East Jemez Landscape Futures Needs Assessment and Recommendations: Identifying cross-boundary opportunities for management in altered landscapes

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By Sasha Stortz[1], Collin Haffey[2], and Cari Kimball[1]
[1]Landscape Conservation Initiative, Northern Arizona University
[2]USGS New Mexico Landscapes Field Station

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EXECUTIVE SUMMARY

The East Jemez Landscape Futures (EJLF) is a collaborative process that aims to develop a holistic and forward-looking approach to managing areas of the eastern Jemez Mountains that have been altered by drought, high severity fire, and post-fire flooding. In order to engage a diversity of regional stakeholders and understand perspectives about the impacted landscape, we conducted a needs assessment to launch the project. Through interviews with 50 individuals representing over 20 agencies and organizations in the eastern Jemez area, we identified common interests and concerns, opportunities for action, and developed recommendations for next steps in the EJLF project.

Interviews centered around three topics: work that is currently happening in the area, information needs, and opportunities for collaboration. Several major themes emerged from the interviews:

- Managers are increasingly able to look at the big picture and the future of this landscape after operating in emergency management mode for several years after major fire and flood events
- Management and research opportunities generally fell into three distinct landscape types: canyon bottoms, vegetation refugia, and areas that have converted from forests to shrub and grassland
- There is interest in conducting culturally relevant restoration and engaging the public and local communities in education, outreach, and action about the highly altered areas of the eastern Jemez
- Opportunities exist to experiment with assisted migration as a potential action strategy

Given what we heard from interviewees, we recommend the following major next steps:

- Build and sustain an overarching coordination group to build communication infrastructure, coordinate information sharing and decision making across agencies and organizations, and creatively engage communities and the public
- Convene watershed work groups to focus research and action on specific canyons in the eastern Jemez. Seek funding at the canyon and landscape-scale to provide the increased capacity needed to conduct work in these areas.

Overall, interviewees expressed support and willingness to participate in future collaboration in order to learn from each other, build a shared sense of possibility, and take action in the highly impacted areas of the eastern Jemez. In order to develop and maintain support across stakeholders, future steps should be transparent, interdisciplinary, and inclusive.

INTRODUCTION

The East Jemez Landscape Futures (EJLF) is an effort to coordinate research, leverage resources, and take a landscape approach to managing areas that have been severely altered by drought, high severity fire, and post-fire flooding. EJLF objectives include identifying knowledge gaps and producing a catalog of research and management options for managers in the eastern Jemez as they deliberately forge a path forward to meet the needs of the local human and ecological communities. Ultimately, the project aims to help communities and managers across the eastern Jemez grappling with altered landscapes to form a collective vision for the future for the East Jemez Mountains, and can be a model for the type of transboundary adaptive planning that has become increasingly necessary in our changing world.

Over the past two decades, the combination of and interactions between hotter drought, severe fire, and post-fire flooding have transformed the eastern face of the Jemez Mountains – an approximately 300,000 acre area that includes lands managed by multiple Pueblos, Los Alamos County, private landowners, the National Park Service (NPS), U.S. Forest Service (USFS), Bureau of Land Management (BLM), and Los Alamos National Laboratory (LANL). Large swaths of this landscape, once dominated by forest, are shifting to shrublands or grasslands. After spending the past several years focused on short-term disaster responses following the 2011 Las Conchas fire such as flood and erosion mitigation efforts, managers are increasingly considering longer-term planning and intervention in these altered ecosystems. These emerging ecotypes present numerous management questions about how and when to attempt restoration or stand back; how to deal with lost or degraded ecosystem services and cultural resources; and how to manage impacted areas that appear to be on novel successional trajectories.

In order to explore these management issues across the landscape and jurisdictions affected by change, Bandelier National Monument partnered with the Landscape Conservation Initiative (LCI) to conduct a needs assessment in conjunction with the New Mexico Landscapes Field Station of the United States Geological Survey (USGS). The purpose of the needs assessment was to query stakeholders in the eastern Jemez about what work they are doing in the area, where they see opportunities for collaboration, and what information needs they have as they consider the future of these altered landscapes. We also asked stakeholders about their interest in taking part in collaborative efforts to conduct restoration, mitigation, and research across jurisdictional boundaries. The following report discusses the findings of that needs assessment process, focusing on themes and patterns that emerged during interviews, identifying shared areas of concern or desire for collaboration, and proposing next steps for EJLF.

BACKGROUND

The Jemez Mountains are a distinct mountain range, separate from the southern extent of the Rocky Mountains and rising above the Colorado Plateau. At the highest elevations, spruce-fir forests dominate the northern aspects. The majority of the Jemez is dominated by dry conifer forests ranging from piñon-juniper to ponderosa pine-Douglas fir mixed conifer. Fire regime reconstructions show frequent surface fire was a dominant process that created open forests with grassy understories that allowed fire to move freely between mature trees even at the highest elevations (Allen 1989, Touchan et al. 1996). Fire exclusion beginning around the turn of the 20th century allowed small trees to fill in the understory. Starting in the mid-1990s, the Jemez Mountains entered a drought that lasted more than a decade. Several human-caused fires burned through the area during that time (1996 Dome Fire, 1998 Oso

Complex, 2000 Cerro Grande, 2011 Las Conchas). Each fire resulted in significant areas of tree mortality and a shift of dry conifer forests to shrublands or grasslands (Coop et al. 2016; data on file at Bandelier NM). In the early 2000s, a drought accompanied by temperatures 1°C hotter than any previously measured (Breshears et al. 2005) caused a massive mortality event that killed 95% of the mature piñon pine along the eastern flanks of the Jemez Mountains. In 2011, the Las Conchas Fire burned across the entire footprint of the 1996 Dome Fire in one day and 153,000 acres in all, nearly 30% at high-severity, including many areas that had burned previously. Las Conchas reinforced transition of conifer forests to shrublands and grasslands in high severity burned areas (Coop 2016) by killing both conifers regenerating after past fires and adjacent seed sources (Allen & Haffey, *unpublished data*). In addition, post-fire floods have scoured the bottoms of canyons and threatened communities, cultural resources, and riparian ecosystems. The recent droughts, fires, and floods have cost millions of dollars, impaired ecosystem services, and left land managers and members of surrounding communities with high uncertainty about what the future may hold and how to address the challenges.

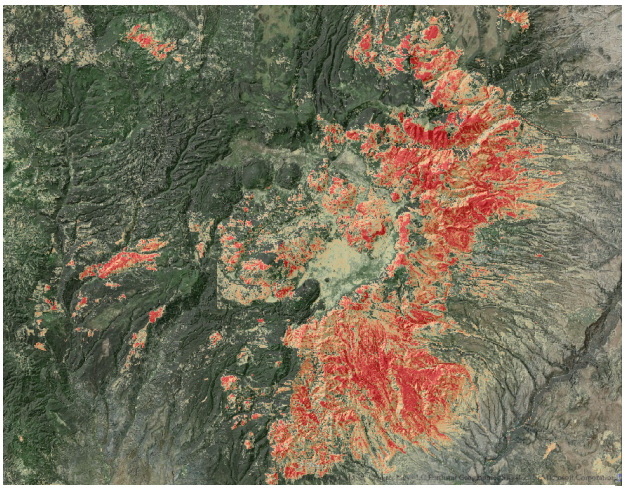

Figure 1: Combined disturbance from fire, flood, and drought in the eastern Jemez. Color shows the relative degree of change, with red as the highest.

EJLF addresses post-fire planning for heavily impacted areas, a compliment to ongoing post-fire restoration efforts such as those at Santa Clara Pueblo, and two large collaborative forest restoration projects in Santa Fe National Forest and Valles Caldera National Preserve, which target restoration in landscapes that are still heavily forested.

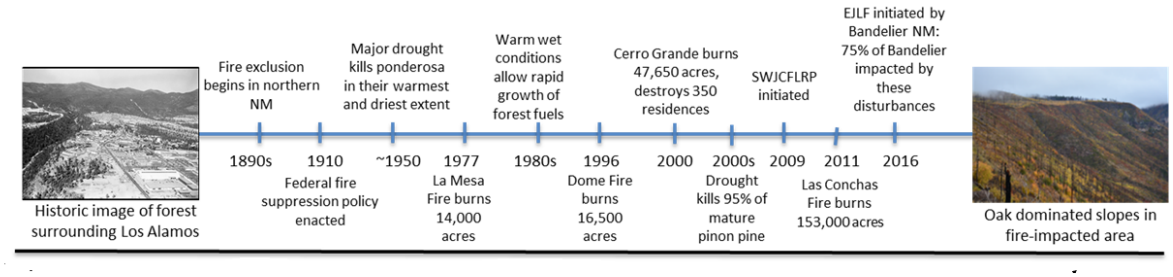

Figure 2: Time line of some of the many changes to the eastern Jemez over the past century.

Approach

A central goal of the needs assessment was to represent a diversity of perspectives from non-profit organizations, tribal representatives, federal, state, and local agencies, scientists, and other communities. In order to build a robust network of organizations and individuals, we used a referral method. After generating an initial list of interviewees, we asked each interviewee to refer us to additional contacts who we should interview or inform of the project. Through this modified snowball

sampling, we interviewed 50 individuals from 23 different organizations (Table 1), and developed a contact list of over 100 individuals.

Interviews were conducted in a semi-structured format. We used several questions to spur conversation, and retained flexibility to expand the conversation into the areas of interviewee interest and expertise (Susskind et al. 1999). The conversations focused on information needs, management issues, existing work and potential actions, opportunities for collaboration and coordination, challenges, and additional interviewees to contact. Interviews took place in person and over the phone, and ranged in length from 30 minutes to three hours. A rough transcript was developed. After the interviews were completed, the transcripts were reviewed, coded, and analyzed qualitatively to identify themes, areas of agreement or disagreement, management options, research needs, and opportunities for collaboration.

Table 1. Organizations represented in needs assessment interviews.

Bandelier National Monument	Santa Clara Pueblo
BLM	Santa Fe National Forest (Supervisor's office, Espanola Ranger District, and Jemez Ranger District)
Cochiti Pueblo	The Nature Conservancy – New Mexico Chapter
Forest Stewards Guild	Universities
Friends of Bandelier	US Army Corps of Engineers
Los Alamos County	US Forest Service Regional office
Los Alamos National Lab	US Geological Survey
National Park Service Intermountain Region	Valles Caldera National Preserve
New Mexico Department of Game and Fish	Wild Earth Guardians
Pajarito Environmental Education Center	New Mexico Wilderness Alliance
San Ildefonso Pueblo	

Key Findings

The needs assessment accomplished several important objectives. First, it offered a sounding board for the initial project idea. Feedback and ideas surfaced in the needs assessment to refine the project going forward and ensure that it most effectively contributes to manager, community member, and researcher's needs and interests. Second, it allowed us, through referrals with interviewees, to construct a contact list of over 100 individual stakeholder and organizations to which the EJLF project is relevant. Third, it provided a strong sense of the existing partnerships and work in the Jemez, and opportunities that EJLF could offer in the existing context, as well as surfacing some potential challenges. Finally, it developed an initial suite of management options that could be attempted, in a research framework, across the landscape, given additional community input. This report lays out key ideas. Attachment A provides a more detailed collection of themes that were derived from the interviews.

A Convergence of Opportunities

It has been nearly six years since Las Conchas Fire. Several interviewees acknowledged a transition from responding to immediate post-fire disasters and infrastructure protection to actively thinking about ecosystem research and management in a deliberate manner. In addition, learning and information

sharing opportunities are emerging as agencies assess what has happened, and what has been done in response. For example, both NPS and USFS are currently analyzing 5-year post-fire effects data, and the USFS is assessing results of post-fire tree planting efforts. The results of both could inform future management decisions across organizations. Taken together, this indicates a "ripe" time to facilitate increased information sharing and knowledge exchange across the eastern Jemez landscape.

In addition, research and modeling by agencies and academic institutions have focused on the drought, fire, and flood-affected areas of the East Jemez. This includes research on hydrology and hydrological modeling, models of reforestation, and other spatial modeling efforts. Interviewees pointed to opportunities to apply findings from these research efforts across the landscape, and identified existing venues such as the interagency East Jemez Resource Council and the Nature Conservancy's emerging Burned Area Learning Network as opportunities to share information, but suggested that a way to collectively move from information sharing to collective interpretation and local decision-making was lacking.

Interviewees also acknowledged the personal and interpersonal context of addressing post-fire management in the East Jemez. From a personal perspective, some described a sense of loss, grief, or paralysis, others a sense of curiosity and fascination with the changed areas, or peace with the cycle of natural processes. They referenced relationships "burned" by fires, and lines of communication lost in post-fire staff transitions. This indicates opportunities to create new connections and rebuild bridges between organizations and communities. Many felt that the opportunity to have a sounding board and strategize together in the face of social and ecological uncertainty was an essential element of the proposed EJLF project; helping each other adapt to change through collaboration and engagement.

Should We Act?

While interviewees were consistently interested in increasing coordination, information sharing, and research across the East Jemez, there were mixed opinions on whether management action on the affected landscape was a priority. For those who felt action was warranted on the landscape, three general attitudes emerged: "it's worth trying," "we have a responsibility to plan and manage in post-fire areas too," and "action is empowering and engaging." For those who felt it was less of a priority, the reasoning was either to let nature take its course or, that there simply wasn't enough capacity to act in the eastern Jemez, especially while large areas with extant forest were in need of restoration in order to prevent future high severity fire events. Others stated that they were unsure if action should occur, either because they don't have the information needed, because of concern over doing "the wrong thing," or because their organizational culture was to take a hands-off approach to land management after disturbance. In addition, management actions of some kind, from ecological research, to riparian restoration, tree planting, and trail work are currently complete or underway in a number of interviewee's organizations. A list of existing management actions, partnerships, and initiatives identified through these conversations is listed in Attachment A. A majority of interviewees felt that management should occur, or were already conducting management in these areas. Fewer perceived it as an issue of low urgency, either because they saw it as a low priority, or were uncertain if management should occur.

