April 2010

Mixed–Conifer Forests in Southwest Colorado

A Summary of Existing Knowledge and Considerations for Restoration and Management

Colorado Forest Restoration Institute

Colorado State University

ABOUT THE COLORADO FOREST RESTORATION INSTITUTE

The Colorado Forest Restoration Institute (CFRI) at Colorado State University was established in 2005 per the authorizing language of the Southwest Forest Health and Wildfire Prevention Act of 2004 and charted by the Western Governors Association. CFRI is part of the Southwest Ecological Restoration Institutes along with the Ecological Restoration Institute at Northern Arizona University and the New Mexico Forest & Watershed Restoration Institute at New Mexico Highlands University. The purpose of CFRI is to conduct, compile, synthesize, and translate scientific research to support restoration and wildfire risk mitigation decision-making by affected entities identified in the Act.

CFRI works with public and private forest land managers, researchers, collaborative partnerships, elected officials, non-government organizations, and the general public to identify needs. Annual work plans are developed based on an assessment of these needs and in consultation with an interagency Development Team. An interagency Executive Team approves and oversees accomplishments of the work plans. Funding for CFRI comes from appropriations through the US Department of Agriculture, Forest Service and the Warner College of Natural Resources at Colorado State University.

CFRI has four programmatic emphases areas:

- Information synthesis, outreach, and application
- Collaborative monitoring and adaptive management assistance
- Enhancing wood biomass utilization (in partnership with the COWOOD program of the Colorado State Forest Service)
- Collaboration assistance and support

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EXECUTIVE SUMMARY

The Colorado Forest Restoration Institute was requested by the San Juan Public Lands Center and the Pagosa Ranger District to compile and synthesize the current state of knowledge, and convene a collaborative learning workshop to assess current restoration activities on the Pagosa Ranger District regarding the mixed-conifer forests in Southwestern Colorado. This report presents the state of knowledge synthesis and key discussion points from the workshop which was held October 21-22, 2009 in Pagosa Springs, Colorado.

In the warm-dry zone (lower to mid-elevations dominated by Ponderosa pine, Douglas-fir and white fir), fire suppression and past management practices have resulted in large areas outside of historic range of variability in terms of stand structure, composition, and disturbance regimes, especially fire. Research suggests that fire rotation has lengthened and an absence of intermediate-scale fires that would have burned with mixed severity across the landscape. The result is increased stand density and species composition shift in favor of Douglas-fir and white fir and a decline in Ponderosa pine. In the cool-moist zone (upper elevations dominated by white fir, but including Douglas-fir, aspen, and spruce), fire suppression has had a lesser effect on forest structure, composition, and disturbance regimes since this zone experiences infrequent fires. However, managers have concerns about age-class distributions skewed towards older-aged stands and relatively few younger stands, and susceptibility to insect infestations. Aspen decline across the mixed-conifer landscape is also a managerial concern due to the lack of disturbance and the presence of Sudden Aspen Decline.

Forest land managers have and continue to conduct restoration treatments in warm-dry mixed-conifer areas. Recent research by Dr. Julie Korb, Fort Lewis College, suggests that a combination of mechanical treatments and prescribed fire result in conditions that are more within the historic range of variability than using mechanical treatments or prescribed fire alone. Workshop discussions affirm that forest land managers should strive to use a mix of treatments across the landscape to restore warm-dry mixed-conifer. Ongoing monitoring and collaborative learning among managers and interested and affected stakeholders were identified by workshop participants to continue to gauge the effect of these treatments and contribute to adaptive management over time.

To perpetuate aspen as a component of mixed-conifer forests, mechanical and prescribed fire treatments can contribute to desired aspen conditions. Attention to fuel loads and soil moisture is necessary when using prescribed fire. Exclosures to prevent elk and cattle browsing can improve aspen regeneration success.

Non-native plant invasions pose a difficult trade-off for managers. Mechanical or prescribed fire treatments can result in restored forest conditions but also increase non-native plant species. Again, monitoring and adaptive management were identified as critical by workshop participants to understand the treatments and conditions under which non-native species invasions increase or can be ameliorated.

The cool-moist mixed-conifer forests may not warrant restoration, as forest structure, composition, and disturbance regimes are likely within historic range of variability. However, there may be a need to increase diversity of age-classes at a landscape scale as a desired condition. Workshop discussions emphasized the need for planning for desired conditions at a landscape scale targeting multiple objectives using a collaborative process.

Local wood industries and community-scale bioenergy users can be used as instruments to achieve restoration and other desired conditions in mixed-conifer landscapes. Southwest Colorado has few wood utilization firms in close proximity so the potential to improve the economics of landscape-scale treatments is limited. Workshop discussions suggested that management planning incorporate multiple objectives, address all forest types, pay special attention to steep slopes and sensitive wildlife and riparian habitats, and use existing road infrastructure.

Forest land managers were encouraged to continue to use a collaborative process inclusive of all stakeholders in planning, implementing, and monitoring treatment activities in order to increase knowledge, share values, and build trust.

(Photo: Peter Brown)

INTRODUCTION

Due in part to the exclusion of fire, mixed-conifer forested areas, especially in the warm-dry zone, were once open and dominated by fire-tolerant species but have become densely forested by shade-tolerant, fire-susceptible trees. The resulting increase in canopy cover reduces sunlight available to the understory, reducing herbaceous shrubs and grasses. This dramatic change is common in forested landscapes throughout Southwestern Colorado, and has led to a common goal of restoring the landscape to its historical conditions.

Cool-moist mixed-conifer forested areas may be within historic range of variability in terms of forest composition, dynamics, and disturbances and may not warrant restoration. However, there are managerial concerns about mortality from large-scale insect outbreaks and age-class distributions skewed towards older stands across the landscapes. Aspen is closely associated with many mixed-conifer forests in Southwestern Colorado. Fire exclusion and past management have in large part decreased the aspen component across the landscape, prompting an interest in maintaining aspen in mixed-conifer landscapes.

At the request of the Pagosa Ranger District of the San Juan National Forest, the Colorado Forest Restoration has prepared this summary of current knowledge about mixed-conifer ecology and management in order to inform management decision-making and stakeholder involvement. The purpose of this report is two-fold: 1) provide a succinct summary of scientific knowledge of mixed-conifer forest ecology and disturbance regimes, and 2) identify general principles to guide decisions to restore and manage mixed-conifer forested areas on the Pagosa Ranger District.

The report is organized into two parts. The first is a synthesis of the scientific literature on warm-dry mixed-conifer forest ecology, with special emphasis of those forested areas in Southwestern Colorado. The second part is a summary of key points emerging from a workshop on mixed-conifer forest ecology and management held October 21-22, 2009 in Pagosa Springs, Colorado, featuring presentations by forest scientists, managers, and stakeholders, and group discussions involving 82 participants representing diverse interests and perspectives.

This report is intended to serve as a basis for further learning and adaptive management on mixed-conifer forest restoration and management. It does not constitute a management plan or set of prescriptions, nor is this the scientific authority on mixed-conifer forests in Southwestern Colorado. While there are emerging understandings about restoration needs and ongoing treatments in mixed-conifer forests, there is much more that remains to be discovered.

PART 1: MIXED-CONIFER FORESTS IN SOUTHWESTERN COLORADO

Kristen Pelz, Department of Forest, Rangeland, and Watershed Stewardship, Colorado State University, with contributions from Dr. William H. Romme, Department of Forest, Rangeland, and Watershed Stewardship, Colorado State University

Mixed-conifer forest type occurs throughout the intermountain West, generally at elevations between 7,500 to 10,000 feet. In contrast with other, well-known and well defined forest types in the southern Rockies, the mixed-conifer forests are relatively unstudied. They are also very complex and diverse forests, leading to a significant challenge for forest managers. Improving our understanding of mixed-conifer forest dynamics is an important goal for the future (Romme et al 2009).

