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Draft Environmental Impact Statement

Monroe Mountain Aspen Ecosystems Restoration Project

Richfield Ranger District, Fishlake National Forest

Sevier and Piute Counties, Utah

Legal Description: Multiple sections in Ranges 1, 2, 2 ½, and 3 West and in Townships 24, 25, 26, 27, 28, and 29 South

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MONROE MOUNTAIN ASPEN ECOSYSTEMS RESTORATION PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Sevier and Piute Counties, Utah

Lead Agency: **USDA Forest Service**

Cooperating Agencies: **Utah Division of Wildlife Resources**

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Abstract: This draft environmental impact statement describes the impacts of mechanical and prescribed fire treatments on stable and seral dominated aspen stands, and spruce/fir and mixed conifer dominated stands on Monroe Mountain. The purpose of this project is to restore aspen ecosystems on Monroe Mountain by achieving the desired conditions outlined in the Fishlake National Forest's Land and Resource Management Plan. To help accomplish this purpose, the Richfield Ranger District has identified a need to (1) address the conifer encroachment that occurs due to the reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and (2) address aspen overbrowsing by domestic and wild ungulates. These are two of the primary underlying causes for aspen decline on Monroe Mountain. The agency developed four action alternatives and the no action alternative, which are outlined and analyzed in this draft environmental impact statement.

Draft Environmental Impact Statement:

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This would enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978)). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement (City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)). Comments on the draft environmental impact statement should be specific and

should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Send Mail Comments to: **Jason Kling, Richfield District Ranger**
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For those submitting hand-delivered comments, the Fishlake National Forest's office hours are 8:00 A.M. through 4:30 P.M. Monday through Friday, excluding holidays.

Comments may also be sent by fax at (435) 896-9347 (fax), or in an e-mail message, pdf, plain text (.txt), rich text format (.rtf), and Word (.doc or .docx) to comments-intermtn-fishlake-richfield@fs.fed.us. Comments must have an identifiable name attached or verification of identity will be required. A scanned signature may serve as verification on electronic comments.

Only those who submit timely and specific written comments regarding the proposed project during a public comment period established by the responsible official are eligible to file an objection.

Date Comments Must Be Received: **March 2, 2015**

SUMMARY

The purpose of this project is to restore aspen ecosystems on Monroe Mountain by achieving the desired conditions outlined in the Fishlake National Forest's Land and Resource Management Plan. The area affected by the proposal includes Monroe Mountain, located in south-central Utah, south of Richfield, west of Koosharem, and east of Marysvale, encompasses approximately 175,706 acres of National Forest lands administered by the Fishlake National Forest, Richfield Ranger District, and approximately 11,805 acres of private inholdings. To help accomplish this purpose, the District has identified a need to (1) address the conifer encroachment that occurs due to the reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and (2) address aspen overbrowsing by domestic and wild ungulates. These are two of the primary underlying causes for aspen decline on Monroe Mountain.

In January 2010, the Utah Forest Aspen Restoration Working Group (UFRWG) finalized the 2010 *Guidelines for Aspen Restoration on the National Forests in Utah*. As part of this effort, the UFRWG submitted a call for project proposals that could effectively test the newly created guidelines. The Forest submitted the Monroe Mountain Aspen Ecosystems Restoration project to the UFRWG for their consideration. The proposal was accepted and in April 2011, the working group created the Monroe Mountain Working Group to provide recommendations and feedback to the District as the project was developed.

The project was posted on the Forest's schedule of proposed actions website on October 1, 2012, the notice-of-intent to prepare an environmental impact statement was published in the Federal

Register on October 3, 2012, and an open house and several public meetings were held to discuss the project proposal.

Major issues raised by the public include the potential for project activities to impact: wilderness attributes and roadless area characteristics; private property; northern goshawk, Bonneville cutthroat trout and boreal toad; stable aspen dominated stands and new aspen shoots post-treatment from browsing by domestic and wild ungulates; livestock permittees; and old growth characteristics. These issues led the agency to develop five alternatives including the no action alternative. The differences in action alternatives are the amount and locations of mechanical treatments and associated slash burning, and prescribed fire treatments in stable and seral aspen stands, and spruce/fir and mixed conifer stands, and the location and mileage of temporary roads.

Based upon the effects of the alternatives, the responsible official would decide: (1) the location and treatment methods for all restoration activities; (2) design criteria, mitigation, and monitoring requirements; and (3) the browse threshold components.

Major conclusions include:

Inventoried Roadless Area and draft Unroaded/Undeveloped Areas

The five Inventoried Roadless Areas (IRA) located in the project area presently average low to moderate ratings for the six wilderness qualities or attributes. The southern portion of the Signal Peak IRA is the best area that seems to hold the potential for manageability as a wilderness area. Alternatives 2 through 5 would leave stumps mostly flush with the ground and a burned appearance. No roads would be constructed, no clear cuts are proposed, control lines would be feathered and reclaimed, sensitive areas would be avoided, and timing restrictions would be imposed. The proposed actions would only temporarily reduce the qualities or attributes and characteristics until the vegetation grows and recovers over a period of about 2 to 5 years. Therefore, alternatives 2 through 5 would take place without permanently lowering the wilderness qualities or attributes and roadless characteristics; therefore, the existing wilderness eligibility would not change.

Effects to the draft Unroaded/Undeveloped Areas (UUAs) would be the same as for the IRAs with the exception of temporary roads in alternatives 4 and 5 being constructed. These roads would be reclaimed after use and would only temporarily reduce the wilderness qualities, or attributes, and roadless characteristics; therefore, the existing wilderness eligibility would not permanently change.

Fire and Fuels

An increase in safety to firefighters and the public is expected from all action alternatives due to treated fuels exhibiting overall lower fire behavior. According to National Interagency Fire Center data, from 1990 to 2013, an average of 18 firefighters were killed annually in the line of duty. Seventeen firefighters have lost their lives while fighting fires in the state of Utah since 1961 (NIFC 2013).

Proactive fuels management has been shown to be effective in lowering risk to people and private property across the country, and that would be an expected outcome once all the treatments were complete. The largest increase in firefighter and human safety would result from alternative 4. The least risk to private property also results from alternative 4 as proposed. It treats the most acres both mechanically and with fire, reducing fuels and therefore lowering fire behavior across the treatment areas. Alternative 4 would best move the aspen ecosystems toward desired condition over time.

Northern Goshawk

Maintaining adequate structural components within the Nest Areas (NAs) and Post-fledgling Areas (PFAs) of northern goshawk territories to ensure habitat effectiveness, which encompasses the entire portion of their life cycle when they are on the forest, is crucial to maintain viability. It is also important to follow recommendations in foraging habitat to manage for prey species habitat. These structural components referred to in the goshawk amendment (USFS 2000) will help maintain a prey base for the adults to utilize during mating and rearing season as well as for the fledglings when they are old enough to hunt for themselves within the territory. Alternatives 3, 4, and 5 do not allow enough of the habitat requirements to maintain this need. Alternative 2 would allow enough habitat requirements to be maintained. Alternatives 3, 4, and 5 may cause territory abandonment across the Monroe landscape. This abandonment may result in dispersion from Monroe Mountain to other mountain ranges or make the birds susceptible to predation. This would move further away from the LRMP goal of a viable population across the forest.