A Catalog of Management and Research Opportunities:

We asked each interviewee if they felt that there are opportunities to conduct coordinated research and management in high severity fire, flood, and drought-affected areas. Though discussion was wide-ranging, three distinct ecosystem types, or landscape categories, emerged from stakeholder discussions

about what is happening or might happen on the eastern Jemez: canyon bottoms, conifer refugia, and type-converted areas that have turned from forest to shrublands or grasslands. In addition, several overarching issues emerged: culturally important restoration, community engagement, and assisted species migration[1]. For each category, we describe the opportunities that were identified for research and management. While a greater level of community visioning and public input is needed to generate additional values and more site-specific options for these landscapes, this represents the start of a catalog of management actions that can be considered through the EJLF project.

Landscape Categories

Canyon Bottoms

Actions identified for canyon bottoms provide the clearest set of approaches for the post-fire landscape, and interviewees expressed a greater sense of certainty about what could occur in these areas, including slowing down water and reducing soil erosion, reintroducing native fish, and bank revegetation. In the words of one interviewee:

> "Some riparian areas now are just rock…Finding places where that hasn't happened yet and trying to prevent losing any more, and then figuring out what you can do in those areas that are pretty much down to bedrock and create some organic material, something in there that can grow again. That to me is one of the key starting points, getting things functioning again."

Extensive work to slow water, reduce erosion, and replant vegetation is being conducted in some areas, including Santa Clara and Cochiti Pueblos, offering an opportunity to conduct field trips to learn from what is already being done. Because fires killed non-native fish previously inhabiting East Jemez streams, a "silver lining," is the ease with which native fish can be reintroduced to streams of the East Jemez, and many expressed a strong interest in doing so. A consistent concern expressed was that burn or re-burn in upstream areas could again impact the whole downstream system, making downstream restoration actions futile without upstream cooperation. Because many canyons run across jurisdictions, this emphasizes the importance of a landscape-scale or watershed-specific collaborative approach to attempting management action.

Action opportunities for this area included:

- Protect less disturbed areas
- Slow water and reduce erosion in canyon bottoms and riparian areas
- Protect and restore riparian areas to enhance biodiversity
- Native fish habitat restoration and fish reintroduction
- Alder (*Alnus* spp.) reintroduction

Research opportunities included:

- Documenting geomorphic changes
- Baseline status and trend for watershed vegetation, species composition, function

[1] This term was used to describe a wide range of actions that fall under a broad umbrella of "assisted species migration" ranging from movement of species *within* the mountain range to bringing in species from outside the Jemez Mountains. For some interviewees, collecting species as far south as Mexico was seen as a worthwhile experiment.

- Plant inventories

Conifer Refugia and Reforestation

Islands of unburned conifer forest or stands surrounded by significantly altered areas were identified as another key category where action might occur. These areas were seen as refugia across the landscape for trees as well as other native plants, and the starting place for establishing or maintaining connectivity of seed sources for forest regrowth or restoration. In addition, several interviewees pointed out that some unburned patches of conifer within the Cerro Grande and Las Conchas Fire footprints are still densely forested, presenting a fire risk that could spread to surrounding vegetation type, and need treatment to establish healthy forest refugia and reduce fire risk.

In the words of one interviewee:

> "If you have an island of trees that survived, that little patch is still what it was prior to the fire. Those are the areas we should perhaps focus on. Whatever it means to get them into such a state so that they wouldn't burn as they did in [the severely burned areas of Las Conchas and Cerro Grande]."

Action opportunities for these areas included:

- Identify and protect ponderosa pine islands from fire by thinning and/or prescribed fire if appropriate
- Identify and protect seed source refugia across the landscape
- If reforestation occurs, do so in a spatial pattern that uses these islands or refugia as a way to build connectivity of desired vegetation across the landscape

Research opportunities included:

- Establishing appropriate reforestation strategies to strengthen or maintain connectivity of exiting forest and establish new stands.

Management of tree islands to reduce fire risk likely can be accomplished by individual agencies and through existing inter-agency fire and forest management coordination. However, considering these forest patches as refugia within a larger network of reforested areas would require landscape-scale planning and coordination.

Type-converted Areas of Shrublands and Grasslands

A third major landscape category identified by stakeholders was formerly forested areas that have converted to grass or shrubland after high severity burns and/or repeat fires. Conversation about these type-converted areas was varied, and interviewees discussed potential actions in these areas with the highest level of uncertainty, pointing to the need to address emerging management issues through adaptive management or experimental approach. Perceived fire risk and understanding of new fire regimes, particularly in oak and locust-dominated areas, varied, emphasizing a research need for fire risk modeling in type-converted areas that takes into account neighboring vegetation types. Some expressed desire to reforest burned areas, motivated by a variety of factors. Other issues included the appropriateness of assisted migration, desire to see reintroduction of culturally important plants, erosion and other impacts to cultural sites, invasive species control, and wildlife habitat and connectivity.

Action opportunities for this category included:

- Manage shrub structure to reduce fire risk
- Make deliberate decisions about if, where, and when to replant trees
- Plant trees as a community (re)engagement strategy
- Plant trees for economic purposes
- Plant for cultural purposes (e.g., replanting Douglas fir, piñon pine, agave, other plants, in coordination with pueblos)
- Reforest in such a way to take advantage of microsites with shade and moisture, and to create seed source connectivity
- Plant trees with consideration for future climactic conditions. Strategically plant species by considering future temperature and moisture. For example, aspen planting in upper elevation moist areas could put landscape on successional pathway to forest rather than shrubland. Or, managing the lower elevation to shift the system toward something that resembles chaparral ecosystem, while introducing plants from surrounding area that have wildlife benefits and regenerate after fire, could build future resilience.
- Manage shrubland areas for wildlife benefit, including planting species important to wildlife such as manzanita, mountain mahogany, and four wing salt bush

Research opportunities for this category included:

- Pairing treatments with controls to assess effectiveness
- Fire risk modeling and assessment in emerging successional ecosystems
- Assisted migration experiments and research, including plant introductions and mixing seed sources from various elevations and latitudes

Overarching Issues

Regardless of the landscape category where research or management is occurring, several overarching social and ecological ideas were identified by interviewees as areas for consideration: culturally important restoration, community engagement, and assisted migration.

Culturally Important Restoration

Action opportunities identified included:

- Focus on traditional uses in restoration choices
- Plant important plants needed by pueblo communities
- Develop a secure garden area in the park where pueblo members could collect
- Engage youth in restoration projects
- Use working with youth on the land as an opportunity to teach traditional languages

Community Engagement

Action opportunities identified included:

- Build a public understanding and awareness of the future for this landscape, including the uncertainty and changing vegetation types and fire regimes in the Jemez
- Strengthen public understanding of reasons the landscape looks the way it does today
- Engage the public in planning for this landscape

- Engage youth in carrying out research and action
- Include the artistic community in planning

Assisted Migration

Assisted migration was discussed primarily in hypotheticals, but with the acknowledgement that future climate conditions may not support dominant vegetation types currently on the landscape, and a curiosity about trying to maintain important plants on the landscape and build resilience for future climactic conditions.

Potential action opportunities identified included:

- Grow out riparian and upland seed sources
- Mix seed sources so they are a combination of genotypes from current and future bioclimatic areas
- Plant tree species that have a high likelihood of flourishing under future conditions
- Plant lower elevation ponderosa pine in higher elevation areas, piñon at higher elevations, maintain a mosaic of species
- Restore lower elevations with chaparral plants that are fire resilient

Research opportunities for this category included:

- Test different mixes of seed source elevations
- Common garden experiments: look to southern limits to find genetic strains of species that are the same, but could be planted here, or plant species not currently found here, like Chihuahuan pine, to see if they are viable options for future forest
- Spatially identify microsite conditions such as topography and moisture that support tree establishment on the landscape

Management Issues and Concerns

In addition to the information above, a number of management issues were identified as cross-cutting concerns. These are issues that may need to be considered in studying or implementing any actions, and may deserve topic-specific coordination and information sharing across the landscape in their own right. They include:

- Protection of cultural resources and other sensitive sites
- Stressors to remaining trees and reforested areas such as insects and disease
- Drought resistance and fire regimes of new dominant vegetation types
- Smoke impacts from any future fires
- Health of watersheds and water sources
- Wetland restoration
- Erosion
- Invasive species management
- Endangered species
- Wildlife-vegetation interactions (e.g. elk-aspen)
- Fish and wildlife reintroduction (e.g. native fish, porcupine, beaver)
- Recreation management & enhancing recreational opportunities
- Intensity of management actions in wilderness areas

- Human relationships to changing landscapes
- Relationships between ecological and social changes
- Addressing species and ecosystem management objectives in light of current type-conversions and future anticipated ecosystem chances

Information Needs

Interviewees pointed to the following information and research areas needed in order to address management in the eastern Jemez. Some information needs may be fulfilled by compiling existing information, or through a landscape-wide dialog on what managers might choose to do given existing science. Others point to new ecological and social research projects.

- Condition and trajectory of canyon bottoms, riparian, and aquatic areas
- Effectiveness of actions in streams and canyon bottoms
- Hydrological information including documentation of geomorphic changes, and modeling
- Soil stability, soil condition, and impacts of erosion to cultural, ecological, and hydrologic resources
- Stream water temperature in relation to trout reintroduction
- Inventory of remaining canyon bottom plants
- Effect of disturbance on range resources
- Drivers of tree regeneration
- Strategies for successful reforestation
- Fire regime dynamics and future fire risk in grass and shrubland
- Trajectory of formerly forested areas now dominated by shrub and grass
- Social perspectives on disaster response
- Community vision for the future
- Impacts of disturbance and change on cultural resources
- Interaction between vegetation types, fire regimes, and archaeological site condition
- Impacts of vegetation changes on wildlife
- Adaptation and assisted migration
- Future impacts of drought and climate change
- Resilience of current and future landscapes and vegetation types

Process

What do we do, where do we do it, and how do we learn from each other?

We conducted the needs assessment with proposed goals for the EJLF, while remaining open to new ideas as we obtained a clearer picture of participants' needs and preferences for collaboration. Through our conversations, interviewees identified a number of opportunities for collaboration and a process for how it might more effectively occur so that stakeholders across the eastern Jemez can learn from each other, and from potential actions or projects that are planned or happening. Qualities for an effective process identified by interviewees included:

Focused, shared, and realistic

- Create a shared vision with concrete objectives

- Develop realistic, shared goals
- Focus on what we want, and what can be done

Collaborative

- Collaborate across organizations and boundaries
- Share information, strategies, and learning across jurisdictions

Forward thinking

- Set up this effort so we are prepared for the next big challenge
- Address climate change and adaptation
- Let this be an opportunity to think differently

Targeted effort to build capacity

- Focus collaboration around the development of funding proposals
- Bring in funding and personnel resources through new and existing partnerships

Watershed or landscape-scale, but grounded in place

- Focus on specific places that are important to many; avoid abstraction of ideas in ways that inhibit local action
- Link smaller projects across the landscape together with a clear vision in order to work at the landscape scale
- Address watersheds to connect up and downstream entities
- Manage issues at the landscape scale

Inclusive and engaged

- Engage youth in action
- Listen to tribes, and find ways to partner
- Maintain inclusivity across diverse groups
- Keep all parties informed regardless of how much they can participate

Grounded in science and learning

- Use science to inform action: set up actions as questions, experimental design, and monitoring
- Use adaptive management
- Conduct field trips

Respectful of culture

- Conduct culturally relevant restoration
- Don't disturb cultural resources

Efficient

- Be efficient and respectful of people's time
- Keep all parties informed regardless of how much they can participate

Relevant to agency efforts

- Integrate this effort with other agency planning processes

Some interviewees focused on the opportunity to think beyond the scale of the eastern Jemez. Some suggested considering research and management across the whole of the Jemez Mountains. Others

emphasized that what is learned in the eastern Jemez has relevance to other landscapes and managers who are currently dealing with change and adaptation in response to extreme events, or might do so in the future. This raises the idea that this effort can be set up as a model, and that what is learned here is significant and relevant beyond the individuals directly involved:

- Set this up as a case study relevant to other landscapes and managers dealing with widespread change, particularly in the West
- Consider the eastern Jemez in the context of the full Jemez Mountains; what can be learned, studied, and coordinated at the scale of the mountain range?

Challenges

In addition to the many opportunities, interviewees also identified a number of challenges, which must be acknowledged and addressed in order to maximize effectiveness of the EJLF project. Lack of agency capacity (i.e., staff, funding, time), coordination, communication, and standardized approaches; varying degrees of willingness to take risks; and the larger environmental context of climate change, were most frequently identified as challenges by interviewees. Other challenges include:

- Procedural challenges such as getting everyone to the table
- Ability to think across boundaries rather than by jurisdiction
- Logistical challenges to action, including local seed source requirements, the Jemez salamander listing, and the ruggedness of the landscape
- Other ongoing conflicts around contaminants
- Organizational and funding priorities are often focused on forested areas; leadership is needed to raise adaptation and management of post-fire landscapes as a priority
- Willingness to address big challenges and take risks
- Emotional context of loss and hopelessness, including a sense of uncertainty and futility regarding the larger environmental context of a continuously changing climate

A Vision for Success for East Jemez Lands and People

We asked each interviewee how they would define success for the East Jemez landscape, communities, and the EJLF project. Collectively, a shared vision for the East Jemez Landscape Futures emerged from our conversations, which defined success as a future in which managers, researchers, and community members are:

- Authentically collaborating and sharing information
- Offering vision and leadership for a resilient eastern Jemez
- Developing usable, transferable information
- Developing action-oriented, concrete strategies that create a sense of possibility and momentum to increase local capacity
- Managing for future conditions
- And making resource management choices that are grounded in research and learning, in order to support healthy species, environmental or physical components, ecosystems, and ecological processes.