The mixed-conifer forest zone in southwestern Colorado typically occurs between lower, ponderosa pine-dominated forests and higher-elevation spruce-fir forests. It is not suprising, then, that mixed-conifer forests contain a range of species from both of these more discrete forest types in typical stands. Mixed-conifer species include white fir (*Abies concolor*), Douglas-fir (*Pseudotsuga menziesii),* ponderosa pine (*Pinus ponderosa*)*,*Englemann spruce (*Picea engelmannii*)*, Abies lasiocarpa/arizonica*, aspen (*Populus tremuloides*), blue spruce (*Picea pungens*) and southwestern white pine (*Pinus strobiformus*)*.*

However, the species actually present at a specific site vary widely, creating an extremely complex landscape of stands types and dynamics. In the southwestern part of Colorado, it is useful to break the mixed-conifer forest into two or three sub-categories: warm/dry or cool/wet and warm/dry, cool/moist and cold/wet. As more research is completed, it may become easier to see which one (if any) is the most appropriate classification (Romme et al. 2009). The general breakdown of mixed-conifer forest characteristics is presented in table 1.

Table 1.The table below summarizes the general characteristics of the mixed-conifer forest based off the warm/dry and cool/wet classification system (table taken from Romme et al. 2009).

	Warm-Dry Mixed-conifer	Cool-Moist Mixed-conifer
Environments	Lower elevations, mostly southerly aspects	Higher elevations, mostly northerly aspects
Major Species	Ponderosa pine, Douglas-fir, white fir, Gambel oak, other shrubs	White fir, subalpine fir (both typical [*Abies lasiocarpa* var. *lasiocarpa*] and corkbark [*A. lasiocarpa* var.

		arizonica), Douglas-fir, aspen, blue or Engelmann spruce, snowberry, other shrubs
Disturbance Regime	Recurrent, non-lethal fires (20-50 yr. intervals); rare lethal fires (>100 yr. intervals)	Lethal fires at long intervals (>100 yr.); occasional small non-lethal fires; landscape patch mosaic
Common Stand Structure	Overstory of ponderosa pine and/or Douglas-fir, white fir; midstory and/or understory of white fir	Even-aged or all-aged stands of variable species composition and structure
Regeneration of Canopy Trees	Episodic establishment of pine and Douglas-fir, perhaps mainly after fire; adult trees survive non-lethal fire	Episodic or continual establishment of conifers between fires; aspen and possibly Douglas-fir establish primarily after fire
Regeneration of Understory Species	Continual establishment of white fir during intervals between fires; both mature and juvenile fir killed by most fires	Continual establishment of white fir and other shade-tolerant conifers during intervals between fires; most trees killed by most fires

Historical species composition and vegetation patterns

Warm/dry mixed-conifer forests were likely much more open in the past than today, with stands dominated by large ponderosa pine, and scattered to infrequent Douglas-fir or white fir, over an understory of containing Gambel oak (*Quercus gambeii*) and other shrubs. This low-density stand structure was probably due to frequent surface fires which would clear out understory trees while leaving mature fire-tolerant ponderosa pine and Douglas-fir (Romme et al 2009). There is reason to think this is the case from mixed-conifer forest descriptions from other areas (i.e., Arizona: Fule et al. 2003, Mast and Wolf 2004; Montana: McCune 1983; the eastern Cascades: Agee 1993; eastern California: Taylor 1993, Taylor and Skinner 1998, Urban et al. 2000, Stephens 2001; Baja California: Stephens et al. 2003, Stephens & Gill 2005, and the southwest in general: Jones 1974; all cited in

Romme et al 2009). However, there is little data reconstructing past mixed-conifer forest structure and composition in Colorado.

Luckily, work published in September 2009 describing Lower Middle Mountain in the San Juan Forest has begun to fill this knowledge gap. According to data collected by Fule et al. (2009), mixed-conifer forests in Colorado have changed significantly in their dominant species and density since the last fires occurred, before 1870 (see Figure 1 & 2 below). In general, forests stands in the study were formerly dominated by ponderosa pine, and accounted for 65% of basal area and nearly all trees >45 cm DBH in 1870. White fir (17% total basal area) and Douglas-fir

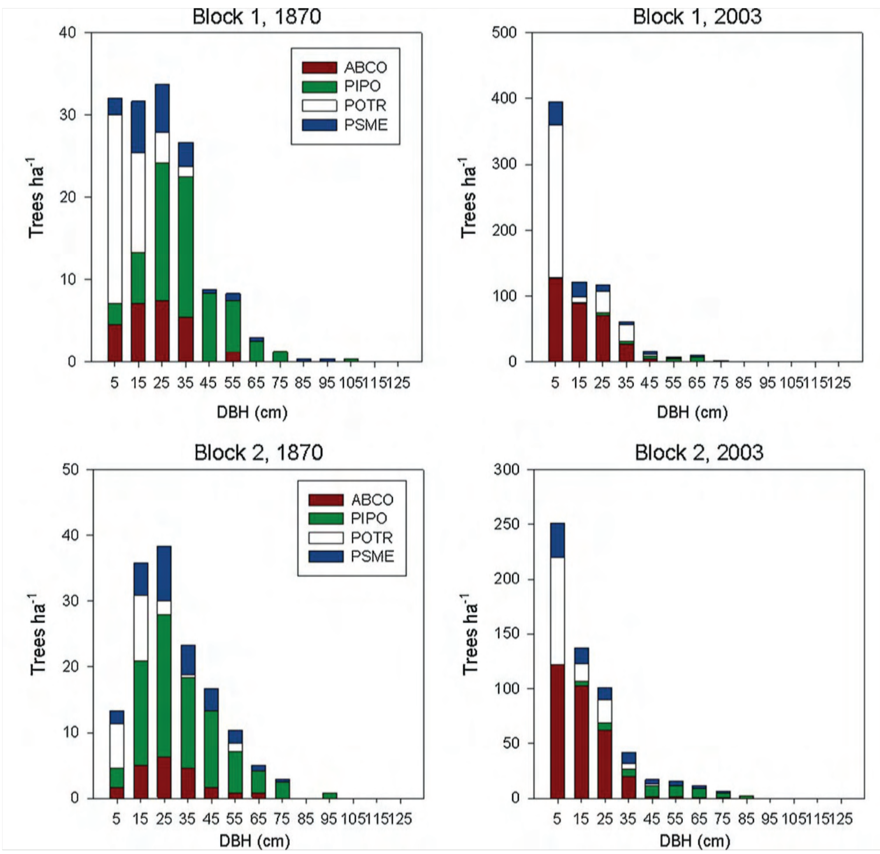

Figure 1. A comparison of species composition in 1870 and 2003. Figure taken from Fule et al. (2009).

