditions that are appropriate to scale of concern that can be used to identify degraded riparian conditions at reach specific scales	Action 2. Identify priority treatment areas to reduce impacts of wildfire through assessments	Action 3. Implement treatments
Barriers	Some people don't care. Money. Institutional controls.	Game plan & identifying areas to treat. Timing of treatments. Getting stakeholders to the table. L& access.	Multiple jurisdiction (engaging I& management agencies; Staffing & increased need for improved coordination	Buy-in issues, different definitions of desired future or degraded riparian conditions, support to implement	Buy-in issues, legal compliance regulatory constraints, I& ownership	Funding, compliance regulatory constraints, I& ownerships, side-effects to other resources
Next Steps	Establish volunteer groups. Identify groups currently do this type of work. Identify gaps, strengths, weaknesses & opportunities.	Identify areas that need to be restored. Reduce the development of new springs; modify existing spring developments (i.e. wildlife ramps)	Understanding roles & responsibilities of existing stakeholders & partners; social & GIS mapping of existing stakeholders/partners project areas	Outreach to relevant agencies/organizations to begin to get buy-in (go to local sites & present/discuss need). Find groups working on the ground & present this as an approach. Facilitate /support coordination between stakeholders to increase buy-in of smaller scale research & assessments	Begin conversations, survey existing prioritizations & assessments	Develop adaptive management/monit or plans

Appendix 1. Agenda

This is the final agenda presented to participants of the Upper Rio Grande Adaptation Forum. Several earlier versions were modified given feedback by planners and following the Four Corners forum. The original agenda included exercises on assessing uncertainty but the two day format proved insufficient to complete these exercises and they were eliminated from the final agenda. Appendix 5 contains the original presentation covering uncertainty.

Upper Rio Grande Adaptation Forum Workshop September 6-7, 2017 Agenda (draft)

**Kachina Lodge
413 Paseo del Pueblo Norte
Taos, New Mexico**

Wednesday, September 6, 8:30am-5pm

8:30–9:00 **Welcome, Introductions, Agenda**
Kevin Johnson, SRLCC Coordinator
John Rice, SRLCC Science Coordinator

Session I. Setting the Stage

9:00–10:00 **Introduction to Landscape Conservation Design**
Kevin Johnson, SRLCC Coordinator

10:00–10:40 **Break**

10:40–11:20 **Linking Vulnerability Assessments to Conservation Action**
Molly Cross, Wildlife Conservation Society

11:20–11:40 **Workshop Objectives and Expected Outcomes**
Megan Friggens, USFS Rocky Mountain Research Station

11:40–12:50 **Lunch:** On your own

Session II. Reviewing Vulnerability Assessments

Breakout Group Leaders: Megan Friggens, Max Smith, and Mary Williams - USFS Rocky Mountain Research Station; Tzeidle Wasserman - Northern Arizona University

Breakout Groups: Riparian, Native Fish, Mule Deer and Elk, Pinyon-Juniper

- 12:50–1:20 **Presentation:** Vulnerability assessments, framework, components, outputs, and use
- 1:20–3:00 **Breakout Groups I:** Review assessment inputs and results. Explore data and consider maps showing threats, sensitivity, and adaptive capacity.

Session III. Evaluating Vulnerability Assessments

- 3:00–3:20 **Presentation:** Evaluation of assessment results and uncertainty
- 3:20–4:10 **Breakout Groups II:** Evaluate assessment results
- 4:10–4:50 **Shareback:** General impressions of vulnerability assessment results
- 4:50–5:00 **Next Steps:** Outline for tomorrow
-

Thursday, September 6, 8:00am-4:30pm

- 8:00–8:15 **Welcome, Review, Agenda**
John Rice, SRLCC Science Coordinator
Megan Friggens, USFS Rocky Mountain Research Station

Session IV. Identifying Conservation Opportunity Areas

- 8:15–8:30 **Introduce Tasks**
- 8:30–9:45 **Breakout Groups III:** Review work from yesterday work and begin to identify priority areas or vulnerabilities within the landscape.
- 9:45–10:15 **Report Out:** Identify priorities or vulnerabilities
- 10:15–10:30 **Break**
- 10:30–11:30 **Breakout Groups IV:** Using assessments to identify conservation priorities for research and management actions.
- 11:30–12:00 **Group Discussion:** Shared conservation and restoration priorities.
- 12:00–1:15 **Lunch:** On your own

- 1:15–3:30 **Breakout Groups V:** Identify collaborative actions or needs that address specific threats or facilitate specific actions.
- 3:30–4:10 **Shareback:** Results of today’s discussions
- 4:10–4:30 **Conclusions and Next Steps**

Appendix 2. Workshop Materials

Upper Rio Grande Adaptation Forum- Day 1 Exercise Materials

Welcome to the second in our series of Adaptation Forums! Over the next two days, we will engage with a variety of exercises and discussions to increase user familiarity with several vulnerability assessment products and set the stage to collaboratively develop conservation strategies. During day one, we assess the assessments and determine what these results mean for individual focal resources. On day two, we continue the discussion and identify next step actions based on what we learned during our first day.

Packet Materials

- ✓ **Summary, Tables, and Maps for Focal Resource Vulnerability Assessment**
- ✓ **Exercise I. Reviewing Vulnerability Assessment Results**
 - **Assessing Exposure Worksheet**
 - **Assessing Sensitivity Worksheet**
 - **Assessing Adaptive Capacity Worksheet**
 - **Assessing Vulnerability Worksheet**
- ✓ **Report out Table**

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## DAY 1

### Session II. Reviewing Vulnerability Assessments

#### *Breakout Groups I*

**Purpose:** To review assessment inputs and results; become familiar with the data and format; identify strengths and needs of analysis. Use these exercises to explore data and begin the process of identifying which data are most important with respect to your management priorities.

**Task:** Group discussion and mapping exercise for each vulnerability element (exposure, sensitivity, adaptive capacity) and overall vulnerability map results. **Take last 5-10 minutes to summarize discussion on report out table for Day 1.**

We provide four worksheets in this packet for your notes. Each worksheet is comprised of two parts:

- 1) Discussion questions. Do these results relate to your research or management activities? Use this discussion to learn about what others are doing in the field to manage the focal resource.
- 2) Urgent/Important Grid. For each indicator, the group determines where each indicator falls on the urgent/important grid. This exercise is based on a classic time management tool and assists with group prioritization. Through this activity you will consider the relative importance of indicators and identify common or different priorities among breakout group members.

#### **Important Terms**

**Indicator-** A dataset used to measure an aspect of a vulnerability Element

**Element-** Term used to refer to Exposure, Sensitivity and Adaptive Capacity

**Vulnerability-** Vulnerability considers the collective impact of Exposure to a threat, potential response or Sensitivity to that Exposure, and the Adaptive capacity or ability to cope with that impact

**Exposure:** External threat to target species, system or place (e.g. wildfire, heat waves, drought)

**Sensitivity:** Qualities that make target resource more susceptible to negative impacts from disturbance (e.g. some species are more sensitive to wildfire)

**Adaptive Capacity:** The ability of target resource to cope with disturbance or threat. These may be intrinsic (species traits) or external properties (potential for management success).

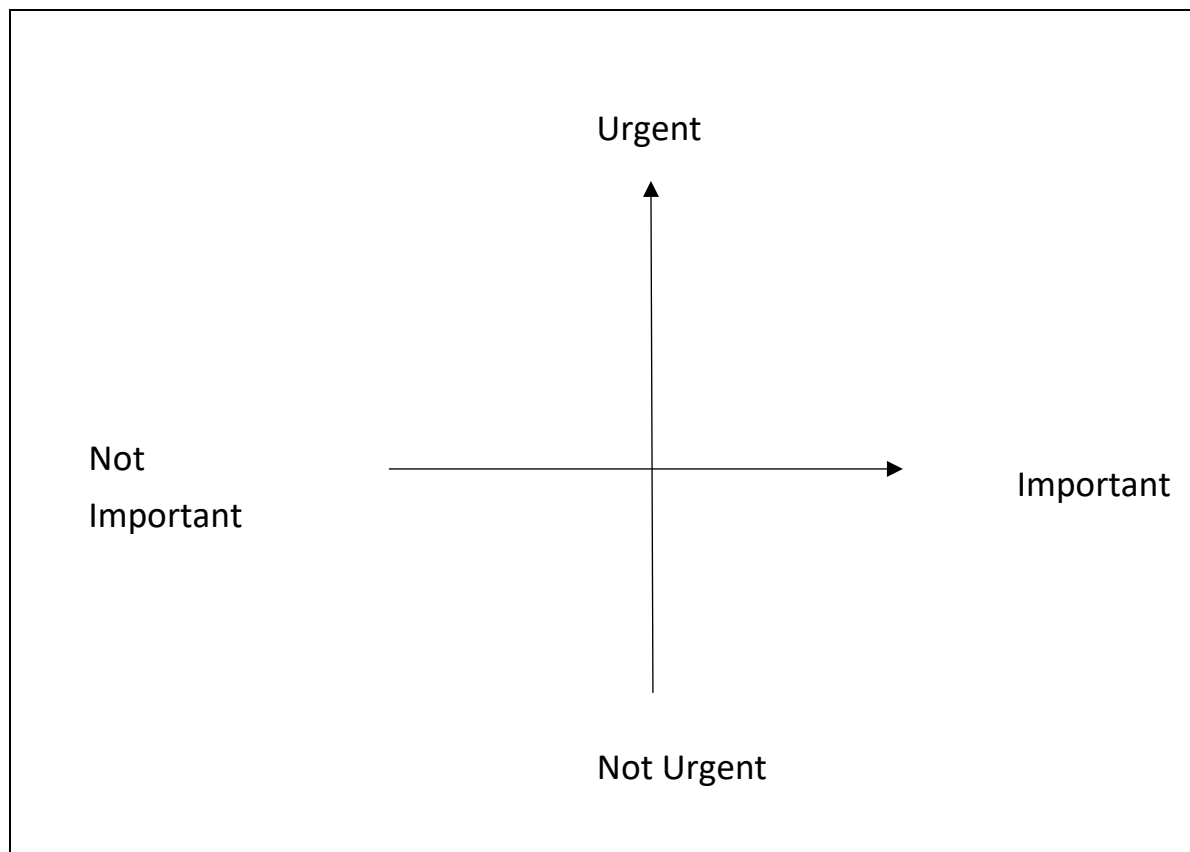
**WORKSHEET 1A. EXPOSURE.** Exposure relates to the degree to which your focal resource is exposed to an external threat. If needed, take a few minutes to review the maps and tables related to the Exposure measures. Discuss:

Q1. General impressions. Do the indicators used to measure Exposure completely represent potential threats for this focal resource? What is missing? What, if anything, would you remove?

Q2. Are there ongoing activities (research or management) related to any of these indicators?

Q3. What do these results suggest with respect to your work? Are there surprises?

Q4. Consider each indicator of Exposure. Where do they lie on this grid with respect to having a potential impact on the focal resource?