Members of the public:

- Understand the current conditions and future trajectory of the eastern Jemez
- Feel connected to these altered landscapes

Recommendations Moving Forward

The needs assessment yielded a wealth of ideas for coordinated research, information sharing, and management actions in the eastern Jemez. The catalog of research and management options identified through interviews provides possibilities for any organization looking to act or study this landscape. Beyond individual jurisdictions, a number of opportunities to coordinate at the watershed level, and across the landscape, stand out. In order to maximize learning and action on this landscape, we suggest a nested approach in which an overarching coordination group, focused on communication, learning, and strategy, supports watershed-specific work groups focused on planning, action, and research. Because there is interest in on the ground action, we recommend selecting a subset of canyons, including their surrounding watersheds, in the eastern Jemez where work groups can design, seek funding for, and implement on-the-ground strategies. In order to maximize coordination and learning across the workgroups and greater landscape, we recommend also convening an overarching coordination group to create structures for ongoing information sharing, dialog, and coordinated research, share strategies across work groups, and address ideas like creative community engagement.

Watershed Work Groups

While all interviewees saw potential benefits of a collaborative, landscape-scale approach to research and management in the East Jemez, their sense of urgency varied. Therefore, planning and action work groups should be used to mobilize those who wish to act now and connect them with those already acting, while other relevant players on the landscape are kept informed, with the door open for collaboration.

Because many major watersheds run through multiple jurisdictions of the East Jemez, management actions taken by upstream and downstream land managers are linked. A watershed approach to addressing management from mountaintop to river mouth in several canyons would offer a logical scale to conduct tangible, coordinated actions across boundaries. Existing work, such as at Santa Clara Canyon, can provide models for top-to-bottom watershed plans. Work group for each watershed could focus on developing shared goals, designing projects, and seeking implementation funding, in order to build staff, time, and funding capacity, an obstacle to action identified by interviewees. Action options could include treatment of forested upstream areas, upland reforestation of burned areas, mitigating flooding and erosion by slowing water, fish restoration, and addressing upland shrubland, grassland, and tree refugia within the watershed. Importantly, these should be paired with monitoring and research projects. Likewise, opportunities to conduct culturally relevant restoration by protecting sensitive areas and replanting culturally important plants across the landscape in partnership with pueblos presents a clear opportunity for specific and engaged conversations and action for each watershed. All working groups should focus on developing plans that seek funding to increase capacity (i.e., staff, funding, expertise and understanding) of the collaborative.

Coordination and Communication

Information sharing, leadership, feedback, and idea exchange were brought up by many interviewees, with the hope that discussion across organizations would provide a sounding board and collective path forward to combat social and ecological uncertainty. Facilitating coordinated information sharing and learning is a therefore a key function for EJLF. An overarching coordination group would fulfill several roles, including: broadening channels of communication, coordinating information sharing and decision

making for complex problems, coordinating across working groups, and creative community engagement. This work should be done in consultation with existing initiatives such as the East Jemez Resource Council, the Burnt Area Learning Network, the Southwest Jemez Collaborative Forest Landscape Restoration Program (CFLRP), and other collaborations, order to maximize relevance and impact, and avoid redundancies.

Broaden channels of communication

1. Create a web site that provides project information, events, and updates
2. Compile relevant research and data in an online repository
3. Host research presentations relevant to management issues in the East Jemez

Coordinated information sharing and decision making for complex problems

Communication infrastructure will be useful in itself to promote information sharing. In addition, there is an opportunity for EJLF to go further by creating space for deliberation, interpretation, and a shared sense of momentum based on available information and needed information. This could include:

1. Field trips to restoration sites to promote learning and relationship development between stakeholders
2. Development of shared strategies or scenarios to address management uncertainty

For example, issue-specific dialogue about type-converted areas or assisted migration would help managers develop strategies when there are multiple potential options, or uncertainty about the best approaches. Interviewees discussed many options regarding fire risk management, replanting, and assisted migration for drought and fire-affected areas, including type-converted areas. However, many interviewees expressed uncertainty about appropriate next steps given current information. Current research efforts including 5-year fire effects analysis, assessment of tree planting efforts, and current modeling of appropriate sites to replant may offer clarity for what to do in type-converted areas, as would updated fire risk modeling for type converted areas. An EJLF-supported dialog could identify a range of actions and experiments given existing and pending information, and identifying criteria such as microsite conditions and locations on the landscape where actions might occur. This type of landscape-scale dialog could mitigate uncertainty that individual managers are experiencing, and is important for climate change planning. Likewise, articulating appropriate culturally relevant restoration opportunities at the landscape scale would allow them to be applied at the project level and vice versa.

Identify and support research opportunities

1. Design and coordination of research and monitoring to assess outcomes of current and potential future management actions in the eastern Jemez.
2. Pair manager's information needs with researchers and graduate students interested in working in the East Jemez

Coordination across work groups

1. Ensure information and strategies are shared across watershed-specific work groups
2. Coordinate integrated grant writing (e.g., Dept. of Interior's Resilient Landscapes program) and planning (e.g., proposed actions)

Creative Community Engagement

Community engagement is a necessary part of any planning effort, and there is a clear opportunity for a work group focusing on public outreach, shared visioning, creative expression, and visitor interpretation about changes in these areas. A creative community engagement effort can have the added benefit of collectively acknowledging the loss and challenge of this landscape, while bringing together new ideas, needed momentum, and the social capital to address big challenges. Community engagement opportunities are described above, and could include approaches such as:

1. Artistic exhibits
2. Interpretive exhibits
3. Community events such as storytelling, series, visioning
4. Educational events such as lectures on why the landscape looks this way, and its future trajectory
5. Volunteer and youth engagement in on-the-ground action and research

Conclusion

Despite the challenges managers, community members, and researchers face on the eastern Jemez landscape, many opportunities to create a resilient future exist. A nested approach, in which watershed-level on-the-ground action is supported by landscape-scale communication, visioning, and engagement, can maximize the opportunities for both action and learning across the eastern Jemez. We believe this approach will support the goals of EJLF by coordinating research, leveraging resources, and incorporating the perspectives of diverse stakeholders at a landscape scale in order to forge a path forward that best meets the needs of the human and ecological communities of the area.

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ATTACHMENT A: EJLF NEEDS ASSESSMENT INTERVIEW THEMES

In order to identify key themes from the interviews we conducted, we categorized ideas from rough interview transcripts. The information that follows was scrubbed of identifying information, and statements were organized to identify major ideas discussed in the needs assessment report. This attachment provides the details that led us to the ideas throughout the needs assessment, and provides a more detailed and specific look at the ideas we discussed.

SHOULD WE DO ANYTHING IN DROUGHT, FIRE, AND FLOOD-AFFECTED AREAS?

Yes

Because it's worth trying

- I'd like to see that landscape rehabilitated and restored as much as possible and also to just try some stuff… really, what have we got to lose? We've got good science, we've got people who care
- It's like planting a garden. There's really no harm in trying.

Because we have a responsibility to post-fire areas. They also need management

- Part of this post fire environment we just need to be realistic about is we can't just walk away from these areas, they need fire management themselves
- Clearly there's a lot of work that can be done there. I personally am a little more interested in re-establishing some patches of trees, trying to get some vegetation going that over 100 years could serve as a seed source to start to revegetate.
- I've been focused on getting infrastructure recovery from the fire, but I need to start re-diverting some energy back to [burned areas]
- It's sad to see that, but can you plant, reseed? Still have to worry about fires, too. I'd like to see some changes, but some things we shouldn't be doing. Stay away from sites. No digging, poking around, doing excavations any more
- We are all interested and fascinated by that area, absolutely want to see the right things happen

Because action is empowering and engaging

- Let's just do something. If you can get people out there and engaged on a small scale, then you get buy in for the larger scale projects.
- Let's just get it done.
- I personally would like to see more active role. To see what can be done. I know it's going to take a long time
- We would like to see something happen
- We could look through the menu of management options that agencies support that overlap with some of their priority areas or advocacy agenda items that they could partner with people to coordinate logistics or resources. We have access to volunteers, the media

Not a priority

Because we don't have enough capacity, and need to address forested areas to reduce their fire risk

- Right off the bat, I can't think of what we would do up there. We have a million plus acres that are ready to go up like Las Conchas, and we have critical areas that are in need of some

attention. Seems like resuscitating someone in the 20s versus a corpse to concentrate on that which has already occurred, I'm trying to save the patient now.

- Not enough capacity to address these areas

Because nature will take its course

- I'm a big proponent of letting nature take its course through these things. I don't think we're the best ones to decide what should be. It's really looking at what we think the new environmental conditions can support, and what timeframe it needs to occur, then we can decide if we want to speed natural recovery up. What can we do that has an impact, and are those choices environmentally sound?

I'm not sure

Because we don't have the information we need

- My main concern is that the science hasn't been done yet. I worry about having conversations that could be unsatisfying, there's not anything new to be said or reached because everyone has these qualitative observations. The science work hasn't been done, we need better information.
- I'm at a loss, as far as where we should be going. Restoration, letting it be. I don't have an answer, so I think involving others to see what they think would be really helpful.
- It would be helpful to just hear what all the options are. Need the side boards, considering the realities of it all. Understanding what's going to impact restoration- funding, people, and drought.

Because I don't want to do the wrong thing

- I have apprehension over making bad decisions. Funding is so limited. I want to make sure that whatever I use that money for I want to make sure it's the right decision. I don't want to waste money.
- Have gotten the impression that everyone recognizes the need, recognizes the problem and complexity, no one feels like they have the info they need to make decisions, or what actions, rather than some experimental plots.

Because we generally take a hands-off approach

- We have a history of not intervening after these things. We tend to be very hands off and let it recover naturally. I've assumed an opinion of let's see what happens, let's see how this goes.

We already are

Management actions taking place in affected areas

- USACE and pueblos: watershed assessments, flood risk projects. Post fire watersheds, how do we prevent the channels from degrading and moving downstream, how do we stabilize channels. Also have an ecosystem restoration business line, mitigating damages due to our dams. Dam such as Cochiti or Abiquiu with downstream impacts, restoration is authorized and we fix that- dig swales, high flow channels.
- Tree planting – several hundred thousand trees after the fire on USFS, county
- Assessing effectiveness of tree planting in 2017
- Remove hazardous fuels around archaeological sites, making them fire ready

- Primary focus is restoration of riparian areas and improvement of water quality. That has both direct and indirect work in post burn areas and in areas that are unburned.
- Monitoring and observation of type converted areas, high severity fire area monitoring
- We just collected 5 year post data from Las Conchas. Our work now is to look at that data and try to see what that means. What's happening with the composition and structure
- All we are doing is monitoring. Five years is a good point to look at that data. So many changes happened between zero and five years. It takes a long time for trees to die. One year after, you don't really know what's happening. At least with our data in the past with prescribed fire, when you look at the 5 year data you really start to see how things are working out, especially with herbaceous veg. After a fire you have a huge influx, but then over time native plants start to reestablish, nonnatives might fade out.
- Our main efforts have been more on the recreation side- trails, accessibility. We've concentrated on trying to restore trails.
- Dam restoration.
- There is leeway for intervention here, in spite of density of archaeological and cultural resources. The pinon juniper work set a precedent
- Oak on trails-trimming it back. Keeping our trails from being completely swallowed up. They're native but it's coming back in a different way.
- Santa Clara canyon- slow down and capture water, hold some of it, drop out the sediment
- Loss of arch sites due to erosion- Putting in controls, monitoring mesa tops
- Geoburg fences- designed for avalanches in the Alps, using to reduce flood impacts. We use them for mitigation; they're meant to flex. Can excavate and reuse. Filled 12 ft. in 2015, 4 ft. in 2016.
- Rock walls and dams (Zuni bowls) made not with rocks but with dead trees felled into incisions. Contour filling and log dams, sediment foundation, water raises, planting willows, packing grass tussocks above.
- Planting Doug fir and ponderosa in upper reaches

EXISTING COLLABORATIONS, INITIATIVES, RESEARCH, AND RESOURCES

Collaborations

- Burnt Area Learning Network- post-fire pre-planning
- East Jemez Resource Council
- FEMA- National Disaster Recovery Framework with Santa Clara
- USACE, BLM, BOR, UNM, Cochiti- stabilization and recovery work
- Santa Clara restoration of canyons
- CFLRP in forested areas
- Los Alamos county canyon restoration pilot project
- USFS, Los Alamos county, volunteers – previously seeds balls and seedling planting
- There's a CERCLA group that meets on a regular basis sponsored by DOE. A trustee council made up of DOE, USFS, state, Santa S, San I, Jemez under the superfund legislation. Some of the things they are talking about is restoration post fire.
- Seeds of Success program
- Southwest Seed Partnership

- Collaborations on native fish reintroduction- pueblos, agencies, state
- Rio Grande Water Fund TNC
- USACE emergency management work with pueblos
- BAND and LANL: erosion, bird studies
- BAND-VALLES: arthropods, elk, willow, long term monitoring, fire management

Organizational Initiatives

- USFS putting together a regional riparian strategy
- Santa Fe NF undergoing a Forest Plan Revision
- South Central Climate Science Centers tribal program
- New Mexico Fisheries Management Plan has goals for East Jemez, priority streams, vetted for restoration
- NMGFD initiative supporting prescribed burning in areas for huntable wildlife habitat, stream restoration in fishable streams
- Bandelier Fire Management Plan
- Los Alamos County has an upcoming tourism strategic plan, land transfer planning efforts
- Los Alamos County community wildfire protection plan

Research

Note: The information collected here was provided by interviewees, and may or may not correspond to specific publications or programs. The EJLF project website will compile more detailed information on research and resources identified through the needs assessment, such as websites or citations.