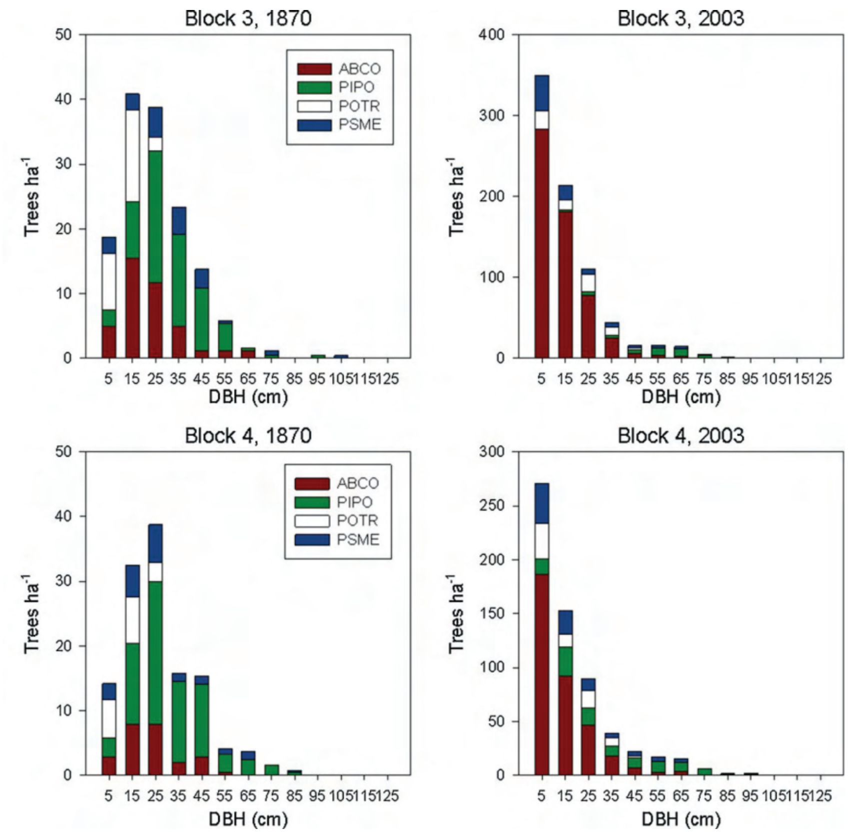

Figure 1 (cont'd). A comparison of species composition in 1870 and 2003. Figure taken from Fule et al. (2009).

(15% total basal area) were a small component of the forest. Ponderosa pine also dominated successful establishment during the period before 1870, while establishment by other species (aspen, white fir and Douglas-fir) became consistent in the period after 1870. By 2003, these sites, formerly dominated by fire-resistant, sun-loving ponderosa pine (now only 36% of the total basal area), were dominated by white fir, Douglas-fir and aspen. The number of ponderosa pine trees per acre has dropped dramatically, and there has been a general shift towards more, smaller trees, especially small white firs (Fule et al. 2009).

The historical structure of the mixed-conifer forest around Lower Middle Mountain was very different from what it is today, suggesting that other mixed-conifer forests in the San Juans may have experienced similar changes during this time.

Historical Disturbance Regimes

Historical Fire Regime - It is believed that mixed-conifer forests historically have had a very diverse, mixed-severity fire regime, existing somewhere between the frequent fires expected in ponderosa pine forests and the infrequent, stand-replacing fires expected in spruce-fir forests at high altitudes. In the period before European-American settlement, fires are thought to have been relatively frequent and moderate in warm/dry mixed-conifer forest areas. A large proportion of these fires were extensive. In contrast, cool/moist mixed-conifer probably had a much less frequent fire-return interval, due to the high-elevation late-season snowpack. Fires in these areas likely occurred only when the normally moist fuels were dry enough to burn in very dry years, resulting in patchy, high intensity, tree-killing fires. This allowed stands to grow for many years before being affected by fire (Romme et al. 2009). Near Pagosa Springs, patches of high tree mortality were mixed with relatively untouched trees to create a very complex landscape of mortality patches (Carissa Akoi, unpublished data, cited in Romme et al 2009).

Recent evidence in mixed-conifer forests of the San Juan National Forest shows a mean fire-return interval of roughly two decades. Pre-1870, the median fire-return interval at the Monument, Taylor Creek, and Burnette Canyon warm/dry mixed-conifer sites in the San Juan National Forest was 18-28 years, which was significantly greater than at lower, ponderosa pine dominated stands (6-10 years) during the same period (Grissino-Mayer et al 2009). There was roughly the same median time between all fires (18-28 years) and between extensive fires (scarring 50+% of the trees - 21-27 years), suggesting that most of the fires in the area were relatively extensive (Romme et al. 2009).

Similar, but slightly longer fire-return intervals were found at the Lower Middle Mountain sites discussed previously (Fule et al. 2009). These sites are currently dominated by white and Douglas-fir, but were once dominated by large ponderosa pines. Before 1868, the mean fire-return interval for all fires in the study area was 24 years (3 – 50 year range), and fires scarring 25%+ of the measured trees occurred every 32 years. There were extensive fire-free periods from 1685 to 1735 and 1824 to 1861, years which were relatively very wet. Years with fire activity tended to be very dry, but there was no significant impact of the previous years' precipitation on fire activity (Fule et al 2009).

Both studies suggest that fires have not occurred in mixed-conifer forests of the San Juan National Forest since before 1880, the time when European settlers began significantly influencing the landscape of the area. This could be due to the introduction of grazing sheep and other domestic animals in the landscape that ate the fine fuels that formerly carried surface fire or increased suppression of natural fires. Whatever the cause, the effects of this exclusion have been profound.

Other disturbances affecting mixed-conifer forests - In addition to fire, secondary disturbances changed the landscape and increased the spatial complexity of mixed-conifer forests. Windthrow of patches of trees can create large canopy gaps, allowing increased understory growth and regeneration of sun-loving species. Other disturbances include fungal diseases and insect outbreaks, such as spruce budworm (*Choristoneura occidentalis*) (Romme et al. 2009). Western spruce budworm is present in mixed-conifer forests, and feeds new growth of Douglas-fir and white fir. In the past, defoliation sometimes caused mortality in these species. Given fire exclusion since the late 1800's, mortality has become more widespread. During the last 350 years, peaks of the insect in mixed-conifer of the Rio Grande National Forest were found to correspond with higher moisture levels during the last 350 years. In general, outbreaks occurred every 24, 35 or 87 years regionally, and had not decreased significantly since Euro-American settlement (Ryerson et al. 2004).

These secondary disturbances were usually restricted in scale (Romme et al 2009). Together with larger-scale fire effects, these localized disturbances increased the historical patchiness of the mixed-conifer landscape. Understanding the relationship of these patches to the landscape-level forest succession and forest dynamics should be a focus of future research on mixed-conifer forests (Romme et al. 2009).

General Management Implications and Considerations

Due in part to the exclusion of fire, forested areas which were once open and dominated by fire-tolerant species have become densely forested by small shade-tolerant, fire-susceptible trees. The resulting increase in canopy cover reduces sunlight available to the understory, reducing herbaceous shrubs and grasses. This dramatic change is common in forested landscapes throughout the region, and has led to a common goal of restoring the landscape to its historical conditions. Unfortunately, this is easier said than done. The first challenge is to understand the natural range of variability. We are beginning to see research into mixed-conifer forest species composition and dynamics, but much remains unknown (Romme et al 2009).

Based off what we do know, if ecological restoration is the goal, it would be appropriate to remove shade-tolerant, fire-intolerant species such as white fir, which could allow fire-tolerant ponderosa pine and Douglas-fir to again gain dominance as they would have in the presence of fire (Battaglia & Shepperd 2007). This may be beneficial in areas similar to Lower Middle Mountain, where it has been documented that white fir is now dominant in areas once dominated by ponderosa pine and Douglas-fir (Fule et al 2009).

If returning forests to their historical condition is the goal, it is important to understand that ecological restoration treatments may not necessarily have the desired, predicted effects. For example, in a study of ecological restoration treatments (which included mechanical thinning and prescribed fire) in northwestern Arizona, Fule et al. (2006) found unexpectedly high post-treatment mortality of ponderosa pine. Post-fire mortality was significantly higher than seen from similar treatments in Grand Canyon National Park (Fule et al 2005, cited in Fule et al 2006), highlighting the uncertainty of outcome we must understand before prescribing treatments with the goal of "ecological restoration."