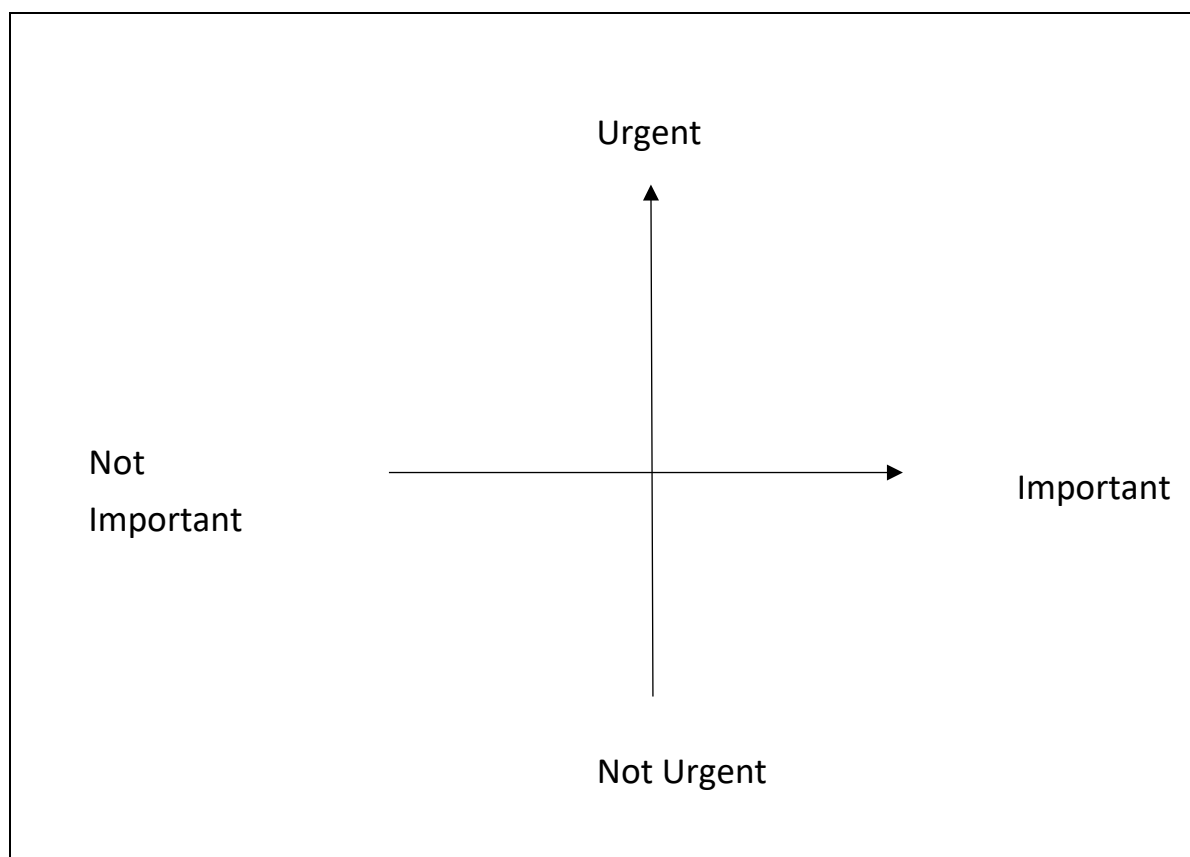
**WORKSHEET 1B. SENSITIVITY.** Sensitivity relates to qualities that make target more susceptible to negative impacts from disturbance. If needed, take a few minutes to review the maps and tables related to the Sensitivity measures. Discuss:

Q1. General impressions. Do the indicators used to measure Sensitivity completely represent the potential susceptibility of this focal resource? What is missing? What, if anything, would you remove?

Q2. Are there ongoing activities (research or management) related to any of these indicators?

Q3. What do these results suggest with respect to your work? Are there surprises?

Q4. Consider each indicator of Sensitivity for the focal resource. Where would you place each indicator considering its potential for predicting or contributing to a negative response to a threat or issue?



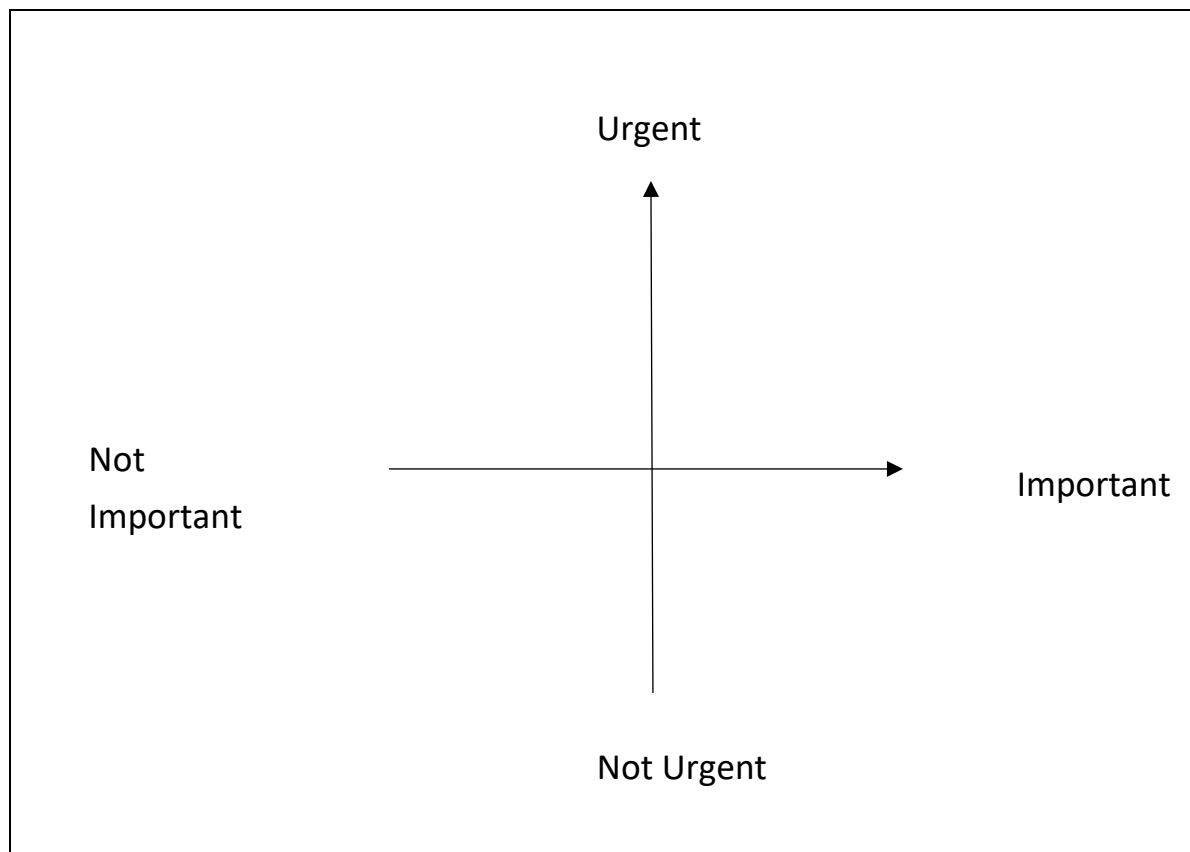
**WORKSHEET 1C. ADAPTIVE CAPACITY.** Adaptive Capacity relates the ability of target to cope with disturbance or threat. If needed, take a few minutes to review the maps and tables related to the Adaptive Capacity measures. Discuss:

Q1. General impressions. Do the indicators used to measure Adaptive Capacity completely represent the potential coping capacity or resilience of this focal resource? What is missing? What, if anything, would you remove?

Q2. Are there ongoing activities (research or management) related to these indicators?

Q3. What do these results suggest with respect to your work? Are there surprises?

Q4. Consider each indicator of Adaptive Capacity. Where would you place each indicator considering its capacity to help resource resistance or recovery?

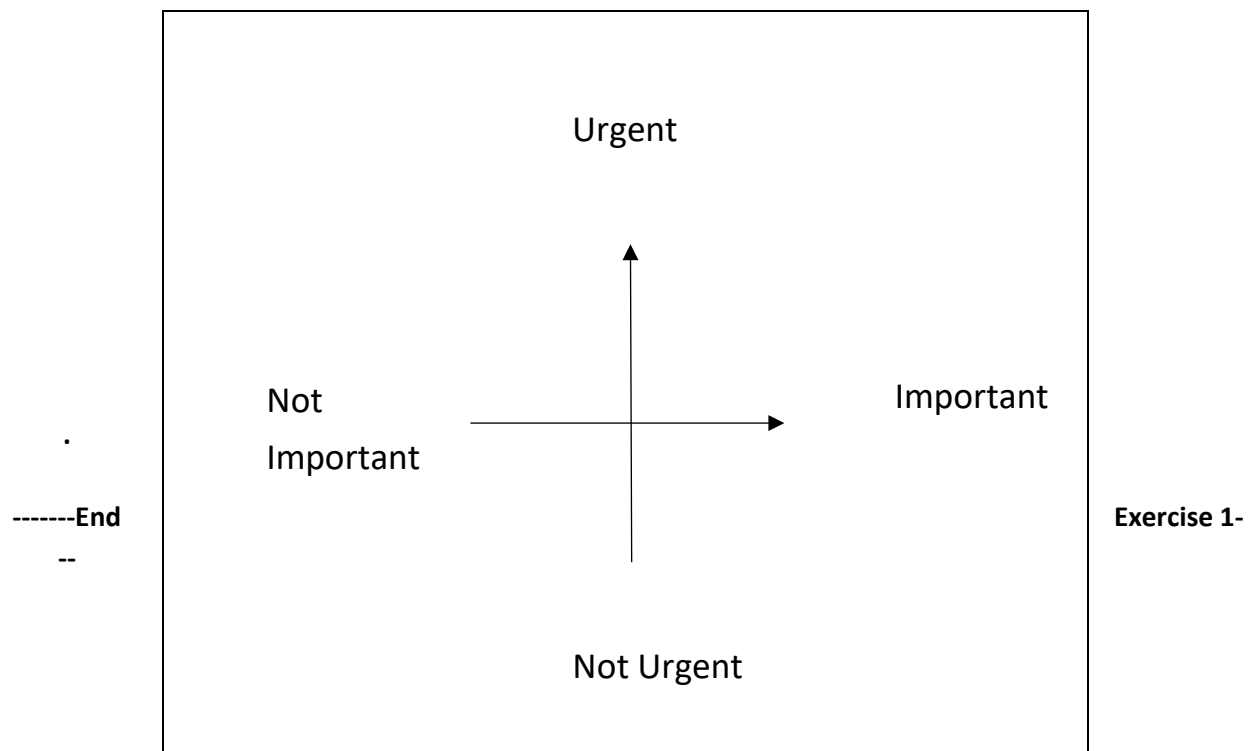


**WORKSHEET 1D. VULNERABILITY.** If needed take a few minutes to review the maps and tables related to vulnerability.

Q1. Consider the overall results. What do areas of high vulnerability have in common? What do areas of low vulnerability have in common?

Q2. Considering the individual elements of vulnerability, which might provide the most useful information for identifying management needs or targets?

Q3. Consider where Exposure, Sensitivity and Adaptive Capacity would lie on the Important/ Urgent grid with respect to management need. Where do these elements fall on this grid with respect to potential management success?



## EXERCISE 2A.

[Please see Appendix 5 for complete review of this exercise. We did not complete this exercise during adaptation forums due to time limits]

### Session III. Evaluating Vulnerability Assessments

#### *Breakout Groups II*

Uncertainty is pervasive, unavoidable and can act as a barrier to implementing conservation actions. To reduce the impact of uncertainty we must 1) Identify sources of Uncertainty 2) Reduce it where possible 3) Acknowledge or manage unavoidable uncertainty. In our presentation, we talked about sources of uncertainty and common approaches used in decision making processes to deal with uncertainty. During this breakout session we will work to identify the sources and relevance of uncertainties within these vulnerability assessments. These discussions will be relevant on day two when begin to identify potential actions.