Aquatic Resources

Bonneville Cutthroat Trout

The introduction of non-native fish, stocking of hatchery fish, grazing, fires, fire management activities, timber/thinning operations, irrigation diversion, and water manipulation has altered riparian and upland vegetation composition and densities and riparian environments, which has reduced habitat for Bonneville cutthroat trout and resident trout species in some cases and created habitat in others. In general, stream habitats have generally been reduced in quantity and quality, while large (verses small beaver pond) lake quantity has increased. In addition, across their historic range, Bonneville cutthroat trout have generally been displaced by non-native trout species. Bonneville cutthroat trout only occur on Monroe Mountain where they have been reintroduced into the Manning Creek drainage. Despite these cumulative effects and concerns, these streams remain an important fisheries resource in the state of Utah, although the true potential biomass for these streams is not known.

The direct and indirect effects from the proposed action to Bonneville cutthroat trout are expected to be of a short to mid-term duration provided that the required design features are properly implemented and the project properly administered. Thus the effects of the activities in the cumulative effects section, in combination with either the no action alternative or one of the action alternatives, are not expected to cause long-term measurable adverse changes to the aquatic species discussed in this document or extrapolated to other aquatic species with similar habitats. None of the alternatives would add cumulative effects that would adversely affect

population numbers or viability of the Bonneville cutthroat trout and resident trout in the long term.

Boreal Toad

The introduction of non-native fish, stocking of hatchery fish, grazing, fires, fire management activities, vegetation management, irrigation diversion, and water manipulation has altered riparian and upland vegetation composition, densities, and riparian environments, which has reduced habitat quality for boreal toads in some cases and created habitat or improved habitat quality in other cases. In general, stream habitats have generally been reduced in quantity and quality, and beaver density reduced from pre-European settlement conditions. Despite these cumulative effects and concerns, Monroe Mountain remains a very important area for boreal toad conservation in the state of Utah, although the true historic population size and distribution of boreal toads on Monroe Mountain is not known.

The effects of the activities listed in the cumulative effects section, in combination with either the no action alternative or the action alternatives, are not expected to cause ***long-term*** measurable changes to boreal toads. None of the alternatives would add cumulative effects that would adversely affect population numbers or viability of boreal toads in the long term.

Browsing by Domestic and Wild Ungulates

With many demands for forage in the West, including elk, deer, and permitted livestock grazing the decision to take no action and face losing such prolific producers of forage, as aspen are capable of should not be acceptable. A decision to make no changes in management (including no treatments) is still a decision and it carries its own risks and consequences as succession continues to move the vegetation toward late seral vegetation communities. The risks and consequences include (1) continued degradation of the aspen ecosystem, (2) continued loss of forage, and (3) increased risks of large wildfires with associated concerns.

Alternatives 2 through 5 are all large-scale aspen ecosystem treatments designed to restore aspen ecosystems. All of these alternatives would treat approximately 23 to 27 percent of the National Forest System acres on Monroe Mountain. Adequate regeneration and protection of the regeneration from the effects of overgrazing (livestock and wildlife) are keys to the success of this project, to restore aspen ecosystems. The rangeland resources should benefit from any of the treatments. The difference between the alternatives regarding disturbance associated with the miles of temporary roads is small and should not affect the results of the project.

There were two issues effecting rangeland resources identified during project scoping. All the alternatives include design features and mitigation measures to address the issues.

There are design features and mitigation measures built into this proposed project that are designed to address two issues. First, livestock will not be allowed to graze treated areas for at least two growing seasons after treatment. Second, the District is proposing quantifiable aspen browse thresholds and response options that would be implemented if thresholds are exceeded (section 2.9 and appendix C). These browse thresholds and response options are applicable to

Alternatives 2 through 5. Based on implementation of the browse thresholds and response options, an adequate number of new aspen sprouts following treatments are expected to reach 6 feet in height and stable aspen stands are expected to begin showing improvement; thus moving towards accomplishing the desired conditions outlined for this project.

Livestock Permittees

The acres that are proposed for treatment through this project are spread across nine different grazing allotments. Impacts to permittees would be minimized by the use of herding and temporary electric fences so that treatment areas and/or stable aspen stands can be rested while non-treatment areas can continue to be grazed. The permittees will also be notified at least 1 year in advance of treatments being done on their allotments so that they can plan accordingly. Based on this summary, the District anticipates that permittees will have a place to graze their livestock while treatment areas or stable aspen stands are being rested.

Even though the difference in effects may be minor, alternative 4 would be the best alternative for range management on Monroe Mountain because more acres, 27 percent of National Forest System land on Monroe Mountain, would be treated. This alternative has the potential to produce the biggest increase in forage resources for grazing animals.

Old Growth

Alternatives 2 and 3 show an 11 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternatives 2 and 3, options 1 and 2 result in Land and Resource Management Plan (LRMP) related old growth standards being achieved. Alternative 4 shows a 10 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 4, options 1 and 2 result in LRMP related old growth standards being achieved. Alternative 5 shows a 9 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 5, options 1 and 2 result in LRMP related old growth standards being achieved.

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1 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Fishlake National Forest (Forest), Richfield Ranger District (District) has prepared this draft environmental impact statement (DEIS) to comply with the National Environmental Policy Act (NEPA), National Forest Management Act (NFMA), and other relevant Federal and State laws and regulations. The direct, indirect, and cumulative environmental impacts to the biological, physical, and social resources that may occur from implementing restoration activities are disclosed in this DEIS. This document is organized as follows:

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need, and how the Forest Service informed the public of the proposal and how the public responded. In addition, this chapter includes the issues identified during the scoping process that will be evaluated during this DEIS process.

Chapter 2. Proposed Action and Alternatives: This chapter provides a more detailed description of the agency's proposed action, how the action alternatives were developed, as well as alternative methods considered for achieving the stated purpose. This section also provides tables that compare the alternatives and show the environmental consequences associated with each alternative. This discussion also includes project design criteria and mitigation measures.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the current condition and the environmental effects of accomplishing the proposed action and alternatives. The analysis is organized by the issues identified in section 1.15.

Chapter 4. Consultation and Coordination: This chapter provides a list of preparers, individuals, and agencies consulted during the development of the DEIS.

Appendices. The appendix consists of multiple parts and provides detailed information to support the analysis:

- Appendix A - modeled photos depicting current and post-treatment conditions.
- Appendix B - the consistency documentation for the *Utah Forest Aspen Restoration Working Group's (UFRWG) Guidelines for Aspen Restoration on the National Forests in Utah (*UFRWG 2010*).*
- Appendix C - Monroe Mountain Working Group's 2014 *Browsing Thresholds and Adaptive Management Pursuant to Aspen Restoration on Monroe Mountain* (MMWG 2014).

Additional documentation, including the complete analyses for each resource, may be found in the project record located at the Fishlake National Forest Supervisor's Office, Richfield Ranger District, 115 East 900 North, Richfield, Utah 84701. All specialists' reports are also posted on

the Forest's website at www.fs.usda.gov/projects/fishlake/landmanagement/projects. Paper copies of the specialists' reports are available upon request at the same address.

1.2 Project-Level Pre-decisional Administrative Review Process

This project was posted on the Forest's schedule of proposed actions website on October 1, 2012 and was subject to the appeal requirements at 36 Code of Federal Regulations (CFR) 215. The Consolidated Appropriations Act of 2012 includes a provision (Section 428) directing the Department of Agriculture Secretary to establish a pre-decisional objection process for projects and activities implementing land management plans in lieu of 36 CFR 215, the post-decisional appeal process used by the agency since 1993. As directed by Section 428, the Project-Level Pre-decisional Administrative Review Process regulations (36 CFR 218) were revised. These regulations apply to projects and activities implementing land management plans documented with a Record of Decision. Although this project was initiated under the 36 CFR 215 regulations, the Record of Decision is subject to the 36 CFR 218 regulations.