Special Concern to Management for Ecological Restoration

Gambel Oak – Restoration activities may have the unintended impact of increasing Gambel oak understory. After a prescribed burn in Arizona, there was less regeneration of ponderosa pine compared to that of Gambel oak (Fule et al. 2006). It seems a single burn may often produce this effect. Harrington (1985) found Gambel oak stem density increased with a single, annual burn, or with successive, spring or fall burns, but that stem density reduced by 20% with two repeated *summer* burns. Two successive burns resulted in reducing the energy available for carbohydrate storage in oak roots enough to cause mortality.

Aspen - Aspen (*Populus tremuloides*) is a much valued component of the mixed-conifer landscape, for wildlife habitat, diversity of the understory and aesthetic values. Yet, many fear that it is in decline in Western Colorado. Typically, successful aspen regeneration occurs after canopy-opening disturbances, often stand-replacing fires, which have been largely excluded from the San Juan National Forest landscape since the late 1800s (Romme et al. 2009, Fule et al 2009). Therefore, most aspen stands which last established with fire in the region have been or are being invaded by conifers (Smith & Smith 2005) and will likely lose the competitive advantage as the stand approaches 100 years of age (Shepperd et al 2001). If increased aspen regeneration is a management goal, it is important to recognize that high browsing pressure from animals (wild and domestic) can cause regeneration to fail (Shepperd, personal communication).

Grazing - As areas that were historically more open or dominated by deciduous aspen become dominated by conifers, managers must be careful not to over-graze areas that were formerly more productive (Stam et al. 2008).

Climate change and carbon sequestration – Restoring forests to their historical range of variability may make them more resilient in the face of more frequent severe fires and extreme weather conditions as predicted in climate change models (Fule et al. 2006, Fule et al. 2009). Because fuels treatments may reduce the probability of mortality due to fires, treatments may have the added benefit of increased carbon sequestration (North et al. 2009, Stephens et al 2009).

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PART 2: SUMMARY OF THE MIXED-CONIFER WORKSHOP, OCTOBER 21-22, 2009, PAGOSA SPRINGS, COLORADO

The Colorado Forest Restoration Institute, with assistance from Fort Lewis College, convened a learning workshop on mixed-conifer forest ecology and management. The purposes of the workshop were to:

- Enhance collaborative learning and communication among citizens, managers, and researchers about the ecology and adaptive management of mixed-conifer forests on the Pagosa Ranger District, San Juan National Forest.

- Identify zones of agreement for the adaptive management of mixed-conifer forests on the Pagosa Ranger District.

The workshop drew 82 participants (see Appendix B) representing diverse interests and perspectives and included land managers, wood products industry and wood users, conservation organizations, Southern Ute Tribal Forestry, CSU Extension, scientists, private landowners, and interested members of the general public.

The agenda (Appendix A) was organized into four components:

1) Historic conditions
2) Current conditions
3) Stakeholder perspectives
4) Field tour of mixed-conifer treatment areas on the Pagosa Ranger District.

Adobe PDF files for all the Powerpoint presentations are posted on the Colorado Forest Restoration Institute's website:
http://warnercnr.colostate.edu/cfri-conferences/

For the purposes of this report, presentations and Question & Answer (Q & A) discussion points are summarized for each workshop component.

AREAS OF AGREEMENT

Based on discussions among workshop participants following the formal presentations, the following areas of agreement were identified.

- Mixed-conifer forests exist along gradients of environment and composition (due to disturbance regimes) but it is useful to deal with warm-dry and cool-moist categories for practical reasons. Often these two categories can be recognized readily in the field, although sites in the transition area may be ambiguous.
- In general, warm-dry mixed-conifer is farther outside HRV than is cool-moist mixed-conifer.
- It is unclear how far out of HRV cool-moist conifer forest is at a landscape level. But, HRV is not necessarily our goal.
- It is useful to evaluate risks of various management options (including no management).
- Coarse-grained, broad-scale vegetation diversity has been reduced in the past century; part of the desired future condition is to increase this diversity in certain areas.
- Monitoring and adaptive management should be an important component of any management plan.
- A high priority for fire mitigation should be proximity to infrastructure and other values at risk.
- A high priority for aspen restoration should be stands affected by sudden aspen decline (SAD). These are mostly at lower elevations.
- We should create conditions in which mixed-severity fires, intermediate to large in size, can be allowed to burn with acceptable risk and cost.
- It is important to retain, sustain and encourage viable local timber, forest products and biomass industries, within the capacity of the landscape.
- Non-native invasive plant species are not desirable; we should not encourage their spread in our management activities.
- We should manage for diversity and resilience.
- There is more uncertainty about ecology of cool-moist than warm-dry mixed-conifer forest.
- We should manage for desired future conditions, not for current fears
- We need to think over long time scales. It will take years or decades to achieve our landscape-level desired conditions.
- We acknowledge that climate change will bring additional uncertainties, problems and opportunities.

Information Needs

- We need better information about potential habitat types and their distributions in relation to gradients in elevation, topography and soils.
- We need a better understanding of HRV in cool-moist mixed-conifer forests, including fire regimes and variability in landscape structure.
- We need to know the frequency and importance of extreme disturbances (like 2002 fires) and their role in shaping the mixed-conifer landscape.

HISTORIC CONDITIONS

Presenters:
Dr. William H. Romme, Professor, Colorado State University
Dr. Peter Brown, Director, Rocky Mountain Tree Ring Research
Dr. Wayne Sheppard, Retired research scientist, Rocky Mountain Research Station, US Forest Service

Presentation Key Points

"What Is This Thing Called Mixed-Conifer?"

Bill Romme provided an overview of mixed-conifer forest ecology and disturbance regimes. Mixed-conifer in Southwestern Colorado is a term used to describe forest conditions not neatly categorized into Ponderosa pine or spruce-fir. There is immense variability within mixed-conifer due to environmental/site characteristics and disturbance history. Mixed-conifer can be categorized as warm-dry and cool-moist, primarily due to site characteristics, such as soils, moisture regimes, and elevation. While there are many disturbance regimes affecting the historic development of mixed-conifer, the main interest is in fire. The development of mixed-conifer forests across the landscape is the result of the interaction between site characteristics and mixed-severity fire regimes. In the past 125 years, fire regimes have been dramatically altered. There are still small and very large fires – what is missing are the intermediate-sized fires due to fire suppression and management. The effect is the lengthening of fire rotation (time between fires). The result is a loss of historic variability in mixed-conifer forests across the landscape.

"Fire and Forest History in Southwest Mixed-Conifer Forests"

Peter Brown described the role of tree-ring research in reconstructing forest and fire history. Using growth rings on a tree and analyzing fire scars in those rings, researchers can reconstruct historic fire intervals and the spatial extent of fires in a stand and across the landscape. Rate of tree mortality from fires are much harder to gauge. Tree rings can also be analyzed to reconstruct tree recruitment after a fire. Climate conditions can also be examined using tree-ring data. Dr. Brown presented results on fire and forest history from several sites across Arizona, Colorado, and Utah using this research method.

"Aspen Ecology in the Mixed-Conifer Type"

Wayne Sheppard discussed the role of aspen as a component in mixed-conifer forests. Aspen is seral in mixed-conifer forests, not a stable component. Aspen sprouts immediately after a disturbance. Over time, aspen will be replaced by conifer in the absence of disturbance. Today, many landscapes have increased conifer and decreased aspen patches due to lack of disturbance. Removing conifer overstory or using prescribed fire can regenerate aspen. However, fuel loads and soil moisture are critical variables in regenerating aspen from fire. Research shows that heavy fuels with dry soil conditions result in little aspen regeneration. Heavy browsing from elk or cattle can also effect aspen regeneration, and may require exclosures to prevent browsing.