Assessing uncertainty can take many forms. The following presents one way to consider the uncertainty within the focal resource vulnerability assessment. Specifically, discuss uncertainties related to the underlying data, the assessment process, and potential for management solutions. We have calibrated uncertainty along a spectrum of confidence. Consider each statement and note for your indicators your confidence that the statement is true. **Take the last 5 minutes of this session to summarize discussion on report out table for Day 1.**

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Summarize Day 1 discussions with the following report out table. You can choose to use/display this slide or not during the shareback.

What were some of the most urgent or important indicators or vulnerability elements?	
What were some of the least important indicators or elements of vulnerability?	

----End Day 1---

DAY 2

Four Corners Adaptation Forum- Day 2 Exercise Materials

Welcome Back!

Today we will build on yesterday's work and begin to identify conservation priorities. Potential priorities may address uncertainties identified in yesterday's discussion, may target individual vulnerability elements, or may focus on specific localities or geographic areas identified by assessment results.

Packet Materials

- ✓ **Summary and Maps from Day 1.**
- ✓ **Exercise III. Identify Needs and Opportunities**
 - **Guidelines for Activity 3a**
 - **Table for Activity 3b**
- ✓ **Exercise IV. Identify Actions or Strategy**
 - **Guidelines for discussion for 4a**
 - **Activity Guidelines for 4b**
- ✓ **Exercise V. Prioritize Actions**
 - **Guidelines for final prioritization 5a**
- ✓ **Report out table**
- ✓ **Brainstorming Worksheet (optional)**

Session IV. Identifying Conservation Priorities and Actions

Breakout Groups III: Identify Needs and Opportunities

In this session, we consider your focal resource vulnerability maps and previous day's discussion and brainstorm priority needs or conservation priorities. During the last 15 minutes, we will walk around to explore what other breakout groups are discussing.

EXERCISE 3A. Identify priorities based on assessment results. These priorities may relate to management strategies to reduce vulnerability or address knowledge gaps. Your group goal is to identify at least 5 priorities. Take about 30 minutes to review:

1. Vulnerability maps and vulnerability elements. Are there key vulnerabilities?
 - a. Do we need to reduce Exposure? Sensitivity? Do we need to focus on increasing Adaptive Capacity?
 - b. Can we identify a particularly important geographic area(s)?
2. Discussions from yesterday.
 - a. Which indicators are most urgent or important to address?
 - b. Where is the greatest certainty and potential for success? Where is the greatest uncertainty and need for additional research or assessments?

EXERCISE 3B. Assess Priorities. For each priority discuss its range of benefits and potential barriers or opportunities related to achieving that priority. If you are taking notes by hand make sure to save time to fill out powerpoint slide (available on thumbdrive).

Need	Benefits	Barriers	Opportunities

PART 3C. During the last 15 minutes, we will walk around to view work of other groups.

-----End Exercise 3-----

Breakout Groups IV: Identify Conservation Priorities

Purpose: During the first part of this session, you will focus on 1-3 top conservation priorities. During the second part of this session, each group will brainstorm actions to address their priority

EXERCISE 4A. Identify 1-3 priorities (suggested time 30 minutes) and prepare for group activity (suggested time 15 minutes). For each top priority, create a priority statement on a flip chart sheet. This statement should be specific enough that someone outside your group can understand the priority. Try to address the What, Where, When and Why of the priority.

EXERCISE 4B. Group Activity. Identify a suite of actions for achieving priority.

We will get up and moving by using ideastorms to identify a suite of potential actions for achieving conservation goal or addressing priority need. Actions may relate to conservation, restoration, research, or further assessments.

The purpose of this activity is to think big. In our final session this afternoon, we will use the results of this activity to create a summary of the focal resource priority needs and actions. To begin the ideastorm, station at least 2 participants at each conservation priority display. Each group will have a timed period to brainstorm specific actions that may be used to achieve the priority need. Write these actions on the flipchart. After the time is up, each group moves to the next priority and brainstorms potential actions for new priority. Groups continue to move around to new priorities until time is up.

Conservation Priorities or Need- We use this term to refer to goals or objectives that identify a high priority geography or address one or more drivers of vulnerability. Priorities or needs may also relate to knowledge or assessment gaps.

Management Actions- This is similar to adaptation actions but we use a more generic term to encourage the broadest consideration for each focal resource. Useful examples of adaptation approaches that address multiple stressors in addition to climate change include: Reducing non-climate stressors, protecting/enhancing key ecosystem features, ensuring connectivity, restore function and structure, support evolutionary potential, protect refugia, relocate organisms

Break

EXERCISE 4C. Evaluate Actions generated during ideastorms. In this session, you will evaluate actions and identify best opportunities for collaboration or research for each priority need. Over the next hour, discuss the potential actions and then **pick your favorite and fill out table below**. If you are taking notes

by hand, please take the last 10-15 minutes to summarize your discussion in the powerpoint slide of the report out table. We will use these slides for our final shareback.

Report out table (available on thumbdrive):

	Time-frame	Breadth of impact	Benefits	Barriers	Next Steps
Action 1					
Action 2					
Action 3					

Time Frame- short term versus long term planning, immediate versus delayed implementation.

Breadth- Does this action influence other resources? Resource goals? Issues and threats?

Benefits- Targets critical need, degree of success, avoids risk, benefits multiple sectors, Low potential for failure

Barriers- Institutional, Time, Money, implementation

Next Steps- Research, working groups, develop strategic plans, adaptive management forum

Appendix 3. Attendees

Table 1. Participants at the 2017 Southern Rockies Landscape Conservation Cooperative Adaptation Forums

Forum	First Name	Last Name	Email	Break out Group
2017 Four Corners Adaptation Forum Workshop	Noah	Barstatis	nbarstat@southernute-nsn.gov	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Pam	Benjamin	pamela_benjamin@nps.gov	Riparian
2017 Four Corners Adaptation Forum Workshop	Marcie	Bidwell	marcie@mountainstudies.org	Riparian
2017 Four Corners Adaptation Forum Workshop	John	Bradford	jbradford@usgs.gov	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Page	Buono	page@mountainstudies.org	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Todd	Chaudhry	todd_chaudhry@nps.gov	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Margie	Connolly	mconnolly@utemountain.org	Riparian
2017 Four Corners Adaptation Forum Workshop	Anthony	Culpepper	anthony@mountainstudies.org	Native Fish
2017 Four Corners Adaptation Forum Workshop	Jim	Dyer	jadyer@frontier.net	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Emile	Elias	emile.elias@ars.usda.gov	Riparian
2017 Four Corners Adaptation Forum Workshop	Megan	Friggens	meganfriggens@fs.fed.us	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Brian	Gideon	bgideon@southernute-nsn.gov	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Melissa	Greulich	mgreulich.cec@gmail.com	Mule Deer/Elk
2017 Four Corners Adaptation Forum Workshop	Garrett	Hanks	ghanks@tu.org	Native Fish

Adaptation Forum Workshop				
2017 Four Corners Adaptation Forum Workshop	Shannon	Hatch	shatch@tamariskcoalition.org	Riparian
2017 Four Corners Adaptation Forum Workshop	Cerissa	Hoglander	choglander@grandcanyontrust.org	Riparian
2017 Four Corners Adaptation Forum Workshop	Kevin	Johnson	kevin_m_johnson@fws.gov	Mule Deer/Elk
2017 Four Corners Adaptation Forum Workshop	Emma	Kelly	ekelly159@gmail.com	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Aaron	Kimble	akimble@mountainstudies.org	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Mary	McFadzen	mmcfadzen@montana.edu	Pinyon-Juniper
2018 Four Corners Adaptation Forum Workshop	Ann	Oliver	annsoliver@gmail.com	
2017 Four Corners Adaptation Forum Workshop	Robin	O'Malley	romalley@usgs.gov	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Dave	Park	dpark@usbr.gov	
2017 Four Corners Adaptation Forum Workshop	John	Rice	jrice@usbr.gov	Riparian
2017 Four Corners Adaptation Forum Workshop	Duncan	Rose	tduncan.rose@gmail.com	Native Fish
2017 Four Corners Adaptation Forum Workshop	Richard	Rymerson	rrymerson@fs.fed.us	Mule Deer/Elk
2017 Four Corners Adaptation Forum Workshop	Tami	Sheldon	tsheldon@usbr.gov	Riparian
2017 Four Corners Adaptation Forum Workshop	Max	Smith	davidmsmith@fs.fed.us	Riparian
2017 Four Corners Adaptation Forum Workshop	Ryan	Swazo-Hinds	rswazohinds@pueblooftesuque.org	Mule Deer/Elk

Workshop				
2017 Four Corners Adaptation Forum Workshop	Gloria	Tom	gtom@nndfw.org	Pinyon-Juniper
2017 Four Corners Adaptation Forum Workshop	Deborah	Tosline	dtosline@usbr.gov	Riparian
2017 Four Corners Adaptation Forum Workshop	Tzeidle	Wasserman	Tzeidle.Wasserman@nau.edu	Mule Deer/Elk
2017 Upper Rio Grande Adaptation Forum Workshop	Loren	Arkie	larkie@sandiapueblo.nsn.us	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Carolynn	Begay	cbegay@nndfw.org	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	John	Bradford	jbradford@usgs.gov	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Benina	Cerno	bcerno@lagunapueblo-nsn.gov	Mule Deer/Elk
2017 Upper Rio Grande Adaptation Forum Workshop	Megan	Friggens	meganfriggens@fs.fed.us	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Randy	Ghormley	rghormley@fs.fed.us	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Garrett	Hanks	ghanks@tu.org	Native Fish
2017 Upper Rio Grande Adaptation Forum Workshop	Jonathan	Hayes	jonathan_hayes@fws.gov	Native Fish
2017 Upper Rio Grande Adaptation Forum Workshop	Emma	Kelly	ekelly159@gmail.com	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Aaron	Kimble	akimble@mountainstudies.org	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Mary	McFadzen	mmcfadzen@montana.edu	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Toner	Mitchell	tmitchell@tu.org	Riparian

2017 Upper Rio Grande Adaptation Forum Workshop	Cynthia	Naha	cnaha@kewa-nsn.us	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Jason	Remshardt	wremshardt@fs.fed.us	Native Fish
2017 Upper Rio Grande Adaptation Forum Workshop	John	Rice	jrice@usbr.gov	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Peter	Rich	prich@fs.fed.us	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Virginia	Seamster	virginia.seamster@state.nm.us	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Max	Smith	davidmsmith@fs.fed.us	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Peter	Vigil	pvigil@tswcd.org	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Tzeidle	Wasserman	Tzeidle.Wasserman@nau.edu	Mule Deer/Elk
2017 Upper Rio Grande Adaptation Forum Workshop	Jim	Wilber	jwilber@usbr.gov	Riparian
2017 Upper Rio Grande Adaptation Forum Workshop	Valerie	Williams	vawilla@blm.gov	Pinyon-Juniper
2017 Upper Rio Grande Adaptation Forum Workshop	Mary	Williams	maryirene75@gmail.com	Pinyon-Juniper

Appendix 4. Discussion Notes

Four Corners Adaptation Workshop

Breakout Group: Mule Deer/Elk

Facilitator: Tzeidle Wasserman

Assistant: Kevin Johnson

Notetaker: Emma Kelly

In Attendance: Melissa Greulich (Independent Contractor), Ryan Swazo-Hinds (Pueblo of Tesuque), Rick Rymerson (USFS-Carson NF), Emma Kelly (BOR/Chama Peak Land Alliance)

DAY 1

Session II. Reviewing Vulnerability Assessments

Conversation Notes:

Potential to divide HUCs up by heard management units etc. Using Vulnerability Assessment in the context of heard management units – VA's to inform management decisions.