- Large mammal research program
- Suitable Beaver habitat research
- Assisted migration study for ponderosa pine in Redondo Drainage – Wild Earth Guardians, NMSU
- Impact of pile burning on soils
- Tree regeneration research: Matt Hurteau and Craig Allan modeling, Owen Burney experiments
- U.S. Army Corps of Engineers (USACE) Research and Development working on watershed sediment movement after wildfire
- Many attempts at modeling post fire flood risk. Attempt from Federal Highways Administration (FHWA), USACE, Gregg Garfin, National Center for Atmospheric Research (NCAR)
- USACE is doing geomorphology, hydrology, flood assessments and sediment transport. Informs stream restoration, hazard mitigation, dams, and roads
- University of New Mexico- Stone and Jaramillo- riparian potential and hydrology. Low level remote sensing to characterize channel and hillslope characteristics
- Testing use of Rubinia as a facilitator of seedlings
- Los Alamos National Lab soil erosion models, photo point documentation after fires, treatments

Resources

- Rocky Mountain Research Station (RMRS) species level climate change vulnerability research, post-fire tool box
- FireClim – mapping fire adaptability
- Open Standards for Conservation

- Miradi
- LANL app development to see past/current images of ruins
- Oak understory control research in northern CA; examples for this landscape?
- Joint Chiefs Projects (NRCS and USFS) potential funding
- LiDar data available that could be shared more

MANAGEMENT AND RESEARCH OPPORTUNITIES

Native fish habitat and reintroduction

- As devastating as the fire was, once the watersheds are recovered, it'll be a net benefit because we'll be able to replicate individual populations. It's a silver lining for fish. In some areas, you see pretty quick recovery of riparian. Don't know if it's the right vegetation, but the fish don't care, its shading.
- Big threat to cutthroat is other trout. One of the silver linings was in a lot of the streams [the fire impacts] got rid of nonnative fish. So we see a big opportunity.
- Water temperatures, stream habitat, and some habitat complexity. If it's just shallow, wide, sandy stream, not so good. Spawning gravel, rearing habitat, rocks to hold food for adults. In the fish shop we'd be supportive of habitat work. The ash and debris really kill the fish. There was always a chance of flooding, even before the fires. Fish are used to flooding. It's the crazy extremes. [For fish restoration this is a] low hanging fruit, great conservation bang for the buck

Protect less disturbed areas, slow water and reduce erosion in canyon bottoms and riparian areas

- We're using rock walls and dams (Zuni bowls) made not with rocks but with dead trees felled into incisions. Contour filling and log dams, sediment foundation, water raises, planting willows, packing grass tussocks above. Started last year close to headwaters. Potential field trip site.
- I think as land managers we can speed up the process. In our canyons, as trees die and fall over in the drainages, they'll start capturing and holding some of the water. Yet if we cut and pile and burn, we have short circuited that natural process. So we're going to go in and try to hold some of that water for a longer period of time. The way our water comes in monsoons, in those rocky areas, the water hits and it's gone in these storm events.
- There's lots of wood standing out there, some folks proposing putting them into stream channels in small ways. Really labor intensive work that there's been some benefits shown from, you can slow down the gully erosion happening in the canyons.
- That's probably the one that can get the biggest bang for our energy, because of the whole riparian connection and how important those areas are in this country compared to the uplands. What we've seen is some riparian areas now are just rock. It went from a typical stream to just a rock. Finding places where that hasn't happened yet and trying to prevent losing any more, and then figuring out what you can do in those areas that are pretty much down to bedrock and create some organic material, something in there that can grow again. That to me is one of the key starting points, getting things functioning again.
- Want to do induced meandering
- Want to do channel stabilization

Protect and restore riparian areas for biodiversity

- If my goal is to restore as much diversity to that landscape as humans can, you want to focus on riparian zones as biodiversity rich places
- I'm drawn to water and trees, that's where I get my core belief on where we can make an impact. Whatever we can do to keep that biodiversity I think is important.
- Had 100% fish mortality, interested in restoring fish. How can we stabilize banks, minimize sedimentation, reintroduce vegetation, get beaver and endemic fish in
- Opportunities for fish restoration.

Research*:* riparian and canyon bottoms

- Wouldn't it be great if there was a riparian ecology research initiative where people who know about fish, and biodiversity, and riparian and geomorphology and biology who could understand what's happened in the long term and what's happening now?
- The geomorphic changes along the canyon bottoms, are a continuing concern for the habitat changes and water quality impacts. Extreme changes and big impacts on downstream communities. Upstream organizations have a responsibility to be engaged with that and ask what adaptation strategies can be brought?
- I might focus it more narrowly than the whole landscape. Maybe six watersheds – ecosystem impacts, linked hydrology, geomorphic and ecosystem response of heavily disturbed... One watershed for each of the major players involved… something that focused on information as much as decisions and futures. We really need to know what's happened in these areas. A project to synthesize baseline and subsequent work to characterize what's happened, where they're going. Documenting status and trend of these watersheds. Could help get funding by bringing people, then we'd have something to talk about. That would be something concrete to focus on, something that I'd be interested in.

Alder inventory and reintroduction

- Couple species of alders at the northern and southern reaches of their habitat that were wiped out.
- These landscapes have always been dynamic. It's probably at the margins of what we can do. But there are some things we can do. If alders have been extirpated, we could reintroduce them. But need to do more formal inventories.

Protect refugia like "tree islands" and build connectivity

- Identify islands that survived the fire and look at opportunities to reintroduce fire in those at random frequent intervals to maintain the forest
- But a first step is identifying the areas that are still intact and trying to protect them. Identifying refugia and ways to protect them. Protected from the potential for fire to come through again, especially 5-10 years as more big trees start to come down, flashy volatile fire with shrubs, certainly have a risk of large fire again.
- And seed sources- trees, native plants, treat to protect those areas.
- I think one of the most important things is looking for areas that are still intact. Identify refugia across the landscape for different vegetation types

- Treating the areas that persisted prior to the fire. If you have an island of trees that survived, that little patch is still what it was prior to the fire. Those are the areas we should perhaps focus on. Maybe thinning, burning them, whatever it means to get them into such a state so that they wouldn't burn as they did in the past.

Fire risk in oak and locust dominated areas

- We're likely to get fires [in the oak], but I think we'll be able to manage them easily given that fuel loads are reduced. Where I focus my thoughts and efforts are on areas that haven't burned yet, with the hope that we can salvage those landscapes and forests.
- Fire in oak and loctus- Definitely concerned. There were areas in the Dome fire where the large shrub component came back. That area burned again in Los Conchas. That is of concern. Especially in areas where the trees are falling, lots of 1000 hour fuels. They typically contribute quite a bit to high severity fires. But it's really hard to imagine what kind of treatment you can implement across such a large landscape that was burned, anything that would be feasible to treat those areas.
- If resources were no constraint. I would do the same thing I do in the forest. Remove some of the fuel, you burn it. In shrub dominated areas you could thin, pile burn, broadcast burn.
- Those thickets- that place is a jungle out by Dome. I look out there and I see fire danger. I'm not an expert but it looks like it would carry fire to me. It burned once, it burned twice!
- If miles and miles of gambel oak chaparral catches fire, you've got that fire disaster all over again, as well as the post fire and flooding and destruction down to the Rio Grande. So if you're OK with chaparral replace the forest, then you need a management plan for chaparral, which means fire breaks, prescribed fire in a big time way, developing patches on the landscape.
- Given that the goal is to reduce fire risk. If you were to adopt a similar [to CFLRP] goal for the East Jemez, knowing that gambel oak is a fire maintained plant, and that it burns savagely when it burns, sprouts, and come back, but if you were to take that goal: "we do not want the EJ to burn on a landscape scale level again…" now you can create some actions

Deliberate decision making about tree planting for future forests

- Would be beneficial to be explicit and think about what do we want, are we going to plant trees rather than be reactive

Tree planting as a venue for community

- I would like to see us pick up the tree replanting if it's possible and needed. We could organize large community events. That's definitely something that we're willing to do if it's needed and possible.
- If there was tree planting, and there was a big lecture series along with that, there would be a big group of people interested, they'd come, hearing different points of view. And then if you had people go do it, they'd love that.
- Looking at community interaction and engagement in post fire restoration, and channeling that into commitment and engagement for the East Jemez

Tree planting for economic and cultural purposes

- Starting in upper reaches- tree planting. Goal is quarter million per year of ponderosa and Doug fir. Has to be commercial grade timber

Reforestation to take advantage of microsites and seed source connectivity

- Maybe we should take a different approach to reforestation. The idea in my mind is to introduce a seed source scattered across the landscape that can facilitate the process of regenerating pine. Read the landscape- was it meant to be a closed canopy forest to begin with? Finding the microsites which might be conducive to growing the trees. Just throwing them out there it seems like we're setting ourselves up for failure. Groups and clumps of planted trees where they have shade from south and west, maybe a dip or swale where they will accumulate moisture. Don't just plant trees to plant trees, plant them with an objective and intent for the long term. Identify those blocks that your definition of large is in there, and then if you're going to reforest, your objective would be create a seed source out there for the future, rather than an isolated stand of trees isolated in the burn. Come up with some criteria and plant in a non-random way that a contract can follow, for example a point with x number of trees within a quarter acre circle from that point. And those trees have to be placed to take advantage of defined microsites. Swales, shade, something to increase the probability of success. Based on known seed dispersal distance, plant those type of quarter acre patterns across a large burned footprint. With a GPS point, could do contract check, survival checks, something that you could administer. And then something hopefully in the future would be 2-3 or 20-30 trees growing in clumps at spatial intervals. What you're not doing is setting yourself up for another crown fire. But you'd have another seed source out there where someone has determined that the seed can travel.
- We are NEPA cleared for planting. That entire area is cleared, at least the majority of it, is clear.
- We have a categorical exclusion for reforestation
- Finding those pockets where Douglas fire and ponderosa pine can grow again without too much difficulty

Replanting with an eye towards future conditions

- Reforestation and replanted areas have often burned over again. Question for the park: is it justified to consider tree planting in some areas, to prevent shifting to shrub land? Might be worth experimenting with planting pines in the park. Upper end of ponderosa pine zone toward the mixed con, more moist area, where aspen are mixed in. Might make sense to plant some aspen at the upper end of the mixed con in the burned areas. An aspen cover might prevent some shrub from coming in and dominating. Might facilitate long term succession back to forested area. Prevent shrub land conversion.
- I think about the potential for tree planting in strategic locations, and planting trees in a way that considers future climate change and temperatures in the area. Where certain tree species might flourish in the future.
- Nobody knows how global warming will really impact rainfall cycles, but we may have a 20-30 year window coming up here where we can plant trees and different species of shrubs and have a reasonable expectation that they'll live. The question becomes, can you maintain the architecture of that forest type with appropriate understory species and keep the level of soil moisture, competition, nutrients, and light at a tolerable level where these trees can survive. In 150 years if we can get temperatures back down again, the trees being planted today as seedlings or pole trees, their lifespan will take them through a whole experience if they can survive. Ecosystem manipulation the idea is to keep them alive for this period. It may be that on

the southeastern slopes of Jemez there are no microclimate that could keep them alive, but maybe on the north slopes, the north sides of Redondo peak, cold air drainages. I'd be interested in creating a landscape mosaic of trees, letting those patches continue on to old growth but clearing meadows between them as fire breaks. Also lots of slash from the past few decades, clearing and burning that, removing the fuels so a fire might stay on the ground.

- In a chaparral system you could be planting tree seedlings- manzanita, mountain mahogany, 4 wing salt bush that are very valuable for wildlife species. All those plants have different assemblages of birds and insects.
- At lower elevation, chaparral restoration. Acknowledge that lower elevations will have chaparral in the future, let's start putting plants in there that will come back after a fire – small scale assisted dispersal. Not that big of an areas. Bringing in species from nearby, cliff rose. Riparian restoration – willows, narrow leaved cottonwoods. A number of trees you could get in after protecting them from beavers.
- I think about the potential for tree planting in strategic locations, and planting trees in a way that considers future climate change and temperatures in the area. Where certain tree species might flourish in the future.

Managing for wildlife in oak shrubland

- Oak areas-wildlife conservation approach.
- Bears and deer love gambel oak. In a chaparral system you could be planting tree seedlings- manzanita, mountain mahogany, 4 wing salt bush that are very valuable for wildlife species. All those plants have different assemblages of birds and insects.

Seed sources

- Right now when we plant, we use elevationally appropriate seed source. Maybe we want to start looking at hotter, drier conditions on the site. Taking seed source from lower elevations. Building resiliency. Half from a seed source at 6K, half at 8K
- We need to be growing out riparian and upland seed sources.

Assisted migration

- [Re: assisted migration] I think it'd be a fascinating conversation to have. I would be open minded.
- I think about the potential for tree planting in strategic locations, and planting trees in a way that considers future climate change and temperatures in the area. Where certain tree species might flourish in the future.
- In an ideal world… these things may or may not come back, again I'm not a researcher, some of the workshops I've attended some have said there's going to be changes to these ecosystems, and where ponderosa was is no longer going to be potentially. Maybe we should prepare for the next ecosystem that's going to be there.
- Got to experiment with assisted migration, common garden experiments, reach out to the broader genetic pool, looking at the southern limits to find genetic strains of species that are of the same species up here, but could be planted here. Might experiment with whole new species (like chihuahuan pine) where jurisdiction allows. And then go from there
- We know from research done by other people that natural migration isn't going to keep up with the changing climate so that's why we're involved in the assisted migration project. If we can go

in there and plant lower elevation of ponderosa in higher areas, maybe we can keep a mosaic in the watershed. It's certainly not going to be at the scale that it was, and the densities shouldn't have been there in the first place because of our hands on/off approach, I think we should make efforts to try

- Acknowledge that lower elevations will have chaparral in the future, let's start putting plants in there that will come back after a fire – small scale assisted dispersal. Not that big of an areas. Bringing in species from nearby, cliff rose. Riparian restoration – willows, narrow leaved cottonwoods. A number of trees you could get in after protecting them from beavers.