<u>Historic Conditions Q& A</u>

Q: What are the implications of the future forests in the mixed-conifer? Does anything which was presented this morning conflict with experience
A: Site conditions, especially soil depth, are key determinants of stand composition. Subtle conditions in soil condition will influence what species will grow where. From a case study of mixed-conifer stands on the Uncompahgre Plateau conducted by Dr. Romme, deep-soiled area had all conifers, but with few ponderosa pine. Subalpine fir is not found in shallow soils, but grow quickly in deeper soils. Engelmann spruce will not grow in shallow soils. Disturbance is interacting with site capacity to influence forest species composition.

Q: Do you have any experience with mortality of mature aspen trees and which time of year to burn or kill them?
A: Aspen regenerated very well. Both elk and cattle will not bother aspen as long as other food is around. The most damage to aspen happens when other foods are gone or have lost their caloric value and then will be grazed by elk and cow. Predators can be reintroduced and help to reduce the degree of aspen browsing (i.e. elk in Jackson Hole, WY are constantly on the move due to wolf predation). There is a need for monitoring data to assess what is happening.

Q: In heavy wooded forests with lots of slash, we're seeing an influx of invasive weeds into areas. Is that something that happened 30-50 yrs ago or is it worse now?
A: Non-native and invasive are becoming more abundant and more distributed throughout the area than existed under historic conditions. On Mesa Verde, thistle is dominant after big fires. Prior to the 1990's, it was thought that cheatgrass could not thrive, but after the big fires in 2000, cheatgrass was in the area. They are in the area and on the move. This is a difficult issue, posing a trade-off between disturbance and the immigration of non-native. There is a need for monitoring to see trends if natives are able to come in or if they are losing the battle to cheatgrass, and other non-native, invasive. Models are being worked on to predict non-native species invasions.

Q: Regarding ecological restoration, large parts of landscape can't have fire on due to human concerns, such as smoke and loss of property. Does that mean these areas will not be fixed, ecologically speaking?
A: There is a need to use the term "ecological restoration" with care. Large parts of landscape can't have fire on due to human concerns, such as smoke and loss of property. Lots of places can't go back to historic fire regimes due to anthropogenic reasons. In other areas, timber production is the goal and not ecological restoration. If ecological restoration is not primary object, than this needs to be acknowledge and manage appropriately to goals of managers.

Q: Is there a term we can use to help with dealing with public that is different than restoration?

A: Reserve the term "restoration" for landscapes and processes that are actually being restored. Though the public likes "restoration", it is important to call things like they are so we do not misuse terms and loose the trust that the public has associated with restoration. Dr. Brown suggested using the term "structural" or "partial" restoration, in contrast to "ecological" or "full" restoration, when a mechanical treatment is being pursued but not to be followed by a prescribed burn. Be cognizant of disturbance factors that happen naturally and try to emulate natural processes as much as possible when calling a project "restoration. Don't do things that will have adverse consequences that we know of.

Q: With spruce mortality resulting in large numbers of downed trees, how will fire behave?

A: Spruce-fir forests experience long fire intervals, so there is a lesser probability of fire, but fuel loading will be greater as trees fall due to mortality. Spruce-fir forests do not burn as often or as severe. In these systems, there is a much greater severity on soil and damage to understory plants and regeneration. The probability of ignitions is low, but now many areas have more people, so probability of fire will increase with more people. In a study done in Northern Colorado of the big spruce beetle outbreak in the 1950's, there were no big fires until 2002, primarily due to extreme weather conditions. Spruce beetle in the 1950's did not seem to induce more fires. GIS analysis showed a little bit more severity but that was not due to beetles as much as it was due to extreme weather events of 2002.

Insect outbreaks have become more synchronous and cover more landscapes (past outbreaks were more localized) and this suggests that there is something underlying all of this. Climate change and warmer trends are suspects. There is not much that can be done to stop extensive outbreaks. There be some localized control, but not across the landscape. There are big unknowns due to climate change. Knowing where trees grow and under what conditions is important to know. We need to use this knowledge about where species might migrate in the future. The state of climate change and prediction is at a point where we cannot guess, so we have to monitor the effect of natural and man-made disturbances and stay light on our feet and be flexible in our management techniques. The ecological structures of the mid-19the century may not be sustainable in the mid-21st century.

CURRENT CONDITIONS

Presenters:
Dr. Julie Korb, Associate Professor, Fort Lewis College
Dave Dallison, Retired, US Forest Service- San Juan National Forest
Dr. Tom Eager, Entomologist, Gunnison Forest Health Service Center, US Forest Service

"HRV vs. Current Conditions Need for Change: Local Mixed-conifer Research on Lower Middle Mountain"

Julie Korb presented results of a study on Lower Middle Mountain on the Pagosa Ranger District. The purpose of the study was to develop site information as a basis for restoration efforts and to quantify the effects of treatments (thinning and fire and fire alone vs. a non-treated control area). The public was involved from the beginning of the process. From 1870 to 2003, there has been a significant increase in basal area and increase in tree stem density at the Lower Middle Mountain sites. There has also been a significant shift in size classes to larger-sized trees (unimodal distribution to a reverse-J distribution). Furthermore, there has been a significant shift from ponderosa pine dominated forests to forests now dominated by white fir. The greatest decrease of trees per acre was achieved using a combination of mechanical treatment and prescribed fire. There was also a reduction in tree density with the prescribed burn, but not nearly as great as the combined treatment areas. Similarly, basal area was decreased most in the areas receiving both mechanical thinning and a prescribed burn. Decrease in basal area also occurred in fire-only areas. Thinning plus a prescribed fire resulted in stand conditions closest to historical forest conditions. Regeneration has been significantly affected by treatment. Species richness increased in all areas and there was an increase of non-native species through time.

"Current Mixed-conifer Acreages and Distribution on the San Juan Public Lands"

Dave Dallison described the current acreage and distribution of mixed-conifer forests on the San Juan Public Lands. According to the San Juan Revised Forest Plan:

- There are 252,712 acres of mixed-conifer forest on San Juan Public Lands.
- Cool/moist mixed-conifer that can be actively managed accounts for 29,928 acres.
- Warm/dry mixed-conifer that can be actively managed accounts for 10,645 acres.
- Mixed-conifer in the WUI accounts for 2,302 acres
- Overall, on San Juan Public Lands only about 45,000 acres of mixed-conifer forest (out of 252,712 acres) has active management possibilities. The remaining acres are in areas (wilderness) that have fire as the only feasible management tool.

"Current Insect and Disease Conditions in SW Colorado Mixed-conifer"

Tom Eager discussed current insect and disease conditions in Southwest Colorado mixed-conifer forests. There is insect and disease throughout the Pagosa District ranging in extent from epidemic to endemic levels. Key concerns revolve around: bark beetle-associated mortality in spruce, Douglas-fir, and white fir; defoliation from western spruce budworm; decline in aspen; dwarf mistletoe and other foliar diseases; and root diseases. A brief description of each agent was given.

Current Conditions Q&A

Q: What is the effect on of fire on thistles? Do they burn? Do roots survive the fire?
A: Some thistles are able to resprout from rhizomes after fire, such as Canada thistle. Other thistles are biannuals that regenerate from seed, so they take a while to come back following fire.

Q. What was the natural disturbance regime historically for insects/disease on a large scale?
A: We do not have hard data from pre-settlement insect and disease conditions; our hard data is post-settlement. John Muir wrote about bark beetles. It is likely that there was a bark beetle outbreak during historical mega-droughts. There have likely been fairly major beetle outbreaks since the ice age, maybe every few centuries or every millennium. Due to management (lack of fire) there is now a large monoculture across landscape leading to increased susceptibility to outbreaks today.