(Ryan) He was recently funded to do a mule deer study on Tesuque Pueblo

Difficult to communicate to people/agencies the intricacies of the mapping.

Data is meant to be collaborative, intended to aid in decision making, not a hammer/knife to tell an agency what to do.

Specifically to Forest Service, this type of information is needed early so that planning can happen around it.

Need an impact (E+S) map

Worksheet 1A. EXPOSURE.

Q1. General impressions. Do the indicators used to measure Exposure completely represent potential threats for this focal resource? What is missing? What, if anything, would you remove?

Potentially missing datasets:

Crash data (#7)

Disturbance events data (high intensity fire) (#11)

Recreation data?

Potentially need threshold of wells for Energy Development, currently only accounts if there is at least one well present (Range of 1-750, could be segmented).

Would it make sense to parse out exposure into gradients? No, each watershed has a different area, very difficult to standardize.

In the Cumulative Exposure map, is there a way to click on an individual HUC to see its compilation of scores? Not right now, easier to look at the individual HUC in the coded data maps

Q2. Are there ongoing activities (research or management) related to any of these indicators?

Q3. What do these results suggest with respect to your work? Are there surprises?

Not really any surprises. Multi-use is relevant for all of our agencies.

Q4. Consider each indicator of Exposure. Where do they lie on this grid with respect to having a potential impact on the focal resource?

Grid notes on group flipboard.

WORKSHEET 1B. SENSITIVITY.

Q1. General impressions. Do the indicators used to measure Sensitivity completely represent the potential susceptibility of this focal resource? What is missing? What, if anything, would you remove?

Potentially missing:

Snow pack data on a year to year basis #8

Migration routes/movement data- could also be Adaptive Capacity? #9

Survival data #11

Discussion on winter and summer range data – seeing that most of the four corners region has year round range (specifically AZ). These two data sets that gets taken out of overall vulnerable assessments. Can skew final results if all additive.

Is summer/winter range a limited capacity? Winter more important than summer

The use of this data is limited in relevance to this landscape

Need to investigate imperviousness indicator – redundant data?

Q2. Are there ongoing activities (research or management) related to any of these indicators?

Q3. What do these results suggest with respect to your work? Are there surprises?

Q4. Consider each indicator of Sensitivity for the focal resource. Where would you place each indicator considering its potential for predicting or contributing to a negative response to a threat or issue?

Grid notes on group flipboard.

WORKSHEET 1C. ADAPTIVE CAPACITY.

Q1. General impressions. Do the indicators used to measure Adaptive Capacity completely represent the potential coping capacity or resilience of this focal resource? What is missing? What, if anything, would you remove?

Does not take tribal lands into account. Include tribal lands that have made specific land protection measures.

Survival data

Q2. Are there ongoing activities (research or management) related to any of these indicators?

Paul Luckas – Survival Data

Q4. Consider each indicator of Adaptive Capacity. Where would you place each indicator considering its capacity to help resource resistance or recovery?

Grid notes on group flipboard.

DAY 2

Session IV. Identifying Conservation Priorities and Actions

Breakout Groups III. Identify Needs and Opportunities

What do each of our agencies/groups need from this?

(Ryan) We've been funded by BIA to study climate change etc. But not funded to produce a product. Trying to gather resources, filter through all of the resources. Visited OSU and NAU for trainings. Too much information! Where do you begin? Framework/template – identify what's at stake for the tribe: food, water etc. We get climate change assessments etc. but then what to do?

Molly Cross could go into her methodology – framework to take information and translate that into action

How do you interpret complex mapping? Need it at the scale of the Tribe – within specific watershed etc.

(Ryan) 150k acres, 100% leased – oil and gas. With priority and valid existing leases, how do we interpret impacts to deer/elk from oil and gas development? Need teeth to request protections. Leases are already purchased – implementing new restrictions on them are almost impossible

Is FS requiring permittees to help mitigate effects on species? You can, at permittee's willingness – historical cultural value especially paid attention to.

Need to look at boarder areas to our jurisdiction, Jicarillas etc.

Hard to make the data meaningful – maybe focus on threshold variables more

Weighting indicators? Finer resolution potentially needed

Apply at landscape and then on a watershed basis – must be binary for each HUC 12

How do we tease out data within each watershed?

Sensitivity a real concern in this region (based on the issues)

(Melissa) Not really affiliated with a specific group. How could CPW use this in their planning – this resource is a great way to quantify effects. Now, how do we get on the ground – implementation ideas! Works on stewardship plans for state parks. How to integrate into plans *as they're being created*. Data exists outside of the focal areas – exists for most of the southern Rockies.

(Emma)

Private data?

EXERCISE 3A.

Identify priorities based on assessment results.

CPLA and Carson regions both have high Adaptive Capacities, relatively low Exposure, Sensitivity is the issue here.

Vegetative cover as an indicator for Sensitivity cancels out it as an indicators for Adaptive Capacity?

Sensitivity as the main driver for our specific watersheds – can we deal with these issues at this scale? Or do we need to tease out data within each HUC 12?

Identify individual factors within each watershed?

Walked through process of identifying management suggestions for each of our region areas.

See table for project ideas.

Breakout Group: Pinon-Juniper Habitats

Notetaker: Todd Chaudhry

Day 1- 8/29/17

Megan Friggens- RMRS

Robin O'Malley- NCCSC

Aaron Kimple - MSI

Page Buono- MSI

Brian Gideon- S Ute Tribe

Noah Barstatis - S Ute Tribe

John Bradford- USGS

Todd Chaudhry- NPS

Gloria Tom- NNDFW

Exposure

- Mechanical disturbance might increase but also decrease exposure and/or sensitivity (e.g. via restoration thinning); may be worth looking into more- incl. change in land use

classifications of forests, other public, and private- based on '92 data and definition available very vague so low level of confidence or may be worth dropping completely

- Development good indicator- habitat loss/degradation, intro of exotics, disturbance to wildlife, etc.
- Should add energy development b/c not incl. in development layer
- Loss of GB woodland good indicator and also incl. in adaptive capacity
- Insect and disease good indicator
- Wildfire good indicator, can result in state changes since not getting good post-fire recruitment of PJ
- For adaptive capacity could try to ID areas where proactive post-disturbance restoration has a higher probability of success- conditions for success of recruitment/planting very different than survival of mature plants
- Road density associated with direct impacts but also leads to other impacts; need to find out if proxy for desire to incl. energy development and be mindful about not incl. too many redundant indicators for a given class (roads can also be useful re firebreaks and management access)
- Mean max temp used b/c hard to find good spatially predictions of drought b/c of impact on soil moisture, fire risk, etc.

Sensitivity

- Presence of associated wildlife species- why were meadow jumping mouse (riparian) and mexican spotted owl (mesic canyons/cliffs- more relevant in some parts of range than others) incl. with PJ habitat- may not be directly dependent for nesting but foraging/dispersal and fire risk are relevant; some debate about how good/important of an indicator
- Critical habitat good, falls in similar space as above
- Water capacity important
- Current intensity development
- Impervious surfaces affect hydrology etc. but consider dropping
- Mechanical disturbance- see caveats under exposure
- Missing some indicators not correlated with human disturbance or have too many of the latter- drop some or weight indicators to reduce bias
- Discussed if having cover threshold for PJ occurrence useful- could consider some below threshold as being potential good future habitat; decided it wasn't a great indicator for sensitivity as currently formulated

Adaptive Capacity

- Is a layer available to assess probability of suppression success? The converse of fire risk is available
- Discussed pros/cons of protected areas as an indicator; overall fewer anthropogenic impacts but complicated b/c some management actions may be harder to implement
- Gain in GB woodland highly relevant
- PJ cover also important

Vulnerability

- Sensitivity has a lot of uncertainty and harder to influence with management intervention b/c in part based on inherent traits (e.g. spp. physiology), but exposure and adaptive capacity (e.g. thinning) have more options
- Harder to think about vulnerability elements within urgent/important space- may be more useful to focus on potential management strategies
- Discussed best scale(s) to assess results and how to figure out next steps re potential management options- some mismatch b/w scale of assessment and scale of management (similar to other landscape products like LANDFIRE); may need to 'ground truth' low/high vulnerability watersheds with the land managers of those watersheds
- May be useful to do overlay with other focal resource VAs to see if coincident high vulnerability watersheds; Megan did one on the fly and some similarities emerging re Mogollon Rim, San Juan Basin etc.
- Navajo has PJ management plan for fire and habitat improvement but not prioritized so this could be useful
- Could try to figure out why some watersheds coming low or high within a given jurisdiction and figure out if it is possible to manage for factors pushing some into the high based on conditions in the low
- We are missing some key reps from BLM, Coconino NF, etc. that manage large areas coming up as high vulnerability

Overall Impressions

- Need to change some indicators; more confidence in exposure than sensitivity; may be worth considering a weighting scheme
- Is time frame of 2030-40s a good time frame- overall yes in terms of being able to get people's heads around the issue re immediacy, but important to game out further to see if it would change potential management strategies
- May be useful to discuss other elements of climate change adaptation re assisted migration etc. even though outside of the scope of this project (e.g. Tom Edwards work out of Utah State re predicting PJ distribution?)

- Can be used to ID research priorities re data gaps etc.
- Can help ID where to focus but doesn't provide actionable information b/c of mismatch in scales
- Multi-resource assessments like this can help land managers to think about watersheds and stressors within more ecosystem-based frameworks and potentially ID management interventions that could help multiple resources
- Can help to support funding requests- e.g. in funding proposals reference that high-priority watersheds identified by multi-resource participatory VAs via SRLCC
- Sensitivity hard to represent via indicators b/c mixes multiple concepts together and involves value judgements, traditionally better to represent at species scale (e.g. physiological traits); low available water capacity seemed to be best fit

Day 2- 8/30/17

Megan Friggens- RMRS

Robin O'Malley- NCCSC

Brian Gideon- S Ute Tribe

Noah Barstatis - S Ute Tribe

John Bradford- USGS

Todd Chaudhry- NPS

Gloria Tom- NNDFW

Reduce vulnerabilities

- Reduce fire, insects, disease (e.g. thinning to reduce competition/fire risk, fire breaks, good sanitation practices etc.)
- Use BMPs for forest management such as timing/location of thinning/piling to reduce probability of insects/disease (e.g. Ips beetle)
- Reduce GHG emissions (e.g. electric well pumps)
- Create mitigation measures in gas plan
- Support better post-closure restoration of gas pads
- Manage invasives
- Improve and enforce BMPs for gas pad development/closure
- Decommission unnecessary roads

Prioritize management

- ID and focus on HUC12s most likely to be suitable for PJ under CC (e.g. HUCs w/ high "B")
- Focus on HUC w/ less C or greater AWC

Knowledge Gaps

- Nail down criteria for ID most likely success
- Climate and edaphic research
- More info needed on PJ associated wildlife spp.
- Policies to reduce land impacts

Breakout Group: Cold Water Fish

Notetaker: Dave Hawksworth

Participants - Garrett Hanks, Anthony Culpepper, Duncan Rose

There was considerable debate, discussion, controversy, among this group as to which indicators and factors are most important to coldwater fish. They felt other factors that weren't considered could also be important. In their recently completed similar project on the Dolores River, they included many other variables to do their modeling. They were uncertain, however, if the results from one specific stream could be applied to the watershed as a whole.