The key difference between the 36 CFR 215 regulations and the 36 CFR 218 regulations is that the 36 CFR 218 regulations requires the circulation of a draft decision document with the final environmental impact statement; a step that is not required by the NEPA or the Council on Environmental Quality regulations (40 CFR 1500). This would allow for a pre-decisional review process where the public can seek higher-level review of unresolved concerns before the project decision has been signed. Preparation and circulation of a draft decision document with the environmental analysis document enables the responsible official to notify the public of the intended decision and the rationale for that decision. In turn, the public is provided with an opportunity to raise any concerns with the decision before it is signed, allowing those concerns to be considered by the responsible official, and reviewing officer, as part of the administrative review process.

The Forest Service believes that considering public concerns before a decision is made aligns with a collaborative approach to public land management and increases the likelihood of resolving those concerns resulting in better, more informed decisions. It is also believed that this would aid in the effort to be more efficient with documenting environmental effects.

1.3 Background and Historic Conditions

Monroe Mountain, located in south-central Utah, south of Richfield, west of Koosharem, and east of Marysvale, encompasses approximately 175,706 acres of National Forest lands administered by the Fishlake National Forest, Richfield Ranger District, and approximately 11,805 acres of private inholdings (Figure 1).

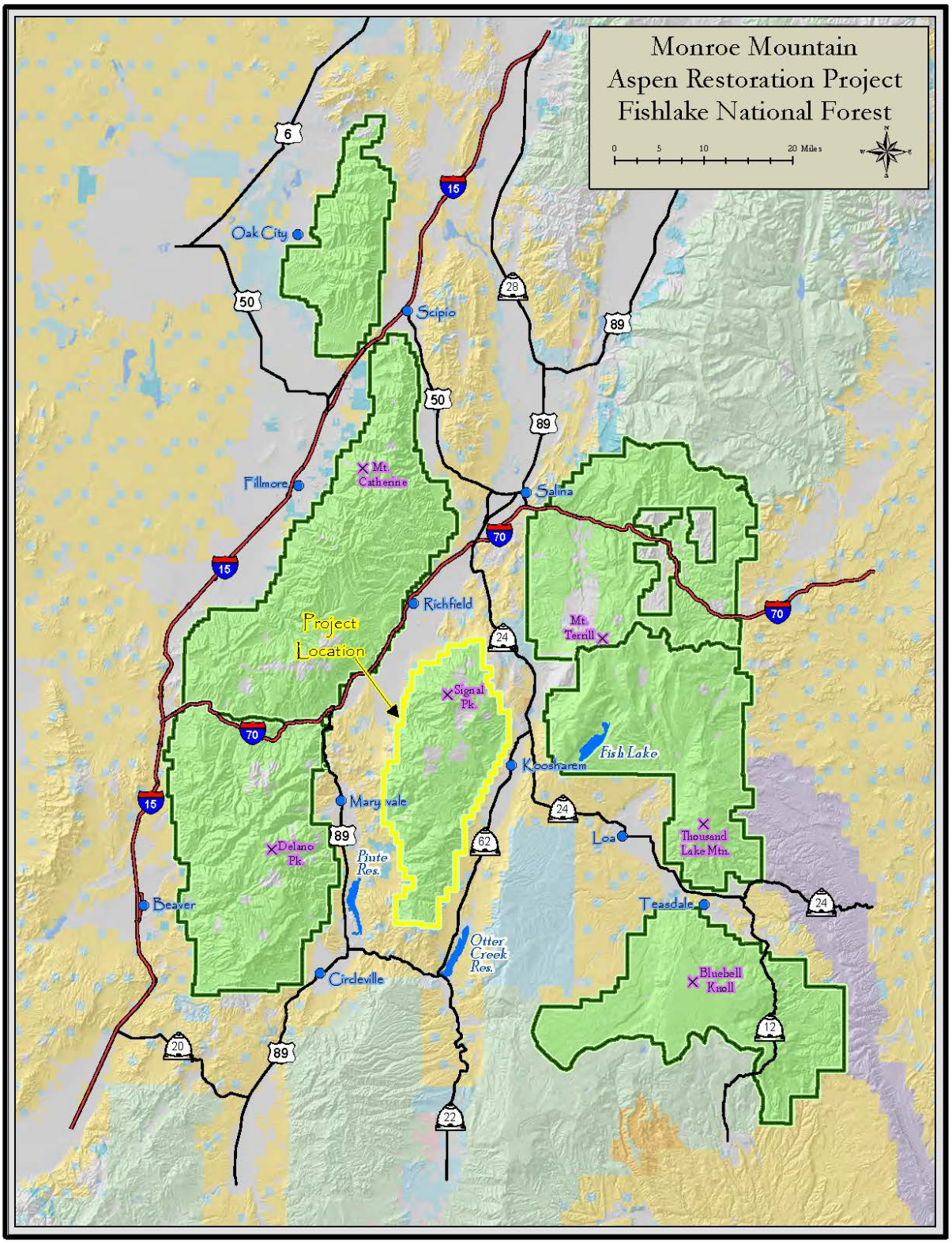


Figure 1. Project vicinity map

Of these 175,706 acres, quaking aspen (*Populus tremuloides*) historically occurred on approximately 71,000 acres on Monroe Mountain (Figure 2). Soil survey information was used to estimate the historic occurrence of aspen. It is widely recognized that aspen ecosystems are capable of supporting one of the largest arrays of plant and animal species due to its high productivity and structural diversity. However, it is also widely recognized that aspen ecosystems have been in decline throughout the Intermountain West during the twentieth century (UFRWG 2010).

On Monroe Mountain, unsustainable aspen ecosystem conditions include, but are not limited to,

1. Conifer encroachment due to a reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression; and,
2. Lack of aspen recruitment due to domestic and wild browsing by cattle, sheep, elk, and deer.

Reduced occurrences of wildland fire primarily due to an increase in wildland fire suppression, and overbrowsing by domestic and wild browsers have been identified by the District as the primary underlying causes for aspen ecosystems on Monroe Mountain being at risk. Aspen of 5 to 15 feet in height ("recruitment") are uncommon on Monroe Mountain, despite continued sprouting of aspen ("regeneration"). Due to high cost and continual maintenance, fencing is not a long-term sustainable response option for protecting aspen sprouts from overbrowsing, and does not address underlying causes of the lack of recruitment.