Q: What is relationship of Douglas bark beetle and fire? Fire and Douglas-fir have coexisted for millennia. Any suggestions for prescriptions when burning mixed-conifer stands to minimize excessive post-burn infestation?
A: Some things that have been done include pre-fire raking of fuels away from big Douglas-fir trees and foaming them to reduce charring. After a fire, people sometimes use anti-aggregation chemicals to reduce insect infestations. However, these are most applicable at a small scale rather than a landscape scale because they are costly treatments.

Q: If you want to only protect big trees but small Douglas-fir are around, will they allow the beetle population to build up and get into landscape?
A: Yes, this can and does happen.

Q: At Lower Middle Mountain, the Douglas-fir beetle has increased recently. Has Douglas-fir beetle been considered in the analysis of forest composition change there?
A: No, the impacts of Douglas-fir beetle have not been analyzed yet. There was a decrease of Douglas-fir from 2003 to 2009, so it is possible this is due to Douglas-fir beetle.

Q: Cool/moist mixed-conifer forest may be in the historical range of variability (HRV) at stand scale. But at landscape scale, there are more old stands than young or middle aged so may be outside of HRV. How much diversity can we expect to be created by high activity of insects and diseases?
A: Before we had the big beetle years, lots of people talked about beetles increasing diversity. But now they are really increasing the monocultures out there.

There won't be the time to get the age-class diversity. Insect and disease will change forest density, insects will take out a specific species and the process of fire will not be restored. The process of fire won't be there. There is the idea that there are two scales for variability in a landscape. There is the coarse, patch scale, and then there is the inside-patch scale of diversity. Inside patches, there is diversity at the tree level for prevalence of root rot and insects. We are still seeing this small-scale diversity, but we do not have the coarse-scale variability that was created by fire in the historical period.

Q: Do winter temperatures have effect on beetle populations?
A: All of these insects are native and have evolved ways to deal with cold temperatures. It really takes extreme conditions to impact their numbers. Spruce bark beetle on the Flattops was finally slowed by several weeks of -30 degree Fahrenheit temperatures.

Q: We have relatively less Douglas-fir here than to the west. With the amount of mortality we are seeing, are we in an epidemic?
A: Yes, we are probably in an epidemic. Dr. Eager also noted that the spruce beetle is also at epidemic levels. Usually, spruce bark beetles kill weak and damaged trees. But the population of insects is such that they are killing everything.

Q: White fir has an economic value at times, but at other times it does not. With the current levels of root disease and other issues, is it an economically viable option to manage white fir as a timber species?
A: In Oregon and Washington, they have been able to use fire as a management tool. If white fir is thinned mechanically, tree stumps are very susceptible to spores of root disease.

STAKEHOLDER PERSPECTIVES

"Ecological Monitoring for the Uncompahgre Mesas Forest Restoration Project" - Tammy Randall-Parker, District Ranger for the Ouray Ranger District on the Grand Mesa, Uncompahgre, and Gunnison National Forests. Randall-Parker relayed her experience working with Colorado Forest Restoration Institute scientists and spoke on the importance of taking a collaborative approach to monitoring the impacts of treatments. In addition to answering ecological questions, multi-party monitoring helps build trust.

"Local Aspen Industry Perspective" – Norm Birtcher, Western Excelsior. WE produces shredded aspen fiber products. The mill is located in Mancos, processes about 10 MMbf/year worth $15 million/year. WE is the fourth largest employer in Montezuma County. The local aspen industry is an asset for restoring forests. Timber harvest can generate revenue while fire and mastication do not. Aspen utilization is a viable tool in the toolbag. The Westside of the San Juan National Forest has the bulk of aspen processing, while the Eastside needs the help of industry. WE is also a tool to address Sudden Aspen Decline.

"Local Conifer Industry Perspective" – Tom Troxel, Colorado Timber Industry Association. Ninety percent of the timber on the San Juan National Forest is mature, and net growth greatly exceed net removals. There is a need to decide on desired future conditions: what do we want the landscape to function and look like? Two financial considerations for the local conifer industry: 1) a consistent supply of timber and 2) sale design to address both ecological and financial objectives. There is demand from the local industry for San Juan mixed-conifer. Desired future conditions should consider sustainable forest structure, composition, and diversity, but also sustainable businesses and communities. Timber harvesting and fire are both tools. We need to conduct implementation and effectiveness monitoring.

"Conservation Community Perspective on Mixed-conifer Management in SW Colorado" – Ryan Demmy Bidwell, Colorado Wild. The conservation community advocates for implementation of natural processes as management tools, such as fire, with the primary goals being the restoration of natural disturbance regimes and making sure natural areas have resilience to climate change. Mixed-conifer is a diverse forest type and therefore management tools need to be diverse as well. Logging can be a tool but it is not a substitute for natural disturbance processes, like fire. Logging can be used to get to a situation where we can allows natural disturbances to affect the landscape again. Historical range of variability should guide management, since HRV may provide the best chance at resilience of mixed-conifer forest to climate change. But, it is important to understand the issues of scale that come into play with HRV. How do we prioritize the limited resources available? Start with areas with greatest risk. The greatest risks are in forests that are outside of the HRV, particularly if this is true at the site scale. Because resources are limited, we must look for opportunities to accomplish multiple goals. Management guidelines from the conservation community include:

- Start with best data possible for HRV
- Prioritize treatments because of limited resources
- Harvest only in roaded, suitable timber base areas
- Avoid steep slopes, sensitive wildlife habitat, riparian areas in treatment plans
- Work on landscape scale to increase landscape diversity in cool-moist
- Meet multiple objectives when possible
- Work to implement a timber management plan that integrates conifer management and aspen management in areas where they are both present

The conservation community wants to be involved in mixed-conifer management. Collaborative efforts are the best way to accomplish our common goals.

"Potential Biomass Renewable Energy Development in SW Colorado" – JR Ford, Pagosa Land Company. The forest provides an excellent source of renewable energy through biomass. There is a need to remove biomass from forests in the area for fire mitigation and there is also a need for renewable energy. Currently, a biomass renewable energy development is in the test phase in Pagosa. The hope is to build a 4 MWh power plant in Archuleta County using wood chips harvested within 50 miles of the power plant. The goal is to have a power plant designed by February 2010 and to determine the viability of harvesting biomass from the Turkey Springs Project by Spring 2010. In order to be possible, the plant would need 40,000 green tons of woody biomass per year. The Pagosa Land Company is willing to work with the Forest Service and others to meet monitoring needs. The next big step is to quantify the costs of removing biomass from the forest and transporting it to the power plant.

"Pagosa Community Perspective" – Bill Nobles, CSU Extension Agent. 54% of homes in the Archuleta County are second homes. Archuleta county has the highest per capita rate of PhDs of any county in Colorado. People are scared of their "little piece of heaven" being taken away. "Old-timers" have an agricultural perspective and feel that we should use the forest resources more. Baby boomers are most concerned with the forest as they experience it from their home. Their home, family and job comes before their concern for the broader landscape. Young people are very interested in the outdoors and are the demographic that spend the most time outside experiencing the forest. We need to bring more people into the discussion when discussing land management. We need to inform people of the options and understand their values.