Some felt that depending on what variables were chosen, the results would vary accordingly. They also felt the binary scoring system might not be the best choice on the theory that some variables are more important than others. They felt more important variables should be given greater weight (e. g., some variables might be scored as 1, 2 or 3 points, for example.)

The most important issue, by far, was introduction of non-native trout. Exotic brown, brook and rainbow trout pose the biggest threat to cutthroat trout due to their ability to outcompete with the natives. Other most important were changing forest types; wildfire vulnerability; stream flow and stream temperature.

They suggested STREAMSTAT from the USGS website as a very useful tool for information on stream flows, hydrology, etc.

Exposure indicators (Worksheet Table 1)

All of the variables listed in Table 1 were in the "Important and Urgent" category, except for Pollution Sources in Catchment and Nitrate/Ammonium deposition, which they rated as "Not Urgent/ Not important".

1. Pollution (such as leaking mines) could be important in specific cases, but only in the stream affected, not for the watershed as a whole.
2. Nitrate/Ammonium deposition would largely affect lower elevation warmer stream segments, not coldwater fisheries. However, some measure of water quality could be important.
3. Change in summer flow was the most important variable among those listed. A better descriptor variable might be change in low flow, as summer flow may not be the lowest flow of the year.

4. Road density by itself isn't as critical as what types of roads; how far they are from the river, etc. Perhaps a more refined road indicator would work better. Road density is also likely underestimated by datasets.

Sensitivity indicators (Worksheet Table 2)

1. Wildfire Hazard and Riparian departure were the only "Urgent and Important" Indicators. Wildfire for the dual reasons of reducing shade cover and increasing erosion/sedimentation.
2. Elevation and Dam Density were rated as "Important not Urgent", since generally there is not much that can be done to alter either of these conditions. Active water diversions rather the number of dams would be a better descriptor as this would include additional barriers to fish movement.
3. All of the fish variables were rated "Not Important/Not Urgent". The other sensitive, endangered and threatened native fish are generally in lower, warmer waters than coldwater fish. Native fish could be move to new areas where habitat conditions are (or become) suitable.

Adaptive Capacity Indicators (Worksheet Table 3)

The group was only able to partly complete this section before we ran out of time.

1. Water temperature predictions, riparian departure and shading were also considered to be "Urgent and Important". Also considered "Urgent and Important" were the related issues of stream flow and timing of peak flows.
2. Reservoir storage was rated "Important, not Urgent". Additional water supplies could be useful for protecting fish in those cases where they are available.
3. Beaver capacity was considered "Important, not Urgent" as they are very helpful in restoring streams to natural conditions.

DAY 2

Vulnerability Maps and Assessments

As with the first day, the conversation was wide-ranging and didn't necessarily follow the projected path. There was considerable disagreement on many issues, but these seemed to be the main points of the discussion.

Again they felt, the presence of non-native fish (especially trout) is the #1 concern for protecting native trout. Hydrological concerns (water temperature; stream flow; peak runoff, etc.) is the next most important issue. Again they suggested STREAMSTAT has useful

information on this. They also recommended WNTI (Western Native Trout Initiative?) for information regarding native fish vulnerability assessments.

Protection of native fishes is determined by two major goals: protecting the locations where native fish are still found and restoring other areas to conditions suitable for native fishes. A key is locating those areas where money can best be used to achieve these goals. Which watersheds can be improved most easily (HUCK 12 vs. HUCK 9 vs. HUCK 8 watersheds, for example). Or, is it better to protect areas with low impact or restore areas with high impact? It is critical to identify current strongholds of native fish and improve the diversity of habitat and connectivity of fish populations. This can best be achieved by:

1. Streams should be improved by the use of both in-stream and near-stream modifications such as planting willows, restoring beavers, or beaver dam analogs (drop logs, etc.). Slowing down streams is important for both improving wildlife habitat and making more water available for downstream users.
2. Increased or improved fishing regulations should be used to help protect native and/or remove exotic fish. Administrative controls can help achieve management goals.
3. Use integrated management to protect the entire forest as well as streams. Steps should be taken to prevent catastrophic wildfires by thinning, creating firebreaks, etc.
4. Promote better cooperation among water users. For example, demonstrate to cattlemen the value of how improving riparian areas and wet meadows will benefit them in the long run.
5. Raise the importance of protecting streams and fisheries with the public to increase awareness and help promote conservation projects. Show the value of storing water both on the landscape in streams and ponds and in underground aquifers.
6. Where practical, try to make improvements at the appropriate scale. (For example, over an entire watershed rather than just one creek.)

Based on the group discussions, they believe these three actions would best benefit coldwater fish in the region:

Action 1 – Develop an appropriately sized tool, between the regional (4 Corners) and reach (CAMF) scale, to identify and prioritize clusters of native fish “strongholds”

Action 2 – Define mutually beneficial upland management for native fish, watershed health, water quality, and other resource concerns.

Action 3 – Monitoring – Develop a plan to monitor the effects of management actions.

Breakout Group: Riparian

Day 1:

Notetaker: Shannon Hatch, Tamarisk Coalition

Riparian Group:

Pam Benjamin – National Park Service, Facilitator

Dave Park – US Bureau of Reclamation

Shannon Hatch – Tamarisk Coalition

Emile Elias – USDA SW Climate Hub

Margie Connolly – Ute Mountain Tribe

Tami Sheldon – US Bureau of Reclamation

Deborah Tosline – US Bureau of Reclamation

Mary McFaden – SRLCC

Ann Oliver – Private consultant

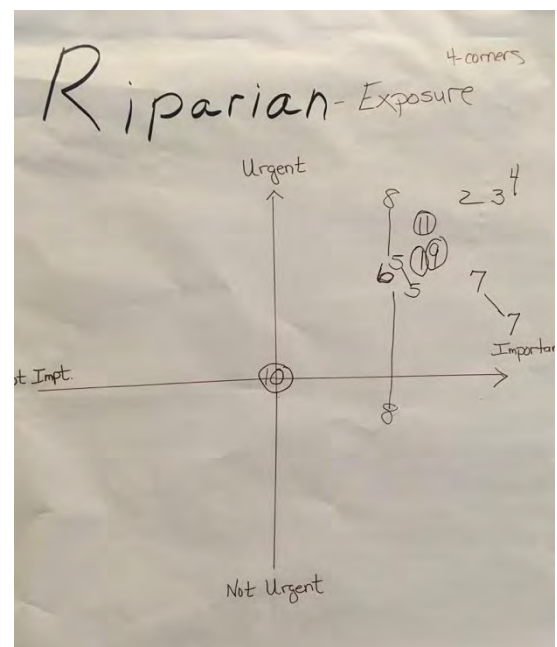
Marcie Bidwell – Mountain Studies Institute

Max Smith presentation notes– coldwater fish habitat and riparian corridors

- There might be more data on spring condition; talk to Cerissa Hoglander.
- It would be good to include Gila Trout data as well; they are present in small portion of watershed.
- Question from John Rice regarding additive effect of projected change in mean annual and mean summer flow volume (may not have captured question well; clarify with John)
 - o Another question about independent vs. dependent variables to determine most robust outcomes; Max said this would be looked into.
 - o If there are too many interdependent variables, could be possible to break down into more specific elements
- There was a suggestion to include different elevation gradients (mean elevation dataset?) for some areas.
- Reservoir capacity variable– areas where water can be released to impact the catchment
- Little hydrology data included; this part is mostly focused on riparian corridor plants and fishes. There was another assessment done with hydrologic data.

Key for Table 4: Exposure

- 1-Projected change in mean annual flow
- 2-Projected change in mean summer flow



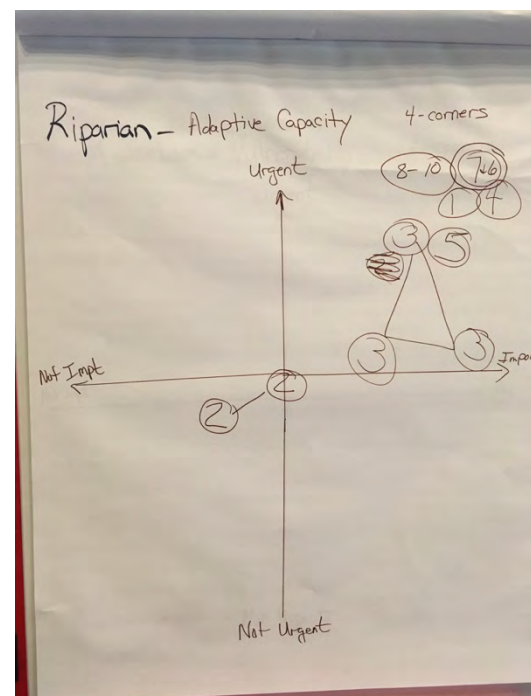
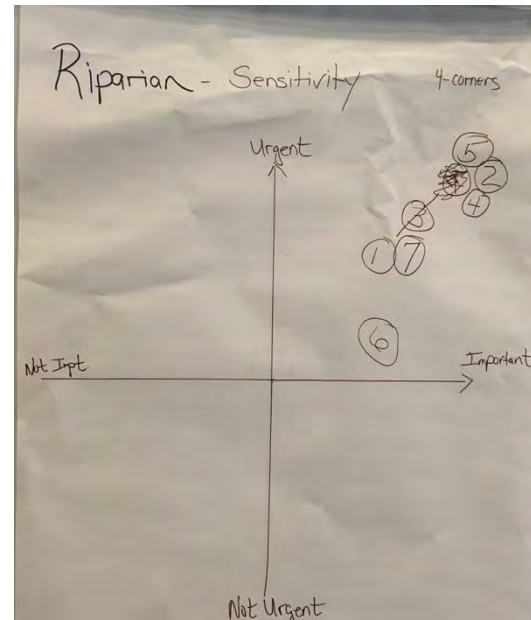
- 3-change in center of flow mass timing
- 4-riparian vegetation departure
- 5-ag cover in riparian buffers
- 6-urban development
- 7-dams
- 8-non-agriculture nonnative introduced or managed vegetation
- 9-erosion/extreme events (new in yellow)
- 10-precip/flooding/drought
- 11-water diversions/consumptive use

Key for Table 5: Sensitivity

- 1-Wildfire hazard
- 2-T&E
- 3-Deciduous or wetland riparian veg
- 4-Land use impacts (new in yellow)
- 5-Groundwater/surface flows
- 6- Regenerative/reproductive capacity for native veg
- 7 – Impervious surfaces

Key for Table 6: Adaptive Capacity

- 1-Mean catchment elevation
- 2-Reservoir storage in watershed
- 3-Public land ownership
- 4-Protected land designation
- 5- Regenerative/reproductive capacity for native veg (new in yellow)
- 6- Water rights/consumption
- 7- Public perception
- 8- Groundwater surface flow
- 9-Riparian connectivity
- 10- Associated springs