COMMUNITY ENGAGEMENT

Public education: uncertainty and changing regimes/landscapes need to be part of the public awareness

- People understand, but people still don't understand. Uncertainty, unpredictability, and messiness is part of the educational component. They think we still need to thin the forests, but we've done that [in our jurisdiction]. You can't plant a whole lot of trees and do much besides make you feel good. They need to understand what's happening now.
- Concerned that people want to reestablish what was there before the fires. Climate change, impacts of monsoon, soil erosion, lack of seed source, temperatures… we're seeing a really slow start
- There's not a neighborhood group or citizens advocacy group pushing to reforest or reseed, everybody is at a point where this is the new normal. Who has the time and effort? I think the work you're doing will bring out that question and help chart where the community may go in the future.
- Responding to the disturbances is a pretty big social problem. Nothing of large scale can happen without social buy in.

Public education: how the landscape came to be this way

- I see one of the most important interpretive themes as being an opportunity to educate the public about fire ecology, climate change, human impacts on the landscape that lead to these catastrophic events, whether it's over grazing, timber cutting, fire suppression.

Include the artistic community

- They want to be involved with the environment and with climate change. Invite them to take part in a conversation about how to communicate with the broader community about these topics. In Santa Fe you've got a big art community and let them know that you're looking for help expressing what's on these landscapes and what we stand to lose and what comes next. You should let them know that artists are invited to be partners in this work.
- There could be an event where artists show at the visitor's center. Or an initiative for artists to get involved with the science and interpretation of park resources in the face of climate change

Public engagement in planning

- Have to have public involvement to do successful management on the landscape. This is a very visible place. Reforestation happening in the wilderness is only going to happen if the public believes it's good. In the past, were able to engage environmental community and wider community about the need for treatments in the wilderness by educating and communicating.

Public perception of fire

- Worried that something bad happens on a managed fire and then everyone's going to flip out and we'll lose the ability to let stuff burn.
- Important to do good science and collect and share that information so that if there is a problem, an individual manager can point to the data and say that it's the best way to manage forests, save money, save lives, have good outcomes. Make the case for choosing to make that choice
- That can be exacerbated by another big fire. Another 100,000 acre fire that could prevent people from supporting more fire in the future or could make them more averse to smoke. Working on a landscape scale makes people uncomfortable.
- Public perception is really important, maybe people want to be working on children's education materials

Connect EJLF to communities: economies and behaviors

- Trying to build some kind of economic base that has positive results for natural areas. Training thinning crews, Youth crews, want them to see themselves as business owners where they're doing restoration work and then doing fire work in the fall, and making a whole year's worth of employment. Thinking about the forest futures
- Work with communities on fire adapted communities' idea. We're a community that's not just trying to stop fire, but acknowledges it's inevitability and how do you mitigate impacts. CWPPs or community meetings around fire adaptive communities. Providing a link between management of the wild land and clearing the pine needles out of your gutter.
- Barrier to businesses working on restoration is they need is help controlling the costs of workman's comp for their employees. Find yourself an expert in workman's comp.

Conduct culturally relevant restoration

- Culturally relevant restoration
- In coordination with pueblo needs: plant important plants needed by pueblo community
- We all have a stake and feelings and opinions but our perspective is dominant so if tribal people were doing more, whether ancestral lands corps coming in to help reduce hazardous fuels, but having people helping out with trail work, or any way to get more tribal participation in what we do, everyone would benefit.
- How do we get back some of these traditional uses? It's going to take a long time. White leaf and narrow leaf Yuccas- maybe having a small farm to just grow. A secure area where the park is in cooperation with the pueblos, where they could go in any time. Yucca- don't grow abundantly, in patches. How to find locations that would produce an abundance. Evergreens you can replant but it's going to take years. Yucca are faster. We won't tell you why, but you see it. For feast days, certain dances. Bandelier could be pilot projects for cultural and ecological restoration. If there is a source then we don't have to look any more. Without the plant you literally can't do the ceremony. Those plants have always been part of the dances
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- Use work on the land as a chance for youth to use and learn their traditional languages
- Try to engage youth a lot, HS groups, Pueblos concern about sacred sites and cultural resources is important—also concerned about having active lifestyles for their children.
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- Being able to offer resources like a bus or lunch, so that more people can participate.

OTHER MANAGEMENT ISSUES AND CONCERNS

Cultural resources

- Cultural landscapes care about the feeling of the viewshed
- Can't understand what's happening to cultural resources if you don't know about the soils and erosion of land under structures. Need to understand vegetation patterns and how that impacts the structures around them. These environmental events have a big impact on the cultural resources. Monitoring programs in natural resources, trying to apply that information to understand the cultural resources that can't move.

Ecosystem transition

- So what would be useful for this whole process and concept, is to image 100 years from now, what does the landscape look like and what is the understanding of citizens? My answer: As climate warming occurs and we get these pivotal events like wildfires and drought areas, the ecosystem types are going to move in latitude and elevation, and we could very well see a Chihuahuan desert chaparral across the east side of the Jemez mountains and that could be the way it is. Not really sure what people see as their range of options. Even if you decide to let it be, it still need a management plan for the new condition. Might have the desire to say oh yeah let's get in there and see if we can get some trees in the ground, with trees and shadings you start to alter the micro and meso climate. There is that sort of approach, the other is you don't, have the money or interest, it's too rugged and remote, it's not easy to do, or its in wilderness, kicking back and saying gambel oak isn't that bad. If you make that decision up front then you have a secondary management issues- if miles and miles of gambel oak chaparral catches fire, you've got that fire disaster all over again, as well as the post fire and flooding and destruction down to the Rio Grande. So if you're OK with chaparral replace the forest, then you need a management plan for chaparral, which means fire breaks, prescribed fire in a big time way, developing patches on the landscape.
- There's already this jumpstart naturally happening with the harsher, drought resistant plants making their way up the mountainside. We're seeing more aspen and oak forest where we used to see ponderosa. We're just watching and seeing what it does.
- Given the drought that we're in, reforestation, planting trees that are just going to burn up or throwing down seeds that won't germinate isn't a solution, so "what is the landscapes ability to heal" and as landscapes change and environmental conditions change, putting together a plan that maries those things together and answers the question what do we as land managers and a community thing would be the best result.

Drought and fire regimes in other vegetation types

- In their areas that have been burnt, expecting a natural successional pattern to come through and just take care of it. However warming climate is increasing the possibility of a second burn. Could burn through aspen too.
- Should we expect a wave of ponderosa pine die off at some point?

Human relationship to changed landscapes

- It's partly acceptance that areas of Las Conchas will never be ponderosa again. It changes how we talk about things.
- Learning to love oak… we're having to think about the forests and fire differently

Watershed health

- How do we want to manage the high country in the future to ensure that it is supporting a quality watershed in terms of quantity and quality?
- Water is going to be the most important issue, and one that can bring a lot of the stakeholders together. When you couch things in terms of water, I think it gets people's attention. Not just a function of wanting to maintain healthy forests, healthy ecosystems, wildlife habitat, it connects to a resource that most everyone in NM understands is scare, important, and needs to be cared for.

Ecosystems may change but social elements endure or change at different rates

- No trees are going to survive here in a business as usual scenario. We're going to lose this stuff. Thinking about how forests have changed in the past, there's going to be something out there that requires collaboration, the same natural resource decision making, and it may be very different in 20 years. It might then be about hand watering the surviving trees in a particular area. The importance of science, of engaging communities, of linking to economics, the importance of livelihoods—it'll all still be there
- There are ecologically important tipping points that compromise resilience, but then the social threshold might be very different

Smoke

- All the Bosque/ Espanola communities, fire's coming up from the bosque, rather than down from the mtn. It's not just about wildland fire. Smoke control is an important topic in the valley bottom communities. How can smoke be avoided, or are there things that as a community can be done to mitigate the impacts there. Smoke barriers are one of the biggest preventions of getting fire on the landscape.

Tree stressors

- Trees that survived or were replanting are showing signs of drought: mountain pine beetle, bacterial root issues, spruce beetle, rot around periphery

Erosion

- Group there have been a lot of discussions about resolving erosion. Reservoir recently got dredged and a bridge, there's a concern that if things aren't done, on upstream lands, it's just going to fill up again.
- Most of the severe burn happened upstream, and we're directly below. Dealing with flooding

Management intensity

- In wilderness: open to science- driven site specific work. But want really know that intervention is necessary and what's the minimum amount that could work.
- Sensitive to road building. Want to use the lightest touch possible. Do recognize that there are extreme situations that might require that. Post fire floods in the Pueblos

Invasive species

- Star thistle
- Siberian elm and Russian olive
- Cheat grass
- Bull thistle spreading Increased
- Forest seed sources are now rare, increase in exotic species- cheat grass, mullein, prickly lettuce, "the front country nasties"
- Russian thistle, at this point a nuisance versus an alteration to the system

Endangered Species

- There are some unifying themes- endangered species- we're all committed to the same set of rules dealing with endangered species. Spotted owl, Jemez mountains salamander, how do you deal with recovering animals. Do you look at restoration?

Wetland restoration

- Some of the restoration ongoing and sorely needed is wetland restoration addressing previous over grazing by sheep and cattle. Damaged wetland areas, narrowed stream channels, increased turbidity and speed of water flowing out rather than letting it sit and soak into the ground.

Elk-aspen interactions

- When I look at what we have in store for the future for the eastern flank, it's going to be looking at how aspens are regenerating, how we look at elk populations and how they might impact or influence aspen regeneration.

Invasive plants

- Life is persistent and something is going to move in, not sure what intervention we could take. The intervention I take is trying to keep exotic plants out. If I catch it early enough there isn't the infiltration.

Manage recreational opportunities

- There's a lot of potential recreation.
- Valles Caldera rim trail, intersect with other trails on forest, ski hill
- Lots of hunter presence during turkey and elk season

- Cross country ski club cleaned some trails in order to restore some historic trails they've used. Chainsaw weekends where large groups of people come in to clear trail. Some dirt bike riders want to do the same thing.
- A lot of user groups who historically used that area who want get back in there.
- Loctus thorns are an issue on trails
- That area is still heavily used. Mountain biking. But some people don't want to go into the burned areas.
- Mountain bikers, walking, hiking, distance running, cross country skiing (but burned area doesn't hold snow as well)
- Access thresholds: Agreed to reopen that trail and monitor things and when you see too many impacts you shut it down. But what is that threshold? Is it vegetation loss? Erosion? How do you draw the line?

Protect sensitive and impacted areas

- Protecting cultural resources, heavily impacted sites
- Treating around archaeological sites
- How we manage obsidian resources going forward, knowing in some areas fire really affects those resources.

Wildlife reintroduction

- This is just a small thing, but can we reintroduce porcupines? Maybe they'll come back naturally but the little guys are so slow

INFORMATION NEEDS

What's happening in aquatic/riparian areas?

- What is riparian doing? Is it changing and how? Vegetation structure, composition, extent.
- Is there new wetland formation?
- What's happening with channel changes
- The riparian and canyon geomorphic hydrology intersect at canyon bottoms and ecosystems. What has happened to the rare plant populations here after high severity fires and floods? What kind of inventory can be done? There were populations of small plants we don't even know if they survived. No one has been tracking them since
- A project or a dissertation for someone to synthesize baseline and subsequent work to characterize what's happened, where they're going. Documenting status and trend of these watersheds.

What actions are effective in streams and canyon bottoms?

- Can we ameliorate incisions and water table drop to aid perennial stream recovery?
- How effective is stream channel restoration. Are you getting back what you expect? Do things hold up after heavy rain events?

Hydrology

- Understanding groundwater-surface water interactions

- If our future is shrubs, what does that mean for watershed function?
- Flood risk models. Water supply going down is universally accepted, but flood risk not really quantifiable at this time. Many working on it, have hit limits.
- Do we really know the flood history and flood magnitude history to know that what's going on there is something to be concerned about in larger time scales?
- How much sediment transport is occurring in geologically unique canyons? Hydrological modeling being done by USACE with Santa Clara canyon
- Spring flow data to be integrated into hydrological models

Soil and Erosion

- Impact of erosion on cultural resources, or natural plus cultural resources
- Need to know if soil is safe for replanting culturally important plants
- Soil and erosion- stabilization experiments needed

Stream water quality

- Water temperature data would be really useful. It'd be good to know how hot it gets in the summer. Spring to fall temperature. Daily or average weekly maximums would help us to know how close we are on [reintroducing] trout and other species

Range Resources

- How are range resources (traditional use area) affected by the disturbance and stress to the ecosystem

Tree regeneration and drivers

- Tree generation- what's coming back, how long is it taking? What drives regeneration- soil type?
- What's the role of grazing before/after fires in regeneration

How to successfully replant trees

- If you want to initiate new trees, how would you mitigate their environment
- Can we get the trees back, and if so how.

Fire in grass and shrubland

- How frequently and how long would you have to burn a landscape to prevent it from converting to shrubland if grassland was preferable to reduce fire risk?
- What can we learn from other Gamble oak areas, and California, with regards to fire regime
- We don't know much about the dynamics in changing shrub species- Gamble oak and locust
- How much is fire risk going down?

Trajectory of formerly forested areas now dominated by shrub and grassland

- What's possible for rehabilitating areas, what are our options for getting some more active management?
- What happens with situations like the Dome fire, where there is an undesirable secondary impact? Can we change the trajectory?
- What can we expect to see in terms of conversion to grasslands, what types of grassland, would that be more stable?