MIXED-CONIFER WORKSHOP FIELD TRIP
(contributed by Pagosa Ranger District Staff)

Stop 1 – Warm-dry Mixed-conifer, Devil Creek Timber Sale Area
[Junction, East Monument Park Rd (630) and closed logging road 630D, Devil Ck TS Unit 14]

Treatment History
Area harvested in 1970's, with traditional prep cut of shelterwood, removing mostly large ponderosa pine and Douglas-fir. In 1999-2000, as part of Devil Creek Timber Sale, south side of Road 630 was harvested with "Improvement" Rx cut, focused on removal of white fir midstory (all WF > 8" dbh, designation by description) beneath ponderosa pine overstory. Some poor quality/growth pine and Douglas-fir selectively cut. The mostly white fir & Gamble oak understory was cut in 2003, via hand crews and mastication (mowing). Area then Rx burned in '05 (hand thinned) and '09 (masticated).

North side of Road 630 is still untreated due to requested delays by timber purchaser.

Discussion Points
North side of Rd 630 is a good example of white fir proliferation, beneath ponderosa pine overstory, in understory and midstory; and significant tree density increase in these warm-dry MC stands. Minimal pine regeneration under relatively (for PP) dense overstory. Fire scar history for general area reflects a 15- year fire-return interval prior to Euro-American settlement period (~1870-1880). No major fires since that time.

Conventional understory thin (slashing, with chainsaws) resulted in substantial fuel loading prior to Rx burn. Masticated fuels were more compressed (reduced depth). Burning hand-thinned slash was much more difficult than burning masticated fuels. Both resulted in substantial scorch to residual overstory, with approx 10% mortality in slash unit. It is too soon to estimate mortality in mowed unit.

Experience on the Pagosa District has shown it is best to wait at least 2 years before burning masticated fuels. When burning masticated fuels, flame lengths and rates of spread are low, but residence time and scorch are high.

Numerous medium-sized Douglas-fir trees remain in the treatment areas following thinning and burning.

Stop 2 – Warm-dry Mixed-conifer, Lower Middle Mountain Mixed-conifer Research area.
[End of graveled/open-to-public segment of East Monument Park Rd (630)]

Treatment History, pre-research
Area first harvested in 1992-93 with mix of silvicultural Rx's (seed cut of shelterwood, overstory removal, selection), removing ~ 30% of overstory/midstory

of ponderosa pine and 62% of white fir & Douglas-fir. Numerous pre-EuroAmerican settlement trees were retained. A small portion of area underwent hand felling of understory in mid '90's.

Research Project
There were 4 replicated study plots with 2 treatments (thin and burn, and burn only) and a control in each. There was no thinning or burning in the control plots.

The restoration thinning for the research project was conducted in 2003-2004 and was based on "evidence of pre-settlement trees". Thinned trees were not removed due to "roadless" designation for area, and roadless policy prohibition on harvesting, resulting in very heavy fuel loadings (~40-100 tons per acre).

An acceptable burn window was greatly restricted due to fuel loadings, the wide variety of fuel models within each burn unit, smoke restrictions, and concerns about an escaped fire.

Burning was very difficult, requiring significant preparation and line construction (including mitigative measures due to numerous snags along control lines). The prescribed fire in these areas was of high intensity and created significant scorch in residual trees. Numerous pre-settlement trees were killed in the slash units.

Lesson Learned – need to work more closely with researchers in identifying study areas, developing prescriptions, and specifying time-frames.

The research study has produced some valuable information for the management of mixed-conifer forests in Southwest Colorado.

Stop 3 – Warm-dry to Cool-moist Mixed-conifer, Devil Creek TS

[Units 4, 5, & 8, Devil Ck TS, Rd 630H]

Treatment History
Initial harvest in 1970's (similar to Stop 1), with traditional prep cut of shelterwood, removing mostly large Douglas-fir and Engelmann spruce. Re-entry In 1999-2000, "Group Selection, with sanitation within residual" Rx cut, focused on removal of white fir and aspen midstory (all merchantable WF and aspen, designation by description). Some poor quality/growth spruce and subalpine fir also selectively cut.

Discussion Points
Tree species diversity was high, including ponderosa pine, white fir, Douglas-fir, aspen, blue spruce, and Engelmann spruce.

Transition from warm-dry to cool-moist mixed-conifer occurs quickly and with subtlety. (A ponderosa pine was noted to stand within 80' ground distance from an Engelmann spruce.)

Aspen regeneration prolific in canopy gaps created by harvest, with suckers ranging from 6-15' in height. Aspen regeneration seen as robust; not appearing to reflect signs of SAD.

Presence of large, old Douglas-fir stumps reflect selective substantial removal of Douglas-fir at time of '70's harvest.

Pagosa RD staff shared data regarding the lack of pure aspen stands on Pagosa Ranger District (in comparison with other San Juan RD's), and conversely, the greatest proportion of mixed-conifer on the Forest. Wayne Shepperd and Bill Romme suggested pursuing removal of conifer overstories to stimulate aspen regeneration, particularly in areas between the wildland/urban interface and undeveloped Forest lands (roadless/wilderness). Conversion to aspen dominance may provide "buffering" (due to aspen's tendency for low fire-intensity or spread) and allow for broader use of beneficial fire on the landscape.

Insect and disease issues were discussed, including recent: a) heavy mortality in white fir, b) ongoing spruce beetle epidemic in spruce-fir stands at higher elevations (but moving into mixed-conifer stands), c) ongoing mortality in Douglas-fir, particularly in largest-sized trees, and d) sudden aspen decline, and its more scattered nature on the Pagosa RD (where pure aspen less abundant). There is concern with cumulative impact of simultaneous multiple insect species at or near epidemic levels.

Stop 4 -- Warm-dry/Cool-moist Mixed-conifer (Transition?), upper slopes, Dunagan Canyon
[along Rd 630]

<u>Treatment History</u>
Only scattered, personal-use cutting of trees, in addition to some clearing along fenceline and Piedra Stock Driveway.

<u>Discussion Points</u>
Lack of disturbance has resulted in significant blue spruce and white fir proliferation among pre-settlement, very large, ponderosa pine and Douglas-fir.

Typical of mixed-conifer on Pagosa RD, this is a good site with good growth and large trees. A comparison of ages was made for two of the largest trees in the stand – a ponderosa pine and blue spruce, in close proximity. PP was approximately 280 years, BS was approximately 110 years, at DBH.

Further up-canyon, stand converts to nearly pure blue spruce, with aspen at edges or in small gaps. Presence of scattered, very large pre-settlement stumps of ponderosa pine or Douglas-fir, amidst decaying aspen poles on ground, appeared to indicate:

- stand was formerly composed of ponderosa pine and Douglas-fir overtopping an aspen mid-story;

- lack of disturbance, resulting in high stand density, shading, and competition, leading to dominance by post-settlement blue spruce at expense of pre-settlement pine and Douglas-fir.

There is concern of not treating forests/fuels on steep slopes and canyons which could lead to stand-replacement fires in these areas and multiple undesirable effects (e.g., loss of pre-settlement pine or Douglas-fir, adverse soil effects, including erosion, greatly increased spread of invasives).

Stop 5 – Biomass Removal/Utilization Demonstration project
[Unit 5, Biomass Demo; end of gravel along Rd 629]

<u>Treatment History</u>
Area has had multiple harvests since the 1960's. More recently, public has used area for fuelwood or Christmas tree gathering.

<u>Biomass Demo</u>
There is a proposal for a 4-megawatt biofuels electrical generating facility, in the Pagosa Springs area, by a local company. A request was made to set aside an area for harvesting of bio-fuels to assess effects, calculate biomass volumes, and test capabilities and effectiveness of different types of equipment for capturing and transporting biomass.

The demo project was offered as a service contract to interested bidders. The project area is comprised of 280 acres of warm-dry mixed-conifer reflecting a wide variety of stand conditions (e.g., low to high density; ponderosa pine-dominant to white fir-dominant, with Douglas-fir and aspen, as well; ranging size classes; etc.). Trees were designated by description (species and size) or were individually marked.