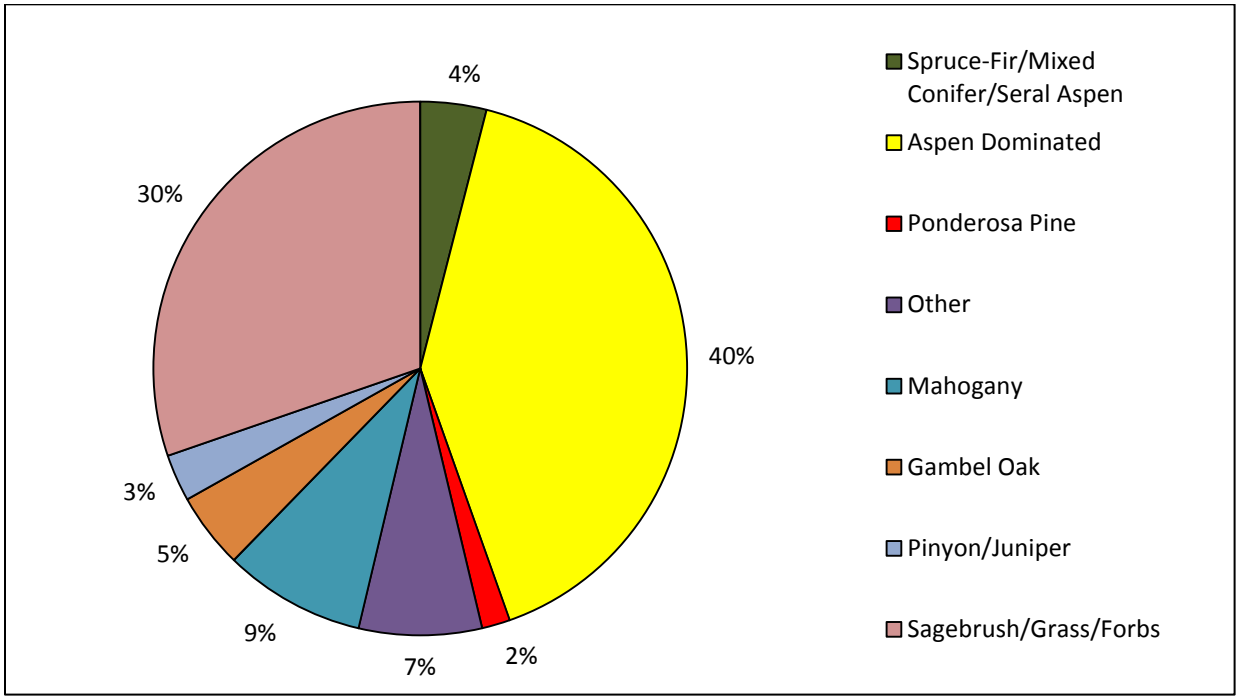


Figure 2. Monroe Mountain historic (200 to 400 years ago) vegetation distribution

Aspen is a keystone species and historically was a landscape dominant on Monroe Mountain. Aspen ecosystems support the highest level of biodiversity for interior western forests and the

productivity of aspen ecosystem understories (grass, forbs, and shrubs) is higher than all other forest types. Individual aspen trees arise almost exclusively from root suckers and are relatively short-lived (i.e., 100 to 200 years). Aspen is shade intolerant and sprouts heavily following disturbance, such as fire, and benefits from disturbance especially where conifer currently shades and competes with aspen. Mechanical treatments can also be an effective disturbance tool for aspen restoration.

Aspen-mixed conifer communities on Monroe Mountain developed with fire as a historical disturbance process. Published multi-century fire histories for Monroe Mountain and five regional landscapes with similar topography and vegetation reveal patterns of abundant fire prior to Euro-American settlement in the mid to late-1800s (Heyerdahl et al. 2011). For four sites, stand demographics, surface fire frequency, and fire severity were characterized for plots arranged in grids to represent a broad range in elevation and vegetation type within small watersheds. Aspen was found in 62 percent (59 of 95) of the study plots. Of these, 53 percent were classified in low to mixed severity fire classes with short to moderate fire-free intervals while the remaining plots were classified as having high fire severity and assumed longer intervals. Fire-scarred ponderosa pine trees (*Pinus ponderosa*) sampled on Old Woman Plateau revealed a consistent pattern of frequent surface fire from the 1500s to the late 1800s. This site is located approximately 40 miles northeast of Monroe Mountain and like much of the east-central and southern portions of Monroe Mountain is characterized by gentle terrain with small stands of aspen separated by openings of mostly non-forested sagebrush steppe.

Reported fire evidence from Monroe Mountain was limited to 10 fire-scarred ponderosa pine trees sampled from across a large portion of the mountain. Although ponderosa pine is an excellent species for preserving long records of surface fire, it is an uncommon species on Monroe Mountain and as such is not sufficiently abundant to drive fuels and fire dynamics. However, the short to moderate fire frequency evident from the sampled trees (Figure 3) is supported by widespread evidence of past fire in the form of fire-injured Douglas fir (*Pseudotsuga menziesii*) and Engelmann spruce trees (*Picea engelmannii*; including multiple injuries per tree; Figure 4) and charred remnants. Collectively, this site-specific evidence and data from the intensively sampled regional sites support an interpretation of historic fire-regimes that included a range of short to long fire-free intervals and low to high fire severity, creating and maintaining a diverse and dynamic vegetation mosaic across time and space. These spatially complex fire regimes ended within decades of Euro-American settlement. As a result, diversity was lost as forest communities became dominated by late seral[1] conditions. In mixed stands, aspen cover and viability decreased due to the lack of disturbance over the past 150 plus years. Although persistent or stable[2] aspen (little or no conifer present) may not be dependent upon periodic fire for regeneration, the evidence suggests that fire was sufficiently abundant across these montane landscapes such that even these conifer-free aspen communities were likely exposed to fire periodically.

[1] A seral aspen community may have some aspen in the overstory, but mostly it is a community where conifer is becoming the doiminant species.
[2] A stable aspen community has a predominantly aspen overstory with little to no conifer regeneration.

Historically, livestock (cattle and sheep) use on Monroe Mountain was much higher than current use (Figure 5). Reductions in livestock animal unit months[3] (AUMs) started in the 1920 and 1930s with continued reductions through the 1970s. Sheep AUMs have decreased slightly since the 1970s and cattle AUMs have increased slightly since the 1970s.

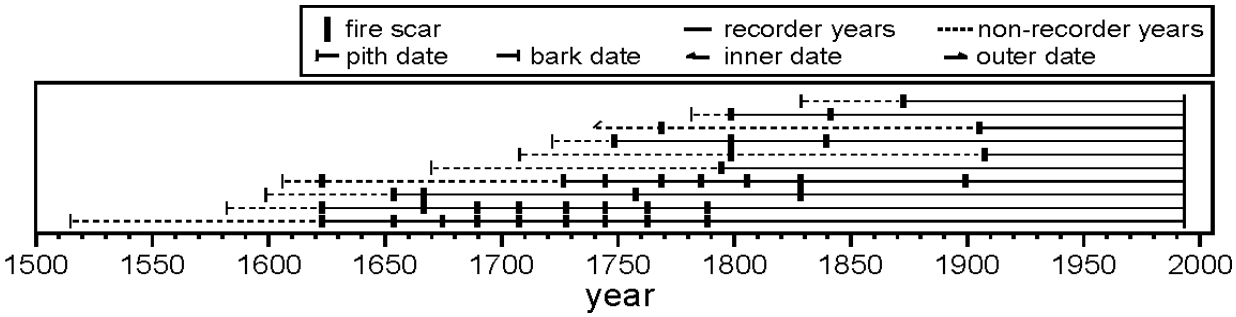


Figure 3. Chronologies of surface fires at Monroe Mountain, sampled over an approximately 35-mile north south transect. Each horizontal line indicates the length of record for a single tree. The short vertical lines indicate years when that tree had a fire scar. Recorder years (solid lines) generally follow the first scar on each tree. Non-recorder years (dashed lines) precede the formation of the first scar on each tree, but also occur when a period of the fire record was consumed by subsequent fires or decay. Inner and outer dates are the dates of the earliest or latest rings sampled for trees where pith or bark was not sampled (Heyerdahl et al. 2011).

Figure 4. Fire-scarred Engelmann spruce, with evidence of three separate fires near Monkey Flat Ridge, Monroe Mountain (photo credit Stan Kitchen).

Few records exist indicating the number of mule deer (*Odocoileus hemionus*) that were present on Monroe Mountain prior to the 1930s. Deer AUMs in Figure 5 and Table 1 are rough estimates between the 1930s and 1970s.