Social perspectives

- Lessons to be learned from human experience after Cerro Grand
- As landscape and environmental conditions change, what do land managers and communities want for places that can't be restored back the way they were?

Cultural resources

- How can information about climate change impacts to natural systems also inform cultural resource management
- Impacts of erosion on cultural resources, differences between forested, shrublands, grasslands

Impacts of vegetation changes on wildlife

- More info on wildlife and when you manipulate vegetation structure, how does that impact different things

Interaction between veg types, fire regime, and archaeological sites

- Is it better for these places to be in grass land or shrub land or forest in order to preserve the soil and archaeological sites and resources there? Should there be some experiments and management actions taken to try to hold these burned over places in grassland vs shrub lands
- What kind of vegetation will best preserve the cultural landscapes that the park is created to protect?
- The landscapes are changing. What are the consequences of these different types of veg fuel types on the arch resources and is there a preferred fuel type to sustain the arch resources.

Adaptation and migration

- Should we start putting more arid seeds in our reseeding mixes, adapted to different climates?
- Should we wait for plants to migrate or introduce species adapted to this climate

Future drought and climate impacts

- Should we expect sudden die off of ponderosa, similar to the piñon pine die-off?

Resilience

- What is the landscape's ability to heal?
- Are formerly forested areas that are now grassland more stable? How do we manage them to be resilient?
- How do you know when to restore versus mitigate

PROCESS

Share information about this experience beyond the East Jemez

- In the context of climate change, this is what we're all facing, opportunity to help other people through our experience and stories… we were taken by surprise, but what things can we do to help other people learn?
- Need this information if/when high severity fire happens in another area we manage

Address the whole of the Jemez Mountains

- Affected, treated, and control groups are all areas happening in the same mountain range. Would love to see connection addressed over the whole landscape. Looking at management and research across the whole.

Create a shared vision and concrete objectives

- What's the objective: resilience of what to what? Here's what we'd attempt. What will enable them? Area is big enough to try different things. When we have a concept for the east Jemez, is it to get forests back? To see if there is a way to rebuild soils? I can think of all the operational things you could think of, but holistically, what do we want and can we get it.
- Philosophically, if we come up with a positive forward looking project even if it's not restoration, if we have something positive to work together, it'll give us a sense of purpose and hope, it will help us all out to have a mutual purpose that we can work towards, just having something. [What we're doing now] is just a band aid on a big wound
- If we come up with the objectives for this landscape holistically- what we want to see, what we want to try, then we get to dig down into what are the barriers to that work? [rather than starting with barriers]
- Works best when the folks you're working with define that scope

Focus to specific important places

- Find a place that everyone cares about, is connected to. It gives people something to concentrate on rather than being too abstract

Develop options together, given the realities of what's on the ground

- It would be helpful to just hear what all the options are. Need the side boards, considering the realities of it all.
- Really want to be listeners. Don't go into the community and say "here's this project!" But ask them what they're working on or worried about. Develop relationships.

Collaborate across organizations and boundaries

- Multi-agency, multi-jurisdiction, that would allow coordination – collaboration and management.
- We want to strengthen our ability to work with partners. Even if we can't provide all the resources, if there are partners and we're able to provide resources, if we're able to fill in the blanks and share information, that'd be great.
- Great opportunity to collaborate and coordinate our approach.
- I think collaboration is important. Land doesn't stop at the border, needs an ecosystem approach.
- Having collaboration happening between these different agencies. We don't really have that now. That in of itself would be success. That's something, it would create bridges for other things to happen, involved or outside this project, it'd be building a bridge.

Share information and learning across jurisdictions

- Sharing results from individual actions across landscape

- If we're managing with uncertainty and we're all comparing notes then at least we can share information and have a sounding board.
- There is interest in doing some field trips together to go out and look at what we're talking about
- We're all really interested in what our neighbors are doing. We'd like to be talking more. Resource Council is one venue
- Just having a better sense of what's happening across this landscape and then people figuring out how to do things together that would be really good. There have been lost opportunities
- Sharing results across landscape
- Understanding why someone needs the information, knowing them, makes sharing easier.
- If we learn just on our lands, others will learn too

Information sharing about 5 year veg plot data and tree planting assessment across several agencies

- We just collected 5 year post data from Las Conchas. Our work now is to look at that data and try to see what that means. What's happening with the composition and structure
- This year I heard they're not going to do new planting, but they're going to assess what kind of survival they're getting in there… opportunity to learn from what's been done. Coincides with 5 year burn plot data
- Seedling establishment- we have plots that barely burned that burned favorably, that burned high intensity and severity. Goal is to look at those areas and at seedling establishment for trees.

Conduct culturally relevant restoration

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- In coordination with pueblo needs: plant important plants needed by pueblo community
- We all have a stake and feelings and opinions but our perspective is dominant so if tribal people were doing more, whether ancestral lands corps coming in to help reduce hazardous fuels, but having people helping out with trail work, or any way to get more tribal participation in what we do, everyone would benefit.
- How do we get back some of these traditional uses? It's going to take a long time. White leaf and narrow leave Yuccas- maybe having a small farm to just grow. A secure area where the park is in cooperation with the pueblos, where they could go in any time. Yucca- don't grow abundantly, in patches. How to find locations that would produce an abundance. Evergreens you can replant but it's going to take years. Yucca are faster. We won't tell you why, but you see it. For feast days, certain dances. Bandelier could be pilot projects for cultural and ecological restoration. If there is a source then we don't have to look any more. Without the plant you literally can't do the ceremony. Those plants have always been part of the dances
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- Build opportunities for youth engagement, making them want to be a part of it
- Use work on the land as a chance for youth to use and learn their traditional languages

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- Youth engagement. Santa Fe Indian School, Polacca, Espanola, youth might be interested in being involved with restoration
- Being able to offer resources like a bus or lunch, so that more people can participate.

Tribal-agency partnerships and listening

- Capacity building/ training/responses to tribal entities to build capacity in natural resource divisions to respond to wildfire
- We've got to hear what values tribes are interested as we're envisioning the type of future we want to protect and enhance. Asking what questions to ask, not trying to get answers. Understanding goals from their perspectives.
- Provide leave for employees for cultural events, so staff can attend feast days, bring understanding back to public and other employees
- Still very sacred areas, some fires have opened up sites we didn't know about. Talk to the pueblos before any excavations happen

Have inclusive conversations

- Engage with Northern NM Hispanic communities. Rarely at the table, but close to the land, probably observing, experiencing, adapting to change
- Most people close to these impacted places are tribes or older Hispanic communities. Trying to find opportunities to engage with non-traditional conservation communities. NM is a multi-cultural state, want to engage multicultural groups.
- Show us where you want to do things, bring it back for input from our pueblo. Translation for elders is important

Be prepared for the next challenge, in spite of differences

- If you had the wherewithal to put together a facilitated discussion where you wanted to get land managers in the same room with people have been affected, we've been arguing about the same things for years and years, but if we could be positive. We all agree that we don't agree on most things, but when disaster strikes, what are our options? I think we'd be better off

Bring in resources through new and existing partnerships

- Bring in outside funding, multiple parties, coalition building
- Game and Fish work that will benefit huntable wildlife
- Share resources where agencies have limited science positions
- Coordination on GIS for archaeology across agencies could increase

Integrate this effort with other agency planning processes

- New rule about plant gathering. An ethnographic study of EJ would help deal with both. Hadn't allowed tribes to collect plants. New final rule allows tribes access to plant collection. Ethnographic study would allow everything that needs to be analyzed to be analyzed at the same time that a broad agreement is getting in place
- Looking for answers to those questions [about what we do post-fire] would be in line with forest plan revision. We're going to be rolling out specific guidelines, objectives, desired conditions,

and it seems like if we can those cross pollinate what you're doing and what we're doing, it would be good for the forest, and for that matter, the whole east side.

Address climate change and adaptation

- Integrating climate adaptation into agency plans
- Begin to respond to climate change and drought within agency and with collaborators

An opportunity to think differently

- It takes ideas like this to get everybody's nose off the grindstone to think about different things.

Use science to inform action: questions, experimental design, monitoring

- If you said this is something we want to do, this is an experimental design, this is what we're trying to look at, and bring people in from the research stations
- If you have the time, there's a lot of questions to be asked
- Know there's a reason to leave some areas alone in addition to conducting experiments in other areas. Have a baseline there. Opportunity to learn from those "control" areas.
- Dealing with more complicated issues than ever before with fewer staff than ever before. Big value is attracting outside research and figuring out where to focus and commit limited resources.
- You've got testable hypothesis and set up objectives that way. If you set up your inventory and monitoring appropriately, you will have science informed data
- Big fan of the notion of high quality science informed conversations.
- Essentially any management action is an experiment. You've got testable hypothesis and set up objectives that way. If you set up your inventory and monitoring appropriately, you will have science informed data brought

Link smaller projects across the landscape together with a clear vision or project plan in order to work at scale of watersheds, landscapes

- Trying to find the links between all these smaller projects. Like with the Southwest Jemez Collaborative Forest Landscape Restoration (SWCFLR), you could be working on a postage stamp size area, but it's the part of a larger whole. If the East Jemez project could provide that context that would be great.
- Where do you need us? Our focus is working down the drainages, headwaters all the way down to the Rio. There's an arbitrary line that separates line, but we could always work and mirror what's happening just below … if funding allows us
- Small chunks of land that we can do treatments on and connect those across the landscape over time. You have to form the big picture first, then say in 10 years, what do we want to accomplish and how can we do it in small chunks that connect across the landscape so in 10 years you can look at it. But looking across other agencies with that idea not something that we've done often.

Scale

- Transboundary- I think it's the only way you can approach it. People still don't see it as a landscape scale problem. Doing short term work without addressing where erosion is coming from upstream
- Land doesn't stop at the border, needs an ecosystem approach.

- Watershed approach would be more effective. We only manage part of our canyon watersheds. Stabilization, riparian, fish and wildlife- look across boundaries. I'd like to learn from the process what the other opportunities are.
- Some of the experiments… we could do different things on different land owners lands.
- My idea is that all these things are landscape problems, all should be addressed in a coordinated fashion.
- I can't think of any issues that shouldn't be addressed across boundaries. We'll have different visions, but in type of the research questions and issues, I can't think of anything that shouldn't be on a landscape scale. Watersheds with similar issues, forest recovery and type conversion will be similar across the landscape. Other agencies might have different strategy because they have different mission, but can't really think of anything that can't be addresses across boundaries.
- Stormwater is an important topic
- Anything happening in upper watersheds, we would be interested in that conversation
- It's important to start at the top [of the watershed]

Keep all parties informed, regardless of how much they can participate

- I think the idea is a good one. I would say don't be afraid that we're too busy. Communicate with us. I'll tell you if I can or can't do that. If we want to see it done, we have limited resources but there are things I'd like to see done

Conversations about what we want and what can be done on the landscape

- EJLF could certainly be useful for at least having the conversations about what do we want landscapes to look like. But in terms of how much ability we have to achieve desired future conditions or avoid undesired future conditions. What ability do we have to do that?
- Looking at the landscape on that larger level certainly makes sense. The fire, animals, range don't care about our boundary lines.
- We've all come through a long hard period of dealing with emergency response. My hope is that we're getting out of that time and to a point where we can think more about the future without having the shadow of Las Conchas and Cerro Grande. Need to rebuild and get the energy.
- Assess condition, assess options and opportunities on the landscape. Let them know what options are and how they might be successful in supporting those.

Developing realistic, shared goals

- If we think about a century time frame, short, medium, and long term goals - the next 5, 20-40 years, and something within the lifespan of the people having the conversations versus end of the century. Those are different sets of futures and goals to consider.
- Maybe we could come up with shared goals.
- What is our goal here, what are we trying to accomplish. Where possible, I think that goal is to bring back healthy old growth forest over time in the Jemez Mountains. If you can give people a visual and sensory experience of what it's like to be in an old growth forest, humans and waterfowl experiencing the wetlands, the wildlife visiting. It's those sensory experiences that can tip the balance with goals, and it's not so abstract to no end.

- It needs to be incremental. We can't accomplish it all in a 10 year period, we have to break it down. So thinking of it that way makes it seem more realistic. Over a very long period of time, you could maybe get things coordinated

Efficiency

- Don't waste people's time. That'll be the last meeting they attend.
- People are more stressed in the job environment than they used to be. Used to be time to be more human, deliberative, winter was a slow season.
- Floods of information, tons of collaborations
- There are enough meetings, and half the people who need to be there never are. They have their place but how to do it most efficiently is a really good question. Something new! More technology savvy even. I think people face to face is really important but supplementing that to help people follow through. Yosemite Conservancy magazine- everyone's work in one magazine. Maybe a collaboration like that- putting it in to an article together. Yellowstone has a science repository.

Potential to focus collaboration around proposal development

- Worked for SWJCFLRP-proposal development phase was the most truly collaborative I've seen. Substantively real, could write, engaged people, so the written document was really collaborative
- Put together a plan: here is our understanding of the landscape as it occurs now, here are the issues, if we wanted to put together a funding proposal, can we meet those goals and objectives? If yes, put together a proposal, get everyone to sign on and write support letters, plan to fund them for work, too. Generally 9-15% of budget goes to monitoring. That's where the collaborative operates

Don't disturb cultural resources

- I'd like to see some changes, but some things we shouldn't be doing. Stay away from sites. No digging, poking around, doing excavations any more

Field trips

- Zuni bowl headwater areas is potential field trip site- ½ mi drainage, headwaters and down

We need strategies

- Having an array of potential strategies, whether we're applying a couple and doing experiments, or different agencies doing different ones and communicating their findings…Different agencies are doing different things. Are we sharing information? Are [trees] growing or dying? Knowing that would be handy. Are you seeing more success? That connection- sharing of data or experiences.

Adaptive management

- Going to have to have serious adaptive management component.