The Pagosa District is partnering with Fort Lewis College to assess impacts to the site, especially as regards to soil compaction.

Contract includes removal of boles, plus limbs and tops. Contractor is expected to begin harvesting in early summer of 2010.

Pagosa RD staff hope that biomass utilization will result in meeting objectives in mixed-conifer stands sooner, with less treatment entries, result in significantly reduced fuel loadings and continuity, allowing for more opportunities ("windows") for burning, and accomplish these objectives at a lower cost per acre.

Workshop participants on the field trip, Mixed-Conifer Workshop, Pagosa Springs, Colorado, October 21-22, 2009 (Photo: Bob Sturtevant)

Appendix A: Workshop Agenda

Wednesday, October 21, 2009

9:00am	Opening and Introduction	Mark Stiles Supervisor SJNF
9:15am	CFRI Role and objectives for the workshop	Jessica Clement Colorado Forest Restoration Institute (CFRI)

Historical Conditions

9:30am	Historic Range of variability in SW Colorado Mixed Conifer	Dr. Bill Romme, Fire Ecologist Colorado State University
10:00am	Fire ecology and stand structure development In SW Mixed Conifer	Peter Brown Director Rocky Mt Tree Ring Research
10:30am	Aspen ecology in the mixed conifer type	Wayne Shepperd US Forest Service – Retired
11:00am	Panel for Questions and Answers	ALL
11:30	LUNCH On Your Own	

Current Conditions

12:30pm	HRV VS Current Conditions Need for Change Local Mixed Conifer research on Lower Middle Mountain	Dr Julie Korb Fort Lewis College
1:00pm	Current Mixed Conifer acreages and distribution On the San Juan Public Lands	David Dallison USFS, Retired
1:15pm	Current insect and disease conditions in SW Colorado mixed conifer	Tom Eager & Jim Worrall Forest Health Service Center
1:45pm	Panel for Questions and Answers	All

Stakeholder Perspectives

2:15pm	Local Aspen industry perspective	Norm Birtcher, Western Excelsior
2:30pm	Local Conifer Timber Industry Perspective	Nancy Fishering Colorado Timber Industry Association
2:45pm	Conservation Community perspective on mixed conifer Management in South West Colorado	Ryan Demmy Bidwell Colorado Wild
3:00pm	Potential Biomass renewable energy development in SW Colorado	JR Ford

3:15pm	Pagosa Community Perspective	Bill Nobles CSU Extension Agent
3:30pm	Panel for Questions and Answers	All
4:00pm	Facilitated discussion of need for change, answered ,and unanswered questions, in mixed conifer types of the San Juan Public Lands	Jessica Clement
5:00	Wrap up/ Adjourn	Kevin Khung Pagosa District Ranger/ Field Office Manager
6:00	Informal mixer at the Springs Resort Lobby	

Thursday, October 22, 2009

<u>Visit examples of ongoing management and research sites in the Field</u>

8:00am Meet at community Center (Lunch Provided)

Notes summarizing the locations and details of the field trip can be found on pp. 24-27 of this report.

Appendix B: Workshop Participants

	Last Name	First Name	Affiliation
1	Allison	Lesli	Banded Peak Ranch
2	Aoki	Carissa	Colorado State University
3	Bachtel	Brian	Pagosa Springs Ranger District
4	Baker	Connie	Pagosa Springs Ranger District
5	Ball	Mark	San Juan National Forest
6	Barstatis	Noah	Southern Ute Tribal Forestry
7	Bidwell	Ryan	Colorado Wild
8	Birtcher	Normand	Western Excelsior Corporation
9	Brinton	Sara	Pagosa Springs Ranger District
10	Brown	Peter	Rocky Mountain Tree Ring Research
11	Bucknam	Amanda	Colorado Forest Restoration Institute/CSFS
12	Burns	Sam	Fort Lewis College
13	Clement	Jessica	Colorado Forest Restoration Institute
14	Compton	Beverly	Horseback Riders for a Wild San Juan Mountains
15	Crawford	Dave	USFS San Juan NF
16	Crider	Wes	USFS San Juan NF
17	Dallison	Dave	USFS-retired
18	Dilling	Dave	Colorado State Forest Service
19	Eager	Tom	Forest Health Service Center
20	Edwards	Jonathan	Colorado State Forest Service
21	Ellis	Fred	United State Forest Service
22	Evans	Zander	Forest Guild
23	Fishering	Nancy	Intermountain Resources, LLC
24	Fitzgerald	Gretchen	San Juan National Forest
25	Ford	J.R	Renewable Forest Energy
26	Friedley	Jim	Bureau of Indian Affairs
27	Frye	Bob	Consulting Forester
28	Garcia	Anthony	Pagosa Ranger District & BLM Field Office
29	Garcia	John	Pagosa Springs Ranger District
30	Garvey	Tim	United States Forest Service
31	Gideon	Brain	Southern Ute Tribal Forestry
32	Goodell	Craig	San Juan National Forest
33	Grant	Kent	Colorado State Forest Service
34	Halabrin	Susan	Forest Service Volunteer
35	Harrison	Randy	
36	Hartvigsen	Steve	San Juan National Forest
37	Hentschel	Steve	Pagosa Ranger District
38	Homstad	Kelly	Bureau of Land Management

39	Irwin	Maria	Ecosphere
40	Johnson	Mike	San Juan Public Lands
41	Jones	Beth	Pagosa Ranger District
42	Jones	Leeland	United States Forest Service
43	Keralis	Mica	Colorado Forest Restoration Institute
44	Khung	Kevin	Pagosa Ranger District
45	Kimple	Aaron	Mountain Studies Institute
46	Kohler	Scott	Pagosa Ranger District
47	Korb	Julie	Fort Lewis College
48	Krabath	Mark	USFS Mancos/Dolores District
49	McCrary	Ben	USFS Pagosa Springs Ranger District
50	Mendoza	Richard	United States Forest Service
51	Morrison	Dave	
52	Nelson	Mary	Saguache Ranger District
53	Newlin	Bob	
54	Nobels	Bill	CSU Extension
55	Norrgard	Kevin	Saguache Ranger District
56	Panek	George	Rio Grande NF
57	Pelz	Kristen	Colorado State University
58	Peterson	Lisa	United States Forest Service
59	Picaro	Willy	
60	Randall-Parker	Tammy	United States Forest Service
61	Reader	Tim	Colorado State Forest Service
62	Reid	Mike	CDOW-Pagosa North
63	Richardson	Dave	Chemical Engineer Consultant
64	Romme	Bill	Colorado Forest Restoration Institute
65	Roper	Mark	Pagosa Ranger District
66	Shepperd	Wayne	Colorado State University
67	Smith	Becca	San Juan Public Lands
68	Stiles	Mark	United States Forest Service
69	Stransky	Laura	San Juan National Forest
70	Sturtevant	Bob	Colorado State University
71	Sullivan	Craig	San Juan National Forest
72	Sutton	Wendy	Pagosa Ranger District
73	Swisher	Laurie	United States Forest Service
74	Taylor	John	Taylor Ranch Limited
75	Thinnes	Jim	United State Forest Service
76	Troxel	Tom	Colorado Timber Industry Association
77	Tuten	Matt	United State Forest Service
78	Vance	Beth	San Juan National Forest

79	Wagner	Scott	Pagosa District/Field Office
80	Wand	Dan	Colorado State Forest Service
81	Wilson	Thurman	US Forest Service and BLM
82	Wu	Ros	San Juan Public Lands

COLORADO FOREST
RESTORATION INSTITUTE

Colorado State University

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