With the exception of 2000, deer AUMs have gradually decreased from the 1960s through 2010. Rocky Mountain elk (*Cervus elaphus*) AUMs have steadily increased from the 1970s through 2000 then had a reduction in 2010. Winter counts were used to calculate elk AUMs; therefore, actual summer elk AUMs may be higher than what is displayed in Figure 5 and Table 1, assuming summer elk numbers are higher than winter elk numbers on Monroe Mountain. For example, the UDWR knows a portion of the elk herd that summer on Monroe Mountain leave the mountain

[3] Most definitions of Animal Unit Months are based on the concept that a 1000-pound cow, with or without an unweaned calf, is one animal unit, with such a cow being assumed to consume 26 pounds of forage dry matter per day, or 780 pounds per month. For the purpose of this document, AUMs for sheep, deer, and elk have already been converted, and the comparisons are correct and standardized.

during the winter months and utilize winter ranges on adjoining units. Although Figure 5 and Table 1 shows total AUMs in 2010 are similar to total AUMs in 1910, the 1910 AUMs displayed in Figure 5 and Table 1 are likely conservative because mule deer AUMs are not included. In 1910, the AUMs were cattle, sheep, and an unknown number of mule deer, while in 2010 the AUMs were cattle, sheep, deer, and elk. All of these species browse aspen.

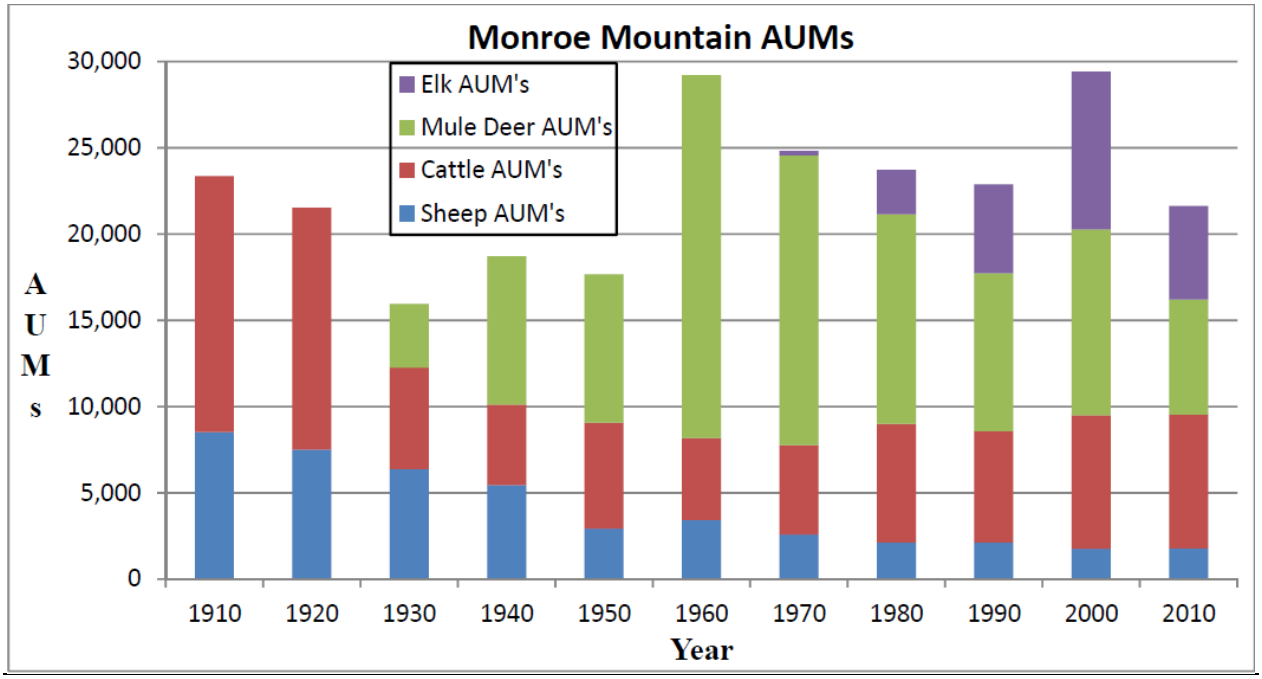


Figure 5. Summary of elk, mule deer, cattle, and sheep Animal Unit Months (AUMs) since the early 1900s

Table 1. Summary of elk, mule deer, cattle, and sheep Animal Unit Months (AUMs) since the early 1910s. This table correlates with Figure 5 above.

Year	Sheep AUM's	Cattle AUM's	Mule Deer AUM's	Elk AUM's
1910	8,513	14,851	Not Surveyed	Not Surveyed
1920	7,501	14,020	Not Surveyed	Not Surveyed
1930	6,373	5,887	3,685	Not Surveyed
1940	5,446	4,664	8,597	Not Surveyed
1950	2,935	6,126	8,597	Not Surveyed
1960	3,424	4,754	21,016	Not Surveyed
1970	2,584	5,186	16,785	257
1980	2,124	6,877	12,145	2,573
1990	2,121	6,458	9,143	5,146
2000	1,763	7,731	10,781	9,133
2010	1,780	7,750	6,687	5,403

1.4 Existing and Desired Conditions

This analysis utilizes vegetative structural stage[4] (VSS), tree height, stand density, and key habitat components as criteria to describe existing and desired conditions for forest structure in the project area.

Aspen-dominated cover (stable aspen) currently occurs on approximately 17,009 acres (Figure 6 and Figure 8). Much of this stable aspen has a component of mixed conifer in the understory (primarily subalpine fir (*Abies lasiocarpa*)). Approximately 31,129 acres are dominated by seral aspen; much of this seral aspen co-exists with mixed conifer (primarily subalpine fir). Approximately 5,210 acres on Monroe Mountain are dominated by mixed conifer (Engelmann spruce, Douglas fir, ponderosa pine, and white fir (*A. concolor*)). Much of this mixed conifer co-exists with aspen. Approximately 13,667 acres are dominated by spruce/fir with an aspen component. Approximately 43,877 acres in the project area are dominated by sagebrush cover types (primarily big sagebrush (*Artemisia tridentata*)), some (approximately 12,231 acres) of which may have been aspen communities in the recent past. Dominance by sagebrush is not a successional pathway for aspen; however, in the absence of recruitment, aspen can be replaced with shrub cover types. These sagebrush-dominated communities still have some scattered aspen trees/stands.

The desired condition as outlined in this document is specific to Monroe Mountain and was