1. Do these results relate to your research or management activities?

- a. Want to see data qualified, with sources, assumptions, and explanation on how data were obtained/used; might be a couple of pieces missing. People may take maps at face value without looking at datasets.
 - i. Since all data are in DataBasin, users can drill down further into data
 - ii. Need to be clear in how data are communicated.
- b. Is there anything missing from **Table 4** (exposure indicators)?
 - i. Include erosion and extreme events (9); impacts water and vegetation
 - 1. Include land degradation in the region; basic land condition (sensitivity)
 - ii. Include precip/drought (10) not captured in mean flow – best to look at long-term low flow
 - 1. Precip was probably included with VIC model (?); however, difficult to model under climate change models
 - iii. Include water diversions/consumptive use (11)
 - 1. Gaining vs. losing stream; critical to know what is happening on a stream with groundwater.
 - 2. Groundwater conditions (*helps to assess vulnerability; best to place under sensitivity; gaining or losing*)
 - 3. Not available on large scale; might need to use proxy data
 - 4. **Emile has base flow raster data that might be helpful for groundwater; from NHD but includes additional data**
- c. Notes on riparian exposure matrix ranking for **Table 4**
 - i. Question about whether or not mean annual summer flow more urgent than projected change in mean annual flow; overall hydrologic regime is important to detail
 - ii. Riparian veg cover just included native
 - iii. A small bit of disagreement on number 5 (agriculture cover in riparian buffers)
 - iv. Dams more important than urgent
 - v. Some debate on whether invasives are important and non-urgent or important and urgent
 - vi. Groundwater pumping might be more urgent as knowing it might help prevent future damage
- d. **How are we addressing scale?**
 - i. How does translation from landscape-scale to local actions happen?
 - 1. Might be best to divide up areas into core areas (e.g. define preservation actions for a certain area)

- 2. Could use geology (e.g. how the 4-Corners area is divided up into two regions)
- ii. Don't want to miss vulnerable areas based on these data
 - 1. Looking at landscape scale stressors first, then split into additional phases/assessments
 - a. Initial phases most coarse; next more refined
 - i. What are additional things to consider at this level?
Are there additional adaptation tools?
 - 1. **Grazing/grazing mgmt. (ask John about new coverages that might be available soon).**
 - 2. People are going to focus on the areas that they are concerned about; use data for their purposes
- e. Is there anything missing from **Table 5** (sensitivity)?
 - i. Include land use impacts (health/condition); exposure and sensitivity (4)
 - 1. Development should be considered; might be more site specific though (would love to incorporate at landscape scale but not sure data are there)
 - ii. Include groundwater/surface water flows; might also fall into adaptive capacity category (5)
 - 1. If there is something you can do to improve water availability then you have more of an ability to respond
 - iii. Regenerative capacity for native veg. (6)
 - iv. Imperious surfaces (7); separate from number 4
 - 1. Impervious surface already included in dataset for flow data
- f. Notes on riparian exposure matrix ranking for **Table 5**
 - i. A bit of disagreement on wildfire hazard
 - ii. Lack of established cottonwood willow might make land more sensitive to invasion by other invasives (e.g. if there is bare ground)
 - iii. If veg isn't present won't have T&E species; makes this more important
- g. Is there anything missing from **Table 6** (adaptive capacity); what needs clarified?
 - i. Mean catchment elevation (surrogate for condition); might be good to move/include w/ sensitivity
 - 1. Looking at higher elevation riparian areas are more intact; more resilient – can adapt to changes in streamflow
 - a. Less development, less ag, etc., few invasives
 - b. Could be a misleading element as this indicator just describes current conditions

- ii. Reservoir storage – lots of discussion; probably not urgent, might be important
- iii. Public land ownership
 - 1. Look at how Tribal Lands are classified; needs to be its own strategy
 - 2. Is it important to consider adaptive capacity due to public lands; what is the permanence, who is the decision maker?
- iv. Water rights/human water consumption
- v. Public perception
- vi. Springs
- vii. Number of riparian areas (riparian connectivity factor)

8/30/2017

Day 2 – Four Corners Adaptation Forum

Riparian Group (see day one for participation; Ann Oliver absent on day two)

What are the key vulnerabilities in the two geographies?

- Protect headwaters of San Juans
- Areas in between (yellow, intermediate) might be best areas to focus on; a lot of headway can be made here; tribes heading into mainstream (bigger creeks and rivers)
 - o North – San Juan
 - Piedra and Pine flow into Navajo Reservoir; everything into reservoir is irrigation water
 - Tribes below Navajo Dam more naturally flowing; these include Florida, Animas, La Plata, and Mancos
 - Mancos would be good focus on for Tribal Lands; great opportunity for upstream and downstream opps
 - o South
 - Little Colorado River
 - o Lots of agriculture in these areas, which is also tied closely to urban development
 - Include discussion about zoning
 - o Public perception and communication; talk about impacts; outline simple steps that people can take

Focus Area 1: San Juan Mts

Need:

1. Protect San Juan Mountains/upper elevation

Benefits:

2. Headwaters that support hydrological drivers further down the system

Barriers:

3. Gravel mining
4. Legacy mining

5. Dispersed recreation

Opportunities:

- Great opportunity to build public perception and understanding of conservation needs/benefits
- Already have restoration activities that can be built upon or expanded

Focus Area 2: Tribs below Navajo Dam

Need:

- Reduce exposure and increase adaptive capacity for free-flowing San Juan tributaries below Navajo Dam

Benefits:

- Enhancement actions could benefit Navajo Nation
- Provides buffer and allows transition between cold and warm water fisheries
- Free flowing part and provides for peak hydrograph
- Ongoing restoration activities
- Better water quality and quantity (better temps and less sediment)

Barriers:

- Water rights appropriation
- Some poorly used ag waters
- Jurisdictional boundaries (multiple states, tribes)
- Permitting

Opportunity:

- Ag lands provide opportunities to improve water use practices to maintain/enhance riparian buffers
- Also, excellent opportunity to further build/enhance public perceptions of conservation (esp. rec groups using waterways)
- Lots of opportunity to engage rec users and sportsman's' groups

Focus Area 3: Little Colorado River, near Springerville (tributaries south Eagar, inclusive of west and south forks of Little Colorado River, Apache-Sitgreaves NF)

Need:

-

Benefits:

- Support hydro drivers
- Public land and neighboring tribal land
- Protection for endangered species
- 4FRI (Four Forests Restoration Initiative) landscape

- Potential increase of focus on spring ecosystems

Barriers:

- Resource extraction
- Recreation pressures
- Wildlife severity (erosion impacts from extreme events/streamflows)
- Susceptible to changes in snow pack (changes in mean summer flow)
- Groundwater pumping not regulated
- Salt River Project (SRP) pumping station could have potential impacts
- Hopi and Navajo haven't finished their water rights adjudication (could be some potential opportunities during negotiations)
- Infrastructure needs (specifically Navajo water resources/water hauling)
- Deep groundwater levels

Opportunity:

- 4FRI driven/expanded restoration
- Increased partnership, funding opportunities
- Installation of grade and erosion control structures to benefit water supplies, water resources

Would be good to gather info from people that work more in this area; many participants not that familiar with this geography.

Priority Statements for Riparian Corridor (actions listed below):

5. Protect headwater environments of the San Juan Mountains to maintain, enhance, and support hydrological drivers/ecosystem services now and into the future. (protection)

- Define BMPs for recreational use
 - Quantify recreation impacts
- Initiate campaign to enhance public understanding of protection and conservation needs
- Work with land management agencies to reduce catastrophic wildfire risks and improve rangeland conditions and reduce road densities
- Develop progressive forest and private management plan to allow natural fire to return to landscape while protecting private property and public infrastructure
- Identify dollar value of headwaters ecosystem services
- Prioritize project treatment areas to preserve ecosystem services
- Assess climate change impacts on snowpack and headwater hydrology
- Restoration treatments as a tool to protect headwaters
- Manage fugitive dust emissions to reduce dust on snow impacts

6. **Reduce exposure and increase adaptive capacity of the free-flowing San Juan River tributaries below Navajo Dam to protect natural river functions (e.g. floodplain functionality) and to enhance native biodiversity.** (enhancement/management)
- Monitor and evaluate restoration activity effectiveness in riparian corridors
 - Minimize floodplain development and protect intact riparian habitat
 - Identify biodiversity hotspots in riparian corridors
 - Inventory hydrological flow/use in the system
 - Increase gauging and monitoring to understand flow gains, losses, and returns in system
 - Engage (strategically) users, esp. recreation and agricultural through education and outreach
 - Increase understanding of forest health changes and water quantity (fire, bugs, crud) vs. water yield
 - Assess potential future riparian extent under altered climate
 - Seasonal changes
 - Enforce water rights/sustainable allocation
 - Understand fluvial geomorphology
 - Promote dryland agriculture
7. **On the Little Colorado River tributaries, support and enhance riparian buffers via incremental water storage to strengthen and enhance local water resources.**
- Restoration/enhancement of local water resources
 - Grade control structures, beaver mimicry, stormflow mitigation measures
 - Invasives management/reduction (tamarisk; define extent)
 - Explore partnerships (who is doing what already, 4FRI and USFS, NAU (riparian restoration groups), tribes, White Mt. Apache, state wildlife agencies, SRP, APS)
 - Post fire thinning erosion mitigation measures
 - Monitoring post fire regen
 - Connect with permittees/ranchers/sportsmen groups and public education campaign to understanding best practices with respect to riparian buffers
 - Pursue and Active Management Area designation (AZ Dept. of Water Resources groundwater management)
 - Develop adaptive management protocols with stakeholders
 - Assisted migration/restoration of drought tolerant genotypes (e.g. riparian/uplands)
 - SRLCC funded project with Lindsay Reynolds
 - Grazing BMPs (rotation, exclosures, water tanks)
 - Restore meadow and spring recharge function

Upper Rio Grande Adaptation Workshop

Breakout Group: Piñon Juniper

Facilitator: John Bradford (USGS)

Materials Expert: Mary Williams (RMRS)

Notetaker: Emma Kelly (CPLA/BOR)

In Attendance:

Mary Williams (Nez Perce Tribe – Ecologist, helped with the Sagebrush VA)

Randy Ghormley (USFS Rio Grande National Forest – Wildlife Program Manager)

Mary McFadzen (SRLCC – Communications and Science Outreach)

John Bradford (USGS in Flagstaff – Research Ecologist)

Cynthia Naha (Santo Domingo Pueblo – Interim Director of Natural Resources)

Valerie Williams (BLM Taos Field Office – Wildlife Biologist)

Megan Friggens (USDA USFS RMRS – Research Ecologist)

Conversation Notes:

Randy pointed out the pattern of PJ ring around the San Luis Valley – his region

Not a real wildfire positive system

Juniper more drought sensitive than Piñon

Discussion on Exposure Indicators:

#1 Change in Mechanical Disturbance:

Urgent – habitat conversion, fragmenting habitat – curious about data sets here?

Wildfire – where are the facts?

Good metric could have been: How far departed is it from its “natural”

Syro-stage?