CHALLENGES

Communication and information sharing

- Sometimes we don't know what's happening with different program areas.
- Terminology and definitions differ across organizations
- Sharing information- doesn't always happen due to legal or cultural reasons
- Authentic communication when relationships are lost due to turnover
- Challenges of communication – everything from personalities and agency perspectives to time.

Lack of agency coordination, communication and standardized approaches

- You're dealing with it one way but across the border they're doing it differently. It doesn't matter what I'm doing here, they're not doing anything right across the road so is it worth the effort?
- Databases and data collection approaches needs to be compatible across agencies
- Agency goals in particular are a constraint. But more than anything it's the logistics, trying to plan for things and for all of the agencies to be able to do them at the same time.
- Contradictory perspectives on cultural resources: preservation versus
- Sharing data, coordinating action with several neighbors, I wouldn't even know who to talk to
- Agency interactions have changed. Those ebb and flow through time for different reasons.
- I wish we could take the process we've used and bring different people to the table. To come up with a landscape driven plan. I really don't know if that will ever be the case, because of all the requirements by different agencies.

Information overload

- There is so much going on, it's hard to keep track. We try to stay tied in.
- A lot going on, how can you compliment and extend those efforts. How is this effort different?
- Understanding what is already happening
- Hard to keep up with everything at every level.

Funding and staff capacity

- Funding – but we can do a lot on a shoe string
- There's got to be someone who has the funded time to do the work.
- Funding and staff capacity
- Resources are limited, haven't had the time or energy to dedicate.
- Money and time

Thinking across boundaries

- Thinking across borders: it is hard to get us to stop thinking at our boundaries. We're so brainwashed. It's easier to think about the big picture when you're downstream. It's hard to get the upstream folks to think that way.

Getting everyone to the table

- It'd be good to have everyone working together. How do we have the right message to get people to the table?

Willingness to address big challenges and take risks

- The will to address climate change and drought. Momentum and passion take a long time to build and to get everyone on the same page
- Willingness to take risk and innovate beyond training and common practice
- I don't want to make a bad decision. I want to make sure that whatever I use that money for I want to make sure it's the right decision. I don't want to waste money.
- The question is, can action be taken on a big enough scale to make a difference
- People are worried about legacy stuff, don't want future people looking back and saying "what the hell were you guys thinking?"
- This requires some bravery. But we need to expect that mistakes are going to be made.
- Worried that something bad happens on a managed fire and then everyone's going to flip out and they'll lose the ability to let stuff burn

Priorities focused on areas that haven't burned; a need for leadership

- People are alrady so stretched to capacity dealing with areas that haven't burned
- It's not that people are disinterested, but is it able to be raised in their priorities so they say yes, we're ready to do it.
- Lack of leadership

Uncertainty and lack of information

- Communities don't have the understanding about "what now." Neither do researchers, managers.
- A lot of science needs to be done. My main concern with EJLF is that the science hasn't been done yet. I worry about having conversations that could be unsatisfying, there's not anything new to be said or reached because everyone has these qualitative observations.

Emotional context: loss and hopelessness

- In order to want to invest time and energy and resources, you have to have a certain amount of belief that there can be positive change.
- Getting agencies excited about a post-apocalyptic moonscape is not easy.
- That type of uncertainty discourages both financial and emotionally investment.
- One challenge will be getting people excited about tackling this formerly forested area. Huge sense of loss.

Environmental context: climate change

- That sense of hopelessness is exacerbated by the quality and amount of climate change research. Bright people are giving us a very bleak picture of what the Jemez Mountains. That's looking at conifer forests. They might go away. What happens next if there is no conifer that are left? Others are less dire, but everyone sees major change
- On top of burned areas and droughts, looking at warming temperatures, we have to manage for all different possibilities. But something will take its place even if conifers go away.
- How do you protect structures built for the historic environment and climate, not for this new environment and climate
- Seeing this stuff happen with just one full degree of warming pattern. For right now, we need to manage to try to sustain what we can where we can, facilitate adaptation to change to

something more resilient in a one or two degree warmer world. 3-4 degrees warmer and we're screwed. There's no management there. What do we do to hang on, there are some resources where we're going to have to make extraordinary investments to save what exists there.

- They had put fish in there. Already talking about wanting to put them back. Maybe it's cheap and easy to do that, but have some concerns about single species management driving this and the futility in the face of climate warming.

Other ongoing conflicts on the landscape

- Contaminants, NARDAR ongoing issue. Need to separate those conversations from this one, or won't be able to have open conversations during the East Jemez Landscape Futures
- Big concern over contaminants of sediment in the reservoirs. Avoid this issue in this context

Policies can slow restoration work

- Revegetation work on NPS requires local seed source: larger hurdles to restoration
- Salamander listing may affect actions

Ruggedness of landscape

- Remoteness- access is difficult due to land ownership and fire impacts, so experimentation is difficult

VISION FOR SUCCESS

Healthy ecosystems and processes

- Landscapes moving in positive direction for ecological indicators
- Obviously for me, it's to restore natural function in the East Jemez. And mitigate as much as possible human impact on these landscapes so they can function how they have for millennia before we decided we could do a better job than Mother Nature.
- An active engaged community making progress toward a resilient natural landscape
- No more Las Conchas style fires, no more high severity large patch size fires occurring on the landscape that are damaging the resilience of these forests
- Protected plant refugia and connected treatments

Healthy species

- Self-sustaining cutthroat population, chub and sucker populations where appropriate. For me, this is one of the easier things I do. Low hanging fruit, great conservation bang for the buck
- Healthy streams with native fish in them

Healthy environment/physical components

- Erosion and sediment transport is number one issue. Vegetation takes care of itself. But that erosion component. I know it's related to vegetation but that's my biggest concern. Keeping the soil in place, on the mountain
- Keep the water on the hill.
- Holding some water back. We have such narrow, deep head cuts in our streams, canyon bottoms. It hits the ground and it's gone. Getting some vegetation to hold seeing some kind of vegetation growth, whether is oak or aspen.
- Don't want a slick rock surface where everything is rolling downhill toward the Rio Grande.

Communication and information sharing

- People talking to each other
- Transparency going forward is important; this is the beginning of a conversation
- Want a deliberate response with community input. Plant trees if it's scientifically justified and it's what the community wants.
- If different agencies are doing different things, communicating findings and making sure we know what's found, so we can see what is happening over the landscape. That connection-sharing of data or experiences.
- I think people face to face is really important but supplementing that to help people follow through. Science repository, technology savvy communication, everyone's work in one magazine (like Yosemite Conservancy magazine)

Authentic collaboration

- It'd be good to have everyone working together. Recreation is huge. We have traditional communities, native communities. How do we have the right message to get people to the table?
- Having collaboration happening between these different agencies. We don't really have that now. That in of itself would be success. That's something, it would create bridges for other things to happen
- Success with EJLF would look like everyone working together and helping one another
- Success would like tribes having a say in management plans
- Encouraged to be forward looking, engage in relationships, cross jurisdictional opportunities
- Reverse insularity and loss of vision that resulted from fires and turnover
- An active engaged community making progress toward a resilient natural landscape. Would be hugely successful
- Balanced perspective gained through real balanced collaboration, with some real strategies were identified, compatible with our needs as managers, and with the people who care about the place, Anglo, Hispanic, tribal
- Providing assistance to each other across agencies. Using the different agencies to accomplish the same goal.

Managing for the future

- Managing for the future. Having people work together, explicitly integrating information, managing for ecosystem processes and sustainability. Managing for ecosystem function so that disturbances like fire and post fire outcomes are integrated into our decision making. Recognizing that we're not ensured successful outcomes for what the landscape looks like. If we're going to be wrong, how can we avoid messing with longer term goals?
- I would consider what we'd be doing here would be an adaptation measure, we're busying society time to get its shit together rather than just say "oh my god the forests are dying." Let's see if we can hold on and maintain at some level until we can get smart with carbon. This is the window we have.
- To manage the land for the next generations

- Pulling back from specific future desired condition—because it's hard to know if ponderosa can be saved, and it can't be saved in some places. Manage for function (erosion, water), and human relationship to the land

Usable, transferable information

- I hope this becomes something useable and transferable

Concrete strategies and action-oriented

- Some real strategies compatible with our needs as managers (needs to be flexible)
- Something to do, action oriented. Open to ideas of restoration versus huge ecological fix versus just going through the storytelling and process of understanding where someone is coming from. Those are all doing things, any one would be success.
- Having an array of potential strategies, whether we're applying a couple and doing experiments, or different agencies doing different ones and communicating their findings
- And into the future, having a process whereby we all come together, and think about the landscape as a whole, think about treatments on that landscape as whole, and then how we're going to accomplish those incrementally over time, and how they're going to connect.
- I think it's for people to have the information and ability to… have some sense that there are some productive and positive actions that we could take on this landscape.

Leadership

- Park take the lead and shows courage in moving the landscapes toward more resilient states.
- Vision coming from park staff

Grounded in research and learning

- If you have well defined questions and you do a study that answers those questions, that's success.
- Being able to track and learn what is being tried in different places
- Want a deliberate response with community input. Plant trees if it's scientifically justified and it's what the community wants.
- Another success would be these experiments we're talking about. Set up experiments with replicates and controls where you burn a mesa top every three years to prevent shrubland from coming in. Keep it in grassland. Have another mesa top that you don't interfere on and let it go to shrub. Have in place landscape scale interventions in experimental mode that could help us know how to manage these places for the next 30-50 years.

Public understanding of the current and future system

- Uncertainty/unpredictability/messiness is part of the educational component. They think we still need to thin the forests, but we've done that [in our jurisdiction]. You can't plant a whole lot of trees and do much besides make you feel good. They need to understand what's happening now.

Public connection to the landscape

- If it's going to be an oak savannah, so be it, if people are out there enjoying it

PHILOSOPHY OF CHANGE

Shifting focus from the negative to the positive

- In order to want to invest time and energy and resources, you have to have a certain amount of belief that there can be positive change. You don't work for a campaign because you think you're going to loose. Getting agencies excited about a post apocalyptic moonscape is not easy.
- Burned over, devastated, destroyed doesn't give the public a good feeling or the staff. It doesn't capture what this place is. Its still an incredible place. Well intact cultural resources, recreational activities and research, all the things other than the forest still exist here. Getting away from the doom and gloom- Bandelier used to be here and now its gone. Its not gone, its just different. Refocusing the landscape and the way we talk about the landscapes. Agreeing that there is a future to be part of.
- The potential and optimism is that within the caldera nature can heal itself given the relative abundance of water and seed sources. We'll see if that comes true. If it was solely dependent on humans to try to restore and repopulate with trees and native species. That would be very daunting and increase pessimism, but I think nature has a lot of potential to restore itself here on its own. I could be wrong, but that's my gut
- Pretty remarkable to have seen such huge change and yet seen things come back. Its not the same, and people get so attached to the way that it was when they arrived or spent time there with their children, so its been hard on people, but there's persistence. Its not stopping, not going to stay bare… it's a cycle that will come back around. I've been seeing life as a cycle for many years, made it easier for me not to be despondent. life will continue on, yet its fragile and disruptable
- On the positive side—this has brought together the natural and cultural disciplines.
- Curiosity on how it goes with other people. Have heard excitement and ambivalence. Getting the impression, maybe I'm just an optimist, but getting good feedback and a lot of people really excited about this. It gets you excited. Hope it has the momentum and synergy we feel that it has.
- Remains optimistic, it can't all be that bad, right?

Taking an action/solutions oriented approach

- Philosophically, if we come up with a positive forward looking project even if its not restoration, if we have something positive to work together, it'll give us a sense of purpose and hope, it will help us all out to have a mutual purpose that we can work towards, just having something
- Thinking about dollars, you think, do we put $100K in to the shrubby burned out areas, or in the catastrophic loss of what we have. Its about values, where do you put it. Part of what this project needs to do is help us to decide where the value is. What can we do?
- We are seeing this stuff happen with just one full degree of warming pattern. For right now, we need to manage to try to sustain what we can where we can, facilitate adaptation to change to something more resilient in a one or two degree warmer world. 3-4 degrees warmer and we're screwed. There's no management there. What do we do to hang on, there are some resources where we're going to have to make extraordinary investments to save what exists there. Think of sequoia groves—they might have to install irrigation sprinklers to prevent fire and drought stress.

- Not making decisions, not paying attention, choosing no action explicitly. Those are still decision. There are outcomes associated with that on the landscape. Mother nature will continue to do what she must, and interact with physical processes. We're experiencing the flux in those things, its been super strong. These landscapes have always been dynamic. Its probably at the margins of what we can do. But there are somethings we can do. If alders have been extirpated, we could reintroduce them. But need to do more formal inventories.
- I went to a meeting and it just scared the hell out of me. [They said that] this is going to be a barren wasteland. That can't be our approach, just scaring people. Bleak. I was almost like, I don't know what we can do about that, the place is just going to die. We've got to sell a message of engaged, interested, thinking about the future. We need to prepare ourselves. There are things we can do.
- Flood risk variables have too much uncertainty. See lots of action around drought and water supply; it's still uncertain, but the level of uncertainty is tractable. Its somewhere in this range.
- Planting a garden. There's really no harm in trying. There are opportunities in chaos.
- I can't recall people in [my organization] who are afraid of making a mistake.
- All this stuff [management issues] never goes away, its just dealing with it from a different angle [post fire].

Grappling with/lamenting the drastic change

- Sense I've gotten- sense of hopelessness... That type of uncertainty discourages both financial and emotional investment. One challenge will be getting people excited about tackling this former forested area. Huge sense of loss.
- That sense of hopelessness is exacerbated by the quality and amount of climate change research. Bright people are giving us a very bleak picture of what the Jemez mountains. That's looking at conifer forests. They might go away. What happens next if there are no conifer that are left. Others are less dire, but everyone sees major changes. On top of burned areas and droughts, looking at warming temperatures, we have to manage for all different possibilities. But something will take its place even if conifers go away.
- When I visit certain places "I see ghosts"
- Its going to take a long time.