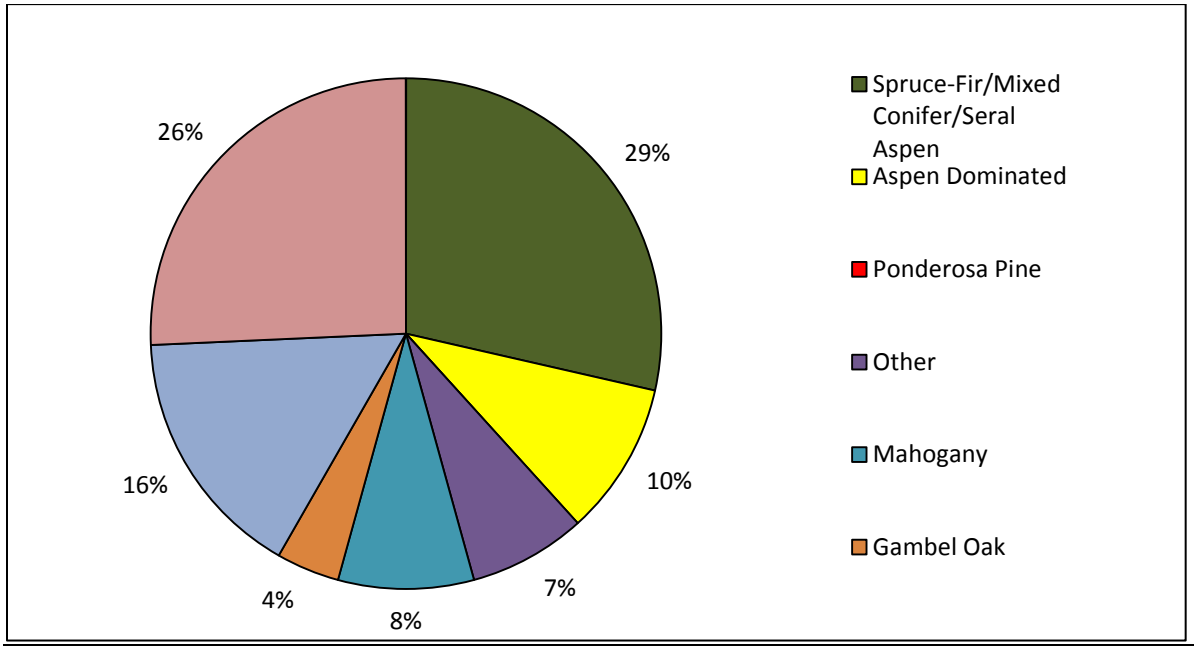


Figure 6. Monroe Mountain existing vegetation distribution

[4] The vegetative structural stage integrates the stages that vegetation complexes (e.g., composition, structure) go through beginning with regeneration through maturation and mortality. (Oliver and Larsen 1990; Franklin et al., 2002; Thomas et al. 1979).

developed by the District; it is consistent with the Forest's Land and Resource Management Plan (LRMP; USFS 1986). The desired condition is to have persistent aspen communities, with multi-height stems (as described in Table 2) and adequate recruitment to perpetuate aspen communities, including site-appropriate, biodiverse understories. Big sagebrush, if present would be a minor component of the aspen community. Fire regimes would be adequate to perpetuate aspen, particularly in areas seral to conifer (approximately every 20 to 60 years; Fishlake National Forest Prescribed Natural Fire Plan (USFS 1998; Table 5)). Table 2 describes the current and desired aspen stand structure for areas currently classified as seral aspen, spruce/fir, or mixed conifer.

Aspen sprouts are defined as aspen less than 6 feet in height, aspen saplings are defined as aspen 6 to 12 feet in height, and aspen recruits are defined as aspen greater than 12 feet in height. For seral aspen stands, the disparity between the existing and desired condition is great. The existing condition describes 592 sprouts per acre compared to 10,000 to 20,000 sprouts per acre as described in the desired condition. Similarly, the existing condition describes 119 saplings per acre while the desired condition describes approximately 1,000 to 2,000 saplings per acre. Lastly, the existing condition describes 276 recruits per acre, while the desired condition is 400 to 600 recruits per acre (Table 2). Similar results occur for aspen in the spruce/fir and mixed conifer dominated stands (Table 2). Accomplishing these 10,000 to 20,000, 1,000 to 2,000, and 400 to 600 sprouts, saplings, and recruits per acre would result in achieving the desired conditions described above of having persistent aspen communities with multi height stems and adequate recruitment to perpetuate aspen communities, including site-appropriate, biodiverse understories.

The existing vegetation distribution (Figure 6) shows approximately 29 percent of Monroe Mountain is dominated by spruce/fir, mixed conifer, and seral aspen while approximately 10 percent is dominated by stable aspen. As shown in (Figure 7), the desire is to have more areas dominated by stable aspen and fewer areas dominated by spruce/fir, mixed conifer, and seral aspen.