Persistent Woodlands, long fire regimes? Real debate about historical fire regime of PJ forests

Do you feel mechanical treatment increasing? Yes, according to Val. Lumber industry. Northern NM – fuel wood as a driver, “very heavy thinning” PJ preferred over ponderosa

****Lack of information on species use of PJ as habitat makes this very important**** (re: Piñon Jay etc.)

Once land is disturbed – very difficult to heal

****Need for synthesis of habitat qualities and response to fire and mech. disturbances****

****Only half of the Upper Rio Grande data is uploaded on the CPA – Eastern half is clipped****

#2 Change in Development - projected

Urban/Suburban development – relative to where you live! Variable based on location. Effects larger animal species (deer/elk etc) but others make it work for them

Not a ton of “big pavement” in Northern NM

#3 Loss of Great Basin Conifer Woodland Climates 2030

“Great Basin”?

Loss of climatic suitability in a larger context

What are the climatic conditions that support PJ regen etc?

Seed crop decrease?

Do we know the specific the tolerance of Piñon to drought in relation to other species? No.
How much can species adapt to or cope with conditions they're not used to? They're aren't specific measures

****What conditions support masting?***

Important and relatively urgent because of climate models, not as urgent as mechanical development as it is separate from direct human

Is urgency related to control that we have over the issue??

#4 Insect and Disease Risk

Synthesis between this and climate change/drought needed

Piñon lpps – related to drought and stand density

Native subsistive diet? Piñon

****Threshold used here not necessarily coordinated with actual threat risk (0-89% is a huge range)**

Complicated – need for understanding of disturbance regime etc. need more info on how the metric is calculated

****Low, Medium, and High ratings of Insect/Disease Risk – maybe only the high should be included in this VA indicator**

#5 Wildfire Risk

What does class 4 or 5 mean? High or Very High Class (top two classes).

If it's in WUI, yes. We want fire to behave in the way that it should, but not when it comes to houses.

PJ has a lot of uncertainty in fire regime – very little understory, potential for cheatgrass takeover

Can we break out things like WUI? We would need a lot more data etc. from CWPPs/Counties etc

Split into two sections: WUI and non WUI, non WUI as less urgent

#6 Road Density

Important – promotes poaching of wood, roads themselves impacting surrounding habitat, access disturbance

Conduit for invasive species, and poaching wildlife

Urgency? Wouldn't expect it as much on public lands – more managed, need for transportation plans etc.

****road rehabilitation**** as a way to limit, problem is topography! Naturally conducive to being closed

Important, not quite as urgent – not incredibly feasible

#7 Mean Max Temperature of Warmest Month

How hot is it going to get by 2030? Important but more important would be winter precipitation and what does the warmest winter month data say?

Piñon seeds need that soil moisture etc.

#8 Winter Precipitation

Very important and urgent, soil moisture for this system and crop rotations for ag etc.

Discussion on Sensitivity Indicators:

#1 Presence of Associated Species

Need to add Piñon Jay, Songbirds, Blackthroated Grey Warbler, Flycatcher to Species list!

Question of relevance of jumping mouse and prairie dog inclusion in this dataset as they aren't really in PJ landscapes.

Very important, not super urgent – although Piñon Jay makes this urgent as they are symbiotic

#2 Fish and Wildlife Service Critical Habitat

T&E Species, not very relevant to PJ regions. The Santo Domingo Tribe sees PJ in their riparian areas though.

These species are not specific to PJ – could drop as a Sensitivity Indicator? But in another habitat like riparian

#3 Low Available Water Capacity

How much water can the soil hold, more shallow soil -> less water retention -> less drought resistant

The soils here are clay based.

Important but not too urgent.

PJ occurs on rocky, sandy soils in northern NM

#4 Medium/High Intensity Development – current state

Important and urgent? Fragmenting habitat

#5 Impervious Surfaces

Influences hydrological process, where it occurs

#6 Mechanical Disturbances – current state

Potential overlap between Mechanical Disturbances and Impervious Surfaces? Yes

But in its own right, thinning and harvesting etc. does impact sensitivity

#7 Percent PJ – current state

The watersheds with less PJ will be more sensitive to climate change

More important than urgent

Discussion on Adaptive Capacity:

#1 Protected Areas

Important and Urgent, gives public ability to help manage, also allows for potential of co-management

#2 Gain in Great Basin Conifer Woodland 2030

Makes sense, a watershed that has upslope land in it that will be able to support the expansion of PJ.

Very important.

#3 PJ Cover

Is the 0.10% number correct?

****The threshold metric correct? >50% more appropriate than >60%****

#4 Piñon Jay Nest Colony Presence

Symbiotic relationship between the jays and the trees. Metric of health and provider of regen capacity
Patch size etc.

Is there data on distribution of these colonies? Scattered info...

Good measure

****Missing metrics on age and stand structure of PJ Forests**** Labeled “NRV” on our flipboard charts

Natural Range of Variability as an indicator for Adaptive Capacity (similarity to natural range) or

Sensitivity (departure from natural range)

Day Two: Identifying Conservation Priorities and Actions

If we manage for the Piñon Jay, we manage for PJ forests

Large patches of population, tall nesting trees, not the tallest trees – need clumps of trees for their habitat

During fuel harvest – need to be careful of populations

Identify areas of vulnerability within the URG region? Or list of vulnerabilities?

Mistletoe threat?

NRV and stand structure uncertainty – without this knowledge it is difficult to manage

Delineation between persistent PJ and savannah PJ? Speaks to natural range of variability

Need mapping of PJ **types** – stand structure, fire ecology, etc.

Disagreement on fire regime and frequency

***Conservation priority: more info on fire regime needed with relation to the various forest types and fire regime history – assessment needed**

PJ is considered a woodland

Reassessment needed of associated species list for VA – need research on the habitat associations with PJ woodlands. What species are the obligate species?

***Need for Ecological Site Descriptions:** don't have them in this region – needed to look at soil and moisture, would be really helpful to identify the different types of PJ and the range of those types

Minimize disturbance in persistent woodlands (specifically old growth and that is concurrent with natural disturbance regime) – without data on disturbance regime, this is difficult

Climate Change:

Projections of how PJ forests will respond to CC

Regeneration of PJ: not a lot of data here?

Regeneration: not wind dependent, primarily moved by animals (especially Pinon Jay)

PJ is very important as a biodiversity hotspot

Looking at Locations:

Rio Grande del Norte?

BLM in Taos and RAC – all PJ is up for harvesting (dead and down AND WUI zones)

***Conservation priority: minimizing mechanical disturbance in critical areas and making informed treatment decisions**

Triaging landscape: manage for projections – where will PJ forests be viable in the future? Manage for those areas, not the areas that will be too hot and dry for the forest to persist

Difficult! Looking at the map – the very red zones are SW of ABQ

Upper Rio Grande usually defined of N. or Santa Fe and into CO?

***Recognize Piñon Jay as a Keystone species – Audubon Society map**

The darkest, most vulnerable spot on the map is in just north of Los Alamos County – highly vulnerable

Western chunk – agencies need to head up conservation as it is in their mission

Conservation easements (Trusts for Public Lands – TPLs)

****Sensitivity is driving the overall Vulnerability map****

National Monument – multiple use doctrine

***WUIs need to be reworked/rethought (especially in on the RG National Monument)**

Wildfire Risk: knowing all aspects of this risk

Managing for insect and disease

Fire Management Units for Tribes – collaboration possible here

Fire regime condition class – protocol to classify a woodland FRCC – way to talk about departure and fire return intervals, fire scars

PJ exists at low elevations – prone to development etc.

CC: impetus to expansion of PJ forests – need collaboration between BLM and FS - those forests will move up into the FS

Ecological Site Descriptions

Conservation Action Brainstorm Activity

Action 1: Implementation

Identify management strategies for the conservation of PJ communities to minimize the detrimental impacts of fire, insects, disease, and drought.

Action 2: Planning

Define and map desired future conditions for PJ based on NRV, stand structure, disturbance regime, landscape patterns (informed by science)

Action 3: Coordination

LCC host annual meeting with URG stakeholders to increase communication to encourage knowledge sharing and collaboration

Breakout Group: Cold Water Fish

Participants – Max Smith, Jon Hayes, Dagmar Llewellyn, Jason Remshardt, Tim Smith

Exposure indicators (Worksheet Table 1)

1. Indicators rated as “Urgent and Important” were: streamflows; low streamflows; water temperature (especially changes). Fire was also believed to be a very important exposure indicator.

2. Indicators rated as “Not Urgent and Not Important” were: pollution; roads; nitrate deposition; and Kf erosion Factor.

Additional points made during the discussion of exposure indicators:

1. Data is especially needed for streams and watersheds in old-growth forests.

2. Pollution is not a significant factor overall, but it needs to be evaluated on a local level.

Certain specific streams may be seriously affected by pollution (such as old mines).

3. Roads overall are not an important indicator, but are also much more important at a local level on site-specific locations.

4. Fires can have a very important effect on streams and watersheds. The effects of fires vary greatly depending on the frequency and severity of fires.
5. Kf Factor and nitrate deposition are of low importance overall, but may be important in some instances. In particular, grazing in high elevation sites may significantly increase the importance of these factors.
6. Some streams may be too cold for native trout now, but may become suitable habitat as the water warms with climate change.

Sensitivity indicators (Worksheet Table 2)

1. Indicators rated as “Urgent and Important” were: wildfire potential and presence of native trout.
 2. Indicators rated as “Not Urgent, but Important” were: Native sensitive fish; riparian departure, and elevation.
 3. Indicators rated as “Not Urgent, Not Important” were: number of dams.
- Additional points made during the discussion of sensitivity indicators:

1. Native trout presence is a critical factor. It’s most important to protect current populations. The Inland Cutthroat Database has the most up-to-date information on the current status of the various populations.
2. Native fish of other species are not as useful an indicator as native trout.
3. Beavers are very useful for improving vegetation departure. They can be used to help restore natural conditions. Regulations on returning beavers to streams are generally less strict than regulations for other types of habitat improvements might require.
4. There are many more road crossings and culverts than dams, so these are more important to consider when assessing sensitivity. Their greater numbers increase the chances for affecting runoff into streams (affecting water quality) and reducing or restricting movement of fish.
5. The effects of fire are highly variable depending on other factors (drought, snowpack, etc.). Fire impacts also vary greatly by location, depending on fire severity, slope, vegetation, etc.

Adaptive Capacity Indicators (Worksheet Table 3)

1. Indicators rated as “Urgent and Important” were: temperature change; beaver capacity; herbaceous wetland cover; public land ownership; and protected land ownership.
2. Indicators rated as “Not Urgent, but Important” were: slope; and density of springs.
3. Indicators rated as “Not Urgent, Not Important” were: riparian vegetation departure; riparian shading; and water storage capacity.

Additional points made during the discussion of adaptive capacity indicators:

1. The most important factor in judging adaptive capacity is the presence of non-native trout. Several felt that should be added as an indicator.
2. Water storage may be helpful for maintaining stream flows, but overall is not significant due to limited number of dams.
3. Slope is very important as it can provide barriers to fish movement. It is important to consider when management decisions are made as to where to place fish, etc.
4. Beaver capacity is very important as beavers can affect other factors (such as slope and vegetation cover). There are some policy/political issues to consider when reintroducing beavers. Some landowners or water districts may oppose them over fears over flooding, restricting water deliveries, etc.
5. Both amount of public land and amount of protected land are important. Amount of public land is more important as there are any more options for management on public lands. Protected lands are important as refugia for native fish.
6. Springs are important as refugia for native fish. "7A Spring" (??) has good data on the location and status of springs.