Acceptance of the drastic change

- Maybe we decide it's not worth investing in. We let nature take its course and protect the [remaining forest]
- One of the scientists was describing that in 50 years there may be no trees left in the Jemez mountains. That's a really striking suggestion that really carries it home for me what climate change could mean. My mind turns to what does that mean for my daughter, my grandkids, how future generations are going to interact and survive in a landscape far different than what we're dealing with now. Making a connection between human experience and climate models. If our watersheds are drying out, what does that mean for what we depend on.
- I think about the [heavily impacted] landscape and I don't want to sound pessimistic, but it feels a bit like a lost cause, we missed the opportunity to try to manage this ecosystem as we knew it before. It's forever going to be changed. I don't know if there's enough money out there to return it to what it was before. I'm somewhat resigned to the fact that when I talk to [scientists]

that that landscape has been forever changed, it will just be more of a scrubland, grassland, like lower elevations are. I don't know if we can come back from that. When you add climate change to that formula, it makes the task even more daunting to try to return some of those landscapes to what they were.

- Want to mange people's expectations about what the future of this place is. Some of these places are changed forever.
- I see these changes and it doesn't surprise me. I don't like it, but it doesn't surprise.
- Coping, grieving, pull it together and move forward. OK what do you do in the post end of the world time, how do you recognize that the world hasn't ended, this is act 2… People are going to love this area no matter what it looks like. 20 years from now, the New Mexican locust might look really, really pretty. We adjust our expectations to what's right in front of our face.
- No trees are going to survive here in a business as usual scenario. We're gonna lose this stuff. Thinking about how forests have changed in the past, there's gonna be something out there that requires collaboration, the same natural resource decision making, and it maybe very different in 20 years. It might then be about hand watering the surviving trees in a particular area. The importance of science, of engaging communities, of linking to economics, the importance of livelihoods—it'll all still be there.
- I'm a big proponent of letting nature take its course through these things. Our history of stopping fire and the impacts it has. I don't think we're the best ones to decide what should be. Its really looking at what we think the new environmental conditions can support, and what timeframe it needs to occur, then we can decide if we want to speed natural recovery up. A good test case is the fires that occurred in Yellowstone. What can we do that has an impact and are those choices environmentally sound?
- Maybe in some ways it's [thinking about change over time is] a coping mechanism. When you've lost your beautiful neighborhood you start thinking about cities and regions.
- If we can't get pines back, can we make trees out of oaks?
- Doesn't mean in the future we might see these kind of events, because of changing climate, but right now I think they're going to behave the way they [fires] have the past few decades when they hit the burn scars, they stop.
- What I'm seeing now is nothing like what it was like. I don't have the perspective. It's important to have that connection. But, maybe that's also good because I'm not feeling like we have to bring it back to what it is, things change. I wish I could experience how things were. Maybe my perspective would be different, but I don't know, it's hard.

Fear of making management mistakes:

- People are worried about legacy stuff, don't want future people looking back and saying "what the hell were you guys thinking?"
- This requires some bravery—giving advice to managers is hard, it's not [my] ass on the line if the fire goes over the hill. But we need to expect that mistakes are going to be made.
- Do you really want to plant trees when research says there might not be trees later? Assisted migration? Replanting under existing trees?
- We've always been able to be in tune with prevailing information on how the ecosystems function. If they [the scientists] don't know, I'm really in the dark then. Anything that benefits figuring out the natural resource game will help me do my job better.

- Apprehension is over bad decisions- funding is so limited. I want to make sure that whatever I use that money for I want to make sure it's the right decision. I don't want to waste money.
- If we're managing with uncertainty and we're all comparing notes then at least we can share information and have a sounding board.

Fire experience

Loss

- It's heartbreaking
- Our soil is measured in tens of centimeters. Watching that wash away in the erosion there is really hard to stomach.
- I put off as long as possible going back to the Dome because I didn't want to see it and I didn't want to go back by myself I wanted to go back with someone with because it was so heartbreakingly painful.
- Two schools of thought: people who haven't set foot into the burned area since 2000 because it's too ugly. [They are] the minority.
- Evacuation stories- if you say evacuation to anyone, you get big story. And then when they come back and saw what happened that was the second trauma.
- Sounds like it's a moonscape watershed now.
- You can talk about tragedies of losing homes, losing life. There are fires that are tragedies, where we lose 19 people in an hour. This is an unfortunate ecological event that we have to take a lot of time to recover from.
- But the other [part of me] is the one who lives here, who loves and hikes this landscapes, has a more emotional response. I understand the people who don't want to go back to this landscape. There are places I became very fond of.
- Driving through there it was disorienting, not having the landmarks that you used to orient by
- Fell in love with Frijoles Canyon the first time I was there. Decided to move there. Now has a hard time going back.
- The fire impacted us in terms of traditional use. [Agency lands], evergreens no longer there, have to go to other places because this area doesn't have what we need. We've had to go beyond out of our comfort zone, ask other pueblos. ALL dealing with that.
- Doing mortality work and wildfire stuff. We're going to lose a lot more forest, and we can do everything we can to try to prevent it, but we're going to lose a lot.
- No trees are going to survive here in a business as usual scenario. We're gonna lose this stuff.

Connection to home

- I grew up in Espanola. The Jemez is my back door.
- A place I loved, I had eaten the soil for god sakes, crawling around on the ground. In some sort of a maternal way, a place that I loved that had been through a hard time,
- My supervisor was from [the Jemez] Knew that place so deeply and had trees and veg landmarks that she had in her head since childhood

Change

- These areas are drastically changed from what they are before.

- For a long time we never saw this kind of fires. It's a different kind of experience
- What I'm seeing now is nothing like what it was like. I don't have the perspective. It's important to have that connection. But, maybe that's also good because I'm not feeling like we have to bring it back to what it is, things change. I wish I could experience how things were. Maybe my perspective would be different, but I don't know, it's hard.
- The world is changing so rapidly.
- I came in 1995, my first season, I was working for resource conservation. 1996 was the Dome Fire. Prior to that the major fire was La Mesa. That was my introduction to unplanned ignitions. I've seen the landscape change.
- When he first arrived in the SW he was talking about thinning and biomass markets and we'll be able to do, it'll take a lot of work, but it's manageable. When Las Conchas burned, it was such a visible sign that the paradigm of "thinning our way out" had shifted. After 2011 and in the intervening six years, there's a change of perspective. It's partly a triage view, acceptance that areas of Las Conchas will never be ponderosa again. It changes how we talk about things.
- "Learning to love oak and making oak great again" having to think about the forests and fire differently. Is changing what [we do] as an organization. Marked a shift, the guild has really moved into prescribed burning and natural ignitions. Thinning isn't [enough].
- Thinking about how forests have changed in the past, there's gonna be something out there that requires collaboration, the same natural resource decision making, and it maybe very different in 20 years. It might then be about hand watering the surviving trees in a particular area.

Curiosity and fascination

- Exciting to have a big fire as an archaeologist. Were there fires like this in the past? Those kind of questions. Exciting for an archeologist to be involved with something with modern relevance, to do something that could be of value to other people.
- Little positive things are happening. It'll be fascinating to watch.
- When my kids come I take them in the burned area, not in the forest. I think it's kind of cool…
- Even the burned landscapes are spiritual for me. What's been lost in beauty has been gained in the fascination in succession, watching what happens next.
- For me, my science mind is very interested. If I have that mind in place and am trying not to be too emotional, I see it as an opportunity to learn a lot. And we've certainly been trying to do that especially over the last 5 years. Part of me thinks this is OK, it's going to recover, it may not be what it was before, but it is going to recover.
- In Santa Fe, seeing the flames reflected in the clouds, going up afterwards and seeing these sites and the transformation.
- People talk about the travesty of the Las Conchas Fire. I never talk about it that way…It's fascinating to see what's happening, how it's rebounding. I walk across the creek every day and I look at it. I can remember it being a straight channel of muddy water, to clear water, then it dropped two feet, now its back up. I'm seeing little meanders, pools, slowing down. That's been something to watch! I'm waiting to see fish jumping up there! It's not a travesty.

Life goes on

- There are things using that land out there. People are still going out there to hunt.

- Optimally what I would like to see is a landscape that manages itself. That is performing naturally and healthy. With our wilderness values and what I understand about ecology, if it were correct and balanced, it would be doing things naturally, and that's what we want. I want people to go out there and experience a wilderness and backcountry that is truly natural. Fire regime, erosion or not, that's what I'd like. Get some balance out there, observe and monitor. But we have a lot of human influence that has modified that behavior. Because of that unnatural influences, we need to respond and try to correct what's happening on the landscape. And I know that.

Silver linings

- Silver lining is it killed nonnative fish. Now low hanging fruit for restoration of native fish
- As devastating as the fire was, once the watersheds are recovered, it'll be a net benefit because we'll be able to replicate individual populations. It's a silver lining for fish. In some areas, you see pretty quick recovery of riparian. Don't know if it's the right vegetation, but the fish don't care, its shading.
- Without Las Conchas you don't have big horn sheep back in the Jemez. And for some people connected deeply to this place, that was a significant event, hugely important, that they'll remember as much as they'll remember in a fire. They don't want to burn the rest of the mountains to put sheep on it, but to think about it in terms of death, destruction, tragedy, it's hard to overcome despair.

An opportunity to be an example for other places

- I believe what we've experienced in the Jemez Mountains is unique right now but will soon become redundant and banal. And that breaks my heart. We're just a little different than everyone else. Right now we can stop and focus. While it's been upsetting and distressing, we've been able to indulge our experience. We can help other people with our experiences and stories. Everyone is going to be facing this. In the context of climate change, this is what we're all facing.
- A place that I loved that had been through a hard time, realizing nope there may not be anything that can be done at this scale. That isn't my conclusion now. That's something the example of the Jemez Mountains can offer, it can help.
- At the last SWFSC board meeting, they were talking about the consortium and what's been happening and in that conversation they were talking about Las Conchas as a turning point in people's thinking about how we manage lands in the southwest.
- [Las Conchas] reaffirmed that landscape restoration was the right way to go, a priority, so we can avoid or reduce [fires like this]

Community memory fades and changes

- The stories are the important part. It's a transient community. Some people have no clue what happened. Older folks have a lot of stories too.
- Then the people who don't know any better cause they just got here. They need to be reached the most. They didn't get the fire ecology lesson. Those who know are much more accepting of the landscape, the way it's recovering, that fire is going to happen.
- Growing up here, I thought forests looked like what they do now. Really dense, small diameter trees. I had no idea what it was supposed to look like. You just assumed you knew about it

always. It was quite a wake up call. Everybody around here recognized that these fires were possible… Everyone was surprised by the scale of Las Conchas. I don't know exactly the acreage of the previously largest fire, but I don't think it was anywhere near the size of Las Conchas. There was a little bit of a shift in how I thought about fire in this landscape.

- Most of the staff had been here since prior to the fires when I came on. We'd been hunkered down too long. People told me, people don't trust us, but honestly it seemed like [the public] had moved on.

Community solidarity in the face of challenge

- USFS said we need to plant trees. Demand was such that we that we had to take reservations and turn people away. And trail restoration, could get in to do volunteer work. But that wasn't what they wanted, they wanted to plant trees. Healing.
- We had an elaborate scheme- mimic the old forest. 3 seedlings 20 ft apart. Reality: Any place you could dig a hole you planted a tree. And you can hire a contractor, their success is 1/3, with volunteers, its more like 50%, there's a lot more care going in to it… It took a champion or two who said we're going to make this happen as a community, and a community that really wanted to get out doors.
- I remember stories of people going out and actually adopting a tree, taking a pail of water out there and watering it. After Las Conchas we kicked a lot of people off because they wanted to do something like plant trees but because of the hazards from falling trees. That's OK, safety rules, but at the same time, maybe that's where building hope back into a community after this happens, the things you're trying to do, they might be small and labor intensive things but that's what a community needs to do to get back in the swing of it. To feel that the doom is not so thick, that there's a reason to stay in the community and not leave, feel that it's all going to be horrible from here on out. Those kinds of projects, if they can be done safely. Most people who are there near the forests love it, love the country.
- The importance of science, of engaging communities, of linking to economics, the importance of livelihoods—it'll all still be there.

Disruption of relationships because of fire

- My understanding is we used to have more collaboration. Soured relationships. Caused long term damage to the interagency relationship. Has healed over time. Now fire programs have good relationships.
- It's the history of Cerro Grande. It's been so hard on staff. The emotional impact of going through these types of experiences. Loss of institutional knowledge. Most people are gone after Cerro Grande. We've all come through a long hard period of dealing with emergency response. My hope is that we're getting out of that time and to a point where we can think more about the future without having the shadow of Las Conchos and Cerro Grande. Need to rebuild and get the energy.
- During Las Conchas, [during one of the meetings] I thought we were going to get lynched, they were so mad, but it was mainly about all that grass. They were angry that the grass got burned up, and they thought the grass carried the fire over to their side of the world.
- Wildfire often burns more than trees.

Can't control the weather alone: feels helpless for management

- Effects of fire are so far reaching that now it's hard not to take a more passive approach [to managing resources]. Well these things are happening, and I have very little power to change things. I'm always grappling with that. What can I do to deal with the loss? Can't grow the trees back, can't prevent erosion…I guess I'm a little bit jaded. [I've been told sites need to be left alone] they're going to do what they're going to do, that's part of their lifecycle, their death cycle. Now thinking more along those lines, but I need to do things, it is part of my job. I find a little bit of contradiction there... You can't stop climate change yourself.
- Fires and floods have been of concern: we don't have control of the weather, fires and floods can affect traditional ways of life. Floods have torn out restoration efforts.