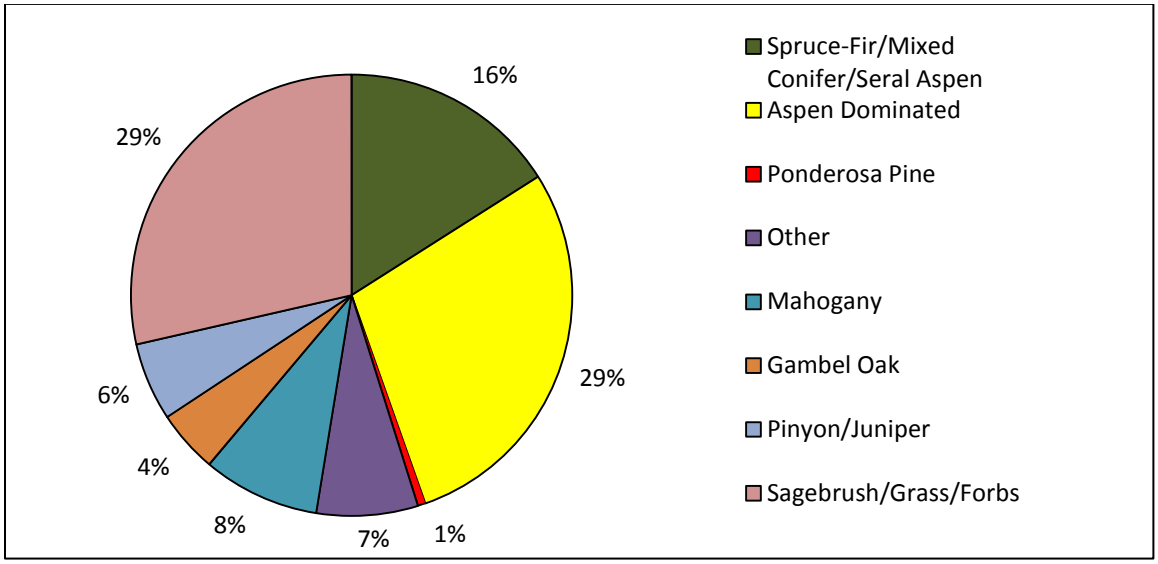


Figure 7. Monroe Mountain desired vegetation distribution

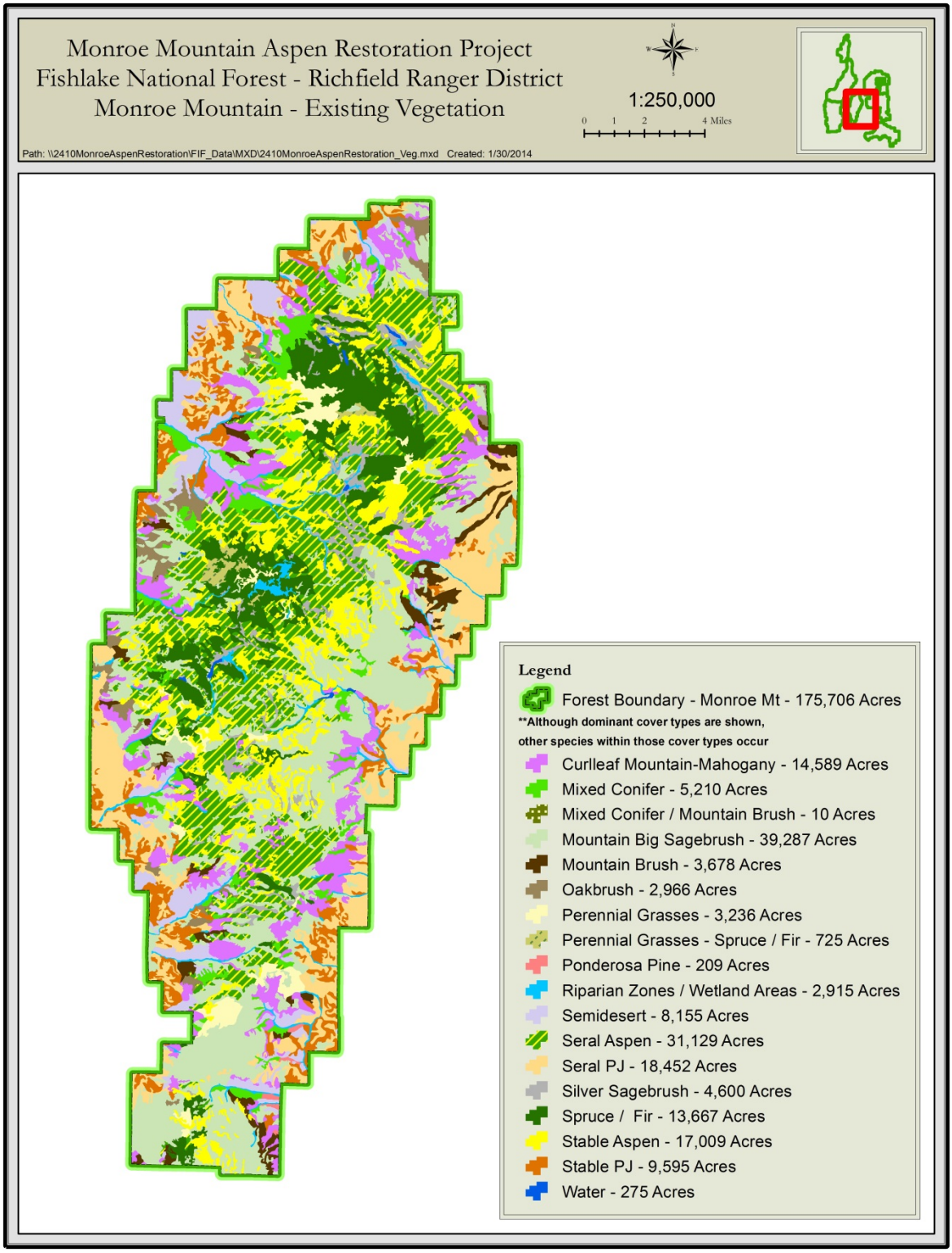


Figure 8. Existing vegetation on Monroe Mountain

Table 2. Current and desired aspen stand structure in areas currently classified as seral aspen, spruce/fir, or mixed conifer

		Aspen Sprouts/Acre (<6 feet in height)			Aspen Saplings/Acre (6-12 feet in height)			Aspen Recruits/Acre (>12 feet in height)		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Current Condition	Aspen: Seral Stands	0	3,286	592	0	911	119	59	615	276
	Spruce/Fir Stands	0	4,433	1,121	0	183	38	0	301	137
	Mixed Conifer Stands	0	1,255	677	0	233	108	0	286	117
Desired Condition[5]	Aspen Structure After Implementation of Mechanical and/or Prescribed Fire Treatments	5,000	No Max	10,000 to 20,000	1,000	No Max	1,000 to 2,000	400	No Max	400 to 600

Vegetation structural stage is a method of describing forest age and tree size from seedling to old forests. The VSS classification is based on the tree size class and is an indication of the dominant tree diameter distribution. A group of trees with a single age class is considered even-aged (usually defined as seral) while a group of trees with multiple age classes is uneven-aged (usually classified as stable).

Table 3 describes the existing and desired VSS for stable and seral aspen, mixed conifer, and spruce/fir stands.

The VSS as it is applied to Monroe Mountain describes the project area as being primarily in VSS 1, 2, and 3, while the desired condition for stable and seral aspen, mixed conifer and spruce/fir stands for VSS 4, 5, and 6 are not being achieved. (The original calibration for VSS assumes that Ponderosa pine is the dominant old growth species. Monroe Mountain has approximately 209 acres of Ponderosa pine scattered throughout the project area (Figure 8); however, the dominant conifer species in the project area are spruce and fir with a diameter at breast height[6] (DBH) for older trees usually much less than the 24 plus inches that describes VSS 6. The larger and generally older aspen trees on Monroe Mountain are also usually smaller than 24 inch DBH.

Forest resiliency and diversity is dependent on the distribution of age and size classes and the capacity of an area. Most stands have some element of VSS 1 through VSS 6 in them; however, most of the forested acres in the project area lack sufficient age and size class diversity. This has resulted in a more uniform landscape with reduced resiliency. Having a better distribution of VSS 1 through 6 is expected to result in more persistent aspen communities, with multi-height stems (as described in Table 2) and adequate recruitment to perpetuate the aspen communities.

[5] These numbers demonstrate that the desired condition of having aspen communities with multi-height stems with adequate recruitment to prepetuate the aspen communities are being met.

[6] Diameter at breast height is a standard method of expressing the diameter of the trunk or bole of a standing tree, measured at the height of an adult's breast (an average of 4.6 feet above ground in the United States).

Table 3. Current and desired vegetation structural stage (VSS) for aspen, mixed conifer, and spruce/fir stands; DBH = diameter at breast height

		VSS 1: Grass-Forb/Shrub (DBH: 0-1 inch)			VSS 2: Seedling-Sapling (DBH: 1-5 inches")			VSS 3: Young Forest (DBH: 5-12 inches)		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Current Condition	Aspen: Stable Stands	19%	24%	22%	6%	36%	23%	40%	63%	50%
	Aspen: Seral Stands	0%	18%	13%	5%	47%	15%	37%	82%	58%
	Mixed Conifer Stands	8%	17%	13%	5%	37%	20%	24%	52%	42%
	Spruce/Fir Stands	4%	20%	13%	7%	26%	16%	23%	63%	41%
Desired Condition	All Stands	****	****	10%	****	****	10%	****	****	20%
		VSS 4: Mid-Aged Forest (DBH: 12-18 inches)			VSS 5: Mature Forest (DBH: 18-24 inches)			VSS 6: Old Forest (DBH: 24 plus inches)		
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Current Condition	Aspen: Stable Stands	0%	11%	5%	0%	0%	0%	0%	0%	0%
	Aspen: Seral Stands	0%	32%	13%	0%	5%	1%	0%	5%	0%
	Mixed Conifer Stands	6%	43%	19%	2%	6%	4%	0%	5%	2%
	Spruce/Fir Stands	4%	31%	21%	0%	14%	6%	0%	13%	2%
Desired Condition	All Stands	****	****	20%	****	****	20%	****	****	20%

Data was collected from 58 stable aspen stands on Monroe Mountain. Data was collected on aspen overstory condition, aspen regeneration and recruitment (including browse use), fecal pellets, and cow pies.

Stable aspen is a term used to describe aspen stands in which conifer trees play little or no role. The stable aspen stands were classified into three broad categories based upon the density of living canopy trees. In addition to the dominant canopy trees, aspen recruits (greater than 12 feet tall but clearly below the dominant canopy), aspen saplings (6 to 12 feet tall and at low risk to being top-browsed), and aspen sprouts (less than 6 feet tall and at relatively high risk to being top-browsed) are also generally present.

The stable aspen stands were further subdivided the three primary classes based upon the perceived ability of these stands to continually, or periodically, replace canopy trees over time through vegetation recruitment. The sub-divisions listed in order of decreasing health are labeled as **full (F)** for fully self-replacing; **transitional (T),** with recruitment levels that are borderline to those necessary for self-replacement; **marginal (M)**, where recruitment is happening but at a level that might not be sufficient for self-replacement; and **non-self-replacing (N)** where recruitment is not happening, or is at a level that is clearly too low to maintain the stand through time.