Vulnerability (Worksheet Table 4)

1. Areas of highest vulnerability are areas with low elevation, low-slope locations (especially near farms, towns and other human-altered areas).
2. Areas of lowest vulnerability are with high elevation, in wilderness and protected areas and at the headwaters of streams.
3. On the vulnerability map, areas shaded in green or yellow (low-to intermediate levels of vulnerability) represent the best areas for management work to improve habitats. Areas of high vulnerability (red) are probably too degraded for management changes to be successful and areas of low vulnerability (blue) are already sufficiently protected and not likely to degrade significantly.
4. Exposure combined with adaptive capacity is the most useful analysis for identifying sites best suited for management actions.
5. Sensitivity issues are less important because not much can be done to alter those factors.
6. Due to the isolation of many fish populations, it's difficult to cover all the potential issues at a landscape level.

The most important factors to consider are:

1. Water temperature and flow (both annual flow and low flow).
2. Effects of fire. The increased isolation of fish populations due to fires makes restocking and managing fish populations more difficult.

3. Beavers. It's Important to consider presence/absence of current beaver populations as well as potential beaver habitat.
4. Wetlands - Springs - Fens. The quality and presence/absence of these are good indicators of the changes in habitat quality. These may degrade or disappear due to climate change, overgrazing, etc.
5. Land Ownership. What areas can have management changes on them vs. protected lands? How large of an area can be treated, managed, etc.

The least important factors to consider are:

1. Number of dams.
2. Reservoir storage. Reservoirs are operated for the benefit of human activities (agriculture, water supply, etc.). Fish are at the bottom of the totem pole for consideration on how water will be used.
3. Any variable that has a very low percentage of stream segments affected. Some indicators may need to have a different cutoff number selected to more accurately assess their impact.
4. The number of roads is less significant than the types of roads and type and number of stream crossings (culverts, etc.)

All management projects should be designed to promote multiple positive outcomes.

DAY 2

Participants reviewed the final topics from yesterday and agreed on those as the most important topics to focus on.

Based on the information review, they selected these seven topics as most significant and in need of further research and should be the focus of work:

1. Gain a better understanding of hydrology and the effects of shading cover. Modelling for this is fairly well understood at a large-scale level, but additional information is needed on smaller scales.
2. Gather additional information on the effects of fire and grazing on vegetation cover.
3. Ensure that fish populations are considered when projects are initiated to reduce fire risk. Thinning projects should be a priority in critical fish areas and should address conifer encroachment as well as fire danger.

4. Beavers. Make habitat improvements beneficial to beavers and restore populations where possible. There is a critical need for surveys to determine where beavers are currently.

5. Monitoring of wetlands, fens and springs. There is a need for basic information on these. What is the water quality in these locations? Are the springs flowing currently? Etc.

6. More information on land classification and ownership, particularly as it relates to connectivity of habitats. Where can projects be done? Etc.

7. A better understanding of the impacts of the different types of roads and road crossings.

Exercise 2B.

The group identified the five most important needs as:

1. Habitat quality related to shade cover
2. Vulnerability of fish populations to fire
3. Beavers - Presence/absence and capacity for beavers
4. Better understanding of the effects of road types
5. Maintaining healthy forest-water connections

Additional comments from this discussion:

There should be more effort on protecting existing stream segments. (For example, through “Wild and Scenic Rivers” designations).

It is essential to continue monitoring existing projects to see the effects.

There is a great need for improved information databases. Are all data in a readily accessible location for those that need it? Are the data up-to-date? What gaps are there in the data? Etc.

Current management plans should be focused on increasing adaptive capacity of watersheds to create a greater cushion against negative impacts.

Breakout Group: Riparian

Day 1

Session II. Reviewing Vulnerability Assessments

Breakout Group – Riparian Corridors

Purpose: to review assessment inputs and results; become familiar with the data and format; identify strengths and needs of analysis. Use these exercises to explore data and begin the process of identifying which data are most important with respect to your management priorities.

Task: Group discussion and mapping exercise for each vulnerability element (exposure, sensitivity, adaptive capacity) and overall vulnerability map results.

Review Exposure Indicators

- *Mean Annual Flow Volume*
 - Useful, but not as important as low flow and peak flow indicators
 - Similar mean flows can represent different events. For main stem Rio Grande, a very high spring runoff flow and very low summer flow can have the same annual mean flow as an average runoff and average summer low flow, yet the scenario with very high spring runoff has the potential to be much more beneficial to the riparian corridor.
- *Mean Summer Flow Volume*
 - Low flow is a very important indicator
 - Replace with the Q 7,10 metric (estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years) as it is a better indicator than mean summer flow.
- *Center of Flow Mass Timing*
 - The magnitude, duration, and timing of peak flow events is a very important indicator
 - Does center of Flow Mass Timing capture all of the magnitude, duration, and timing components?
- *Riparian Vegetation Departure*
 - Riparian vegetation departure - definition: What riparian vegetation should be there vs. what riparian vegetation is there now
 - Consider comparison based on historical conditions. Difficult to define baseline historical conditions.
 - Width and length of riparian vegetation is important in high elevation, headwater stream segments.
 - While not the best metric, riparian vegetation departure should still be included.
 - This is not as important for lower elevation, main stem Rio Grande.
 - The 79% decrease for affected segments is questionably high. Reassess with different threshold.
- *Agriculture Cover*
 - While important, not a good indicator of exposure.
 - For lower elevation main stem Rio Grande, agriculture can provide a buffer from urban effects and can be important for adaptive capacity.

- *Urban Development*
 - Important and urgent where urbanization occurs.
 - What about exposure to water infrastructure such as acequias, canals, low head diversion dams?
 - Drainage systems reduce stream flow
 - Ditches can provide riparian habitat
- *Dams*
 - Effects of dams not only in stream segment but also far downstream
 - Not the best indicator.
 - Important, but static so not especially urgent
- *Nonagricultural Nonnative vegetation*
 - Urgent and important to both high and lower elevation segments.

Review Sensitivity Indicators

- *Wildfire Hazard*
 - upper Rio Grande watershed, higher elevation segments should be shown in map as much more sensitive
 - true fire potential/risk is not captured; assessment should be much more generous as 10% is too low.
- *Threatened and Endangered Species*
 - Bird, mouse, plants.
 - Not the most useful indicator as presented.
 1. T&E is already addressed significantly in other forums and may be redundant
 2. Should also include fish and other “species of concern”.
 3. Could also include indicator for Critical Habitat
 4. Presence threshold might be more meaningful if >3 instead of 0-3, for example.
 - Biodiversity would be a better metric
- *Vegetation Cover*
 - Assumed to be native species
 - Important but not as urgent as wildfire and T&E.
- *Sensitivity Map*
 - Generally should be more sensitive
 - Limited number of variable probably effects this.
 - Wildfire effects more than just local segments. Consider aggregating segments to make more sensitive.
 - Too main stem focused.

Review Adaptive Capacity Indicators

- *Mean Catchment Elevation*
 - Is this high to low elevation difference due primarily to temperature, or precipitation as well?

- IT is more temperature based as precipitation is too variable
 - Not as important if focused on temperature
 - Higher elevation riparian areas are more intact, which turns out to be part of this indicator.
- *Reservoir Storage in Watershed*
 - Important in lower elevation main stem Rio Grande from an infrastructure perspective.
 - Important in high elevation watersheds from a landscape storage perspective, e.g., wetlands, beavers, etc.
 - Without upstream storage options, stream flow variability is very limited during drought.
- *Public Land Ownership*
 - Ro Rio Grande this is less useful as there are fewer larger tracts of private ranches.
 - Public land does provide increased adaptive capacity.
 - Land ownership is somewhat important but not as urgent.
- *Protected Land Designation*
 - Not the best indicator
 - Somewhat important but not too urgent
- *Adaptive Capacity Map*
 - More resolution is needed in lower elevation main stem reaches, i.e., Middle Rio Grande below Cochiti Dam. This can be a driver for a reach specific vulnerability assessment.

Urgent/Important Grid Exercise for Vulnerability Elements

- See flipcharts for each element.

General Notes

- Focus efforts on being spatial

Fluvial geomorphology is an important indicator, likely for adaptive capacity. It is not included in the assessment as it applies more readily to the reach-specific rather than the watershed scale. Keep this in mind when completing reach-based assessments

Day 2-Needs

1. Increase upstream storage capacity
2. Enhance our capacity to manage magnitude, duration, timing mass flow (mass flow may not be getting at magnitude duration and timing)
3. Developing hydrograph for native vegetation, sediment transport and aquatic/riparian ecosystems
4. Conservation of native vegetation
5. Removal of non-native species
6. Maintain or restore high percent cover of woody veg.
7. Removal of fuels that have built up due to lack of overflow in main stem areas.
8. Increase woody debris in upper elevation stream
9. Reduce post-fire erosion (mass flow events and sedimentation)
10. Manage grazing impacts

11. Reduce incised channels
12. Increased need for smaller scale reach specific assessments/research-Separate decision support tool to address this
 - a. Scale down vulnerability assessment
13. More holistic watershed scale approach for managing riparian area
14. Introduce Beaver

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Discussion Day 2

Trout unlimited is applying Dolores assessment/study to other areas.

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Appendix 5. Evaluating Vulnerability Assessments: Uncertainty

[Note: We did not have time for this exercise during the workshop]

Uncertainty is pervasive, unavoidable and can act as a barrier to implementing conservation actions. To reduce the impact of uncertainty we must 1) Identify sources of Uncertainty 2) Reduce it where possible 3) Acknowledge or manage unavoidable uncertainty. In our presentation, we talked about sources of uncertainty and common approaches used in decision making processes to deal with uncertainty. During this breakout session we will work to identify the sources and relevance of uncertainties within these vulnerability assessments. These discussions will be relevant on day two when begin to identify potential actions.

EXERCISE 2A.

Assessing uncertainty can take many forms. The following presents one way to consider the uncertainty within the focal resource vulnerability assessment. Specifically, discuss uncertainties related to the underlying data, the assessment process, and potential for management solutions. We have calibrated uncertainty along a spectrum of confidence. Consider each statement and note for your indicators your confidence that the statement is true. **Take the last 5 minutes of this session to summarize discussion on report out table for Day 1.**

[Data] We have enough information to measure indicator

High Confidence —————→ Low Confidence

**[Process] We understand or can accurately measure
relationship between indicator and focal resource**

High Confidence —————> Low Confidence

[Process] We understand or can accurately measure outcome for focal resource

High Confidence —————> Low Confidence

[Model] The vulnerability measures (Exposure, Sensitivity and Adaptive Capacity) provide meaningful information (list element on line)

High Confidence —————> Low Confidence

Management actions can be undertaken to reduce Impact, Sensitivity or Adaptive capacity

High Confidence —————> Low Confidence

EXERCISE. Given your responses and discussion in Exercise 2A, where would you place the assessment indicators/elements on this spectrum?

Uncertain —————> Certain

Even in absence of perfect knowledge we can identify useful information and strategies for reducing vulnerabilities. Hopefully these exercises have helped your group identify the strengths of this assessment as well as some critical needs. Another source of uncertainty that may have become apparent during your discussion can arise from differences in personal (agency/organization) opinions and goals. As with data driven uncertainties, acknowledging this source of uncertainty is a first step towards identifying ways to deal with it. While working through tomorrow's activities, consider the level of agreement within your working group and how this might impact collaborative actions.