Dense stands of canopy trees occurs when initial sucker density is high and browse pressure is low following a disturbance, such as fire or mechanical treatments. In these stands, mature-tree densities often exceed 1,000 canopy trees per acre. The density and relative health of these relatively young stands suppress further root suckering and growth (except at stand edges) for several decades until the stand self-thins as individual trees die, opening up the canopy. Therefore, there should be no minimum expectation for saplings or sprouts as a measure of stand health for this class. Stable aspen stands with greater than 1000 canopy trees per acre (Figure 10) are therefore classified as **high density Stable Aspen Class 1 (SA1)** and are considered self-replacing regardless of the presence or absence of saplings or sprouts. It should be noted that SA1 stands do not persist indefinitely, but would eventually transition to SA2 or SA3 classes as trees thin. As this occurs, smaller-sized trees are used for classification as explained below. Only one of 58 Monroe Mountain stable aspen monitoring stands was classified as SA1 in 2013 (Table 4).

At the opposite end of the spectrum for canopy tree density is the **low density Stable Aspen Class 2 (SA2)** with canopy tree densities of less than 200 trees per acre (Figure 9; Figure 11 through Figure 14). Healthy stands produce abundant sprouts resulting in sufficient saplings and aspen recruits to ensure replacement in the absence of excessive browse pressure. When browsing is excessive, sprouts are not able to grow sufficiently high to escape browsing (even when sprout density is high), and recruitment into the sapling and recruit size classes does not occur or is insufficient to maintain a healthy aspen stand through time. As these stands remain open (high levels of light) over time, competitive shrubs such as big sagebrush invade the understory and compete with aspen sprouts for limited resources further complicating recovery. Within this classification, stand status is further assigned based upon the combined density of saplings and recruits, independent of sprout density. Aspen stands with greater than two times the number of canopy trees in the saplings and recruits are considered fully self-replacing (Figure 11). Stands with saplings and recruits less than two times but greater than one time the number of canopy trees are classified as transitional (Figure 12). Stands with saplings and recruits less than one time but greater than one-half time the number of canopy trees are classified as marginal (Figure 13) and stands with saplings and recruits less than one-half the number of canopy trees are classified as non-self-replacing (Figure 14). In 2013, 30 of the 58 aspen stands were classified as SA2 with a subclass breakdown of 5 in SA2-F, 3 in SA2-T, 7 in SA2-M, and 15 in SA2-N (Table 4).

An **intermediate-density Stable Aspen Class (SA3)** is defined by a density of 200 to 1000 canopy trees per acre; (Figure 9; Figure 15 through Figure 18) generally accepted as an indicator of a stand that is fully stocked. As is the case for SA2 stands, aspen sapling and recruit density is used for subclass assignment. Like the SA2 stands, as saplings and recruits decrease, SA3 classifications also decrease from fully self-replacing (Figure 15), transitional (Figure 16), and marginal (Figure 17), to non-self-replacing (Figure 18). In 2013, 27 of the 58 Monroe Mountain monitoring plots were classified as SA3 with a subclass breakdown of 5 in SA3-F, 2 in SA3-T, 6 in SA3-M, and 14 in SA3-N (Table 4).

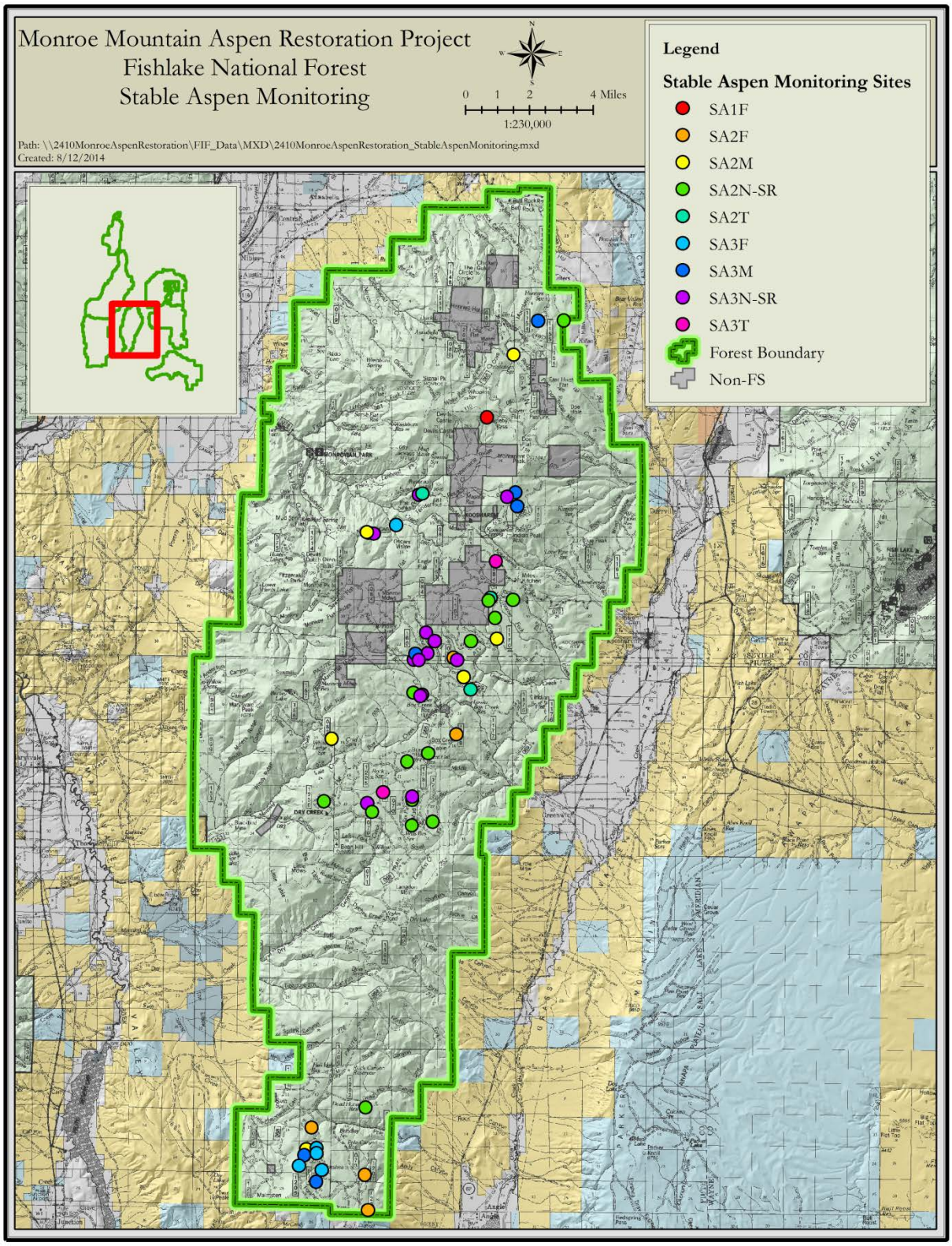


Figure 9. Stable aspen monitoring sites

Overall, in 2013, 11 of 58 (19 percent) stable aspen stands were classified as fully self-replacing, five (9 percent) as transitional, 13 (22 percent) as marginal and 29 (50 percent) as non-self-replacing (Table 4). To move towards the desired conditions of having persistent aspen communities, with multi-height stems and adequate recruitment to perpetuate the aspen communities, the desire is for the stable aspen stands to be in SA1, SA2-F, or SA3-F; therefore, 79 percent (47 stands) of the stable aspen stands need to improve.

Table 4. Classification of 58 stable aspen stands on Monroe Mountain. Data for these stands was collected in 2013.

Classification	Number of Aspen Stands
SA1	1
SA2 -F	5
SA2-T	3
SA2-M	7
SA2-N	15
SA3-F	5
SA3-T	2
SA3-M	6
SA3-N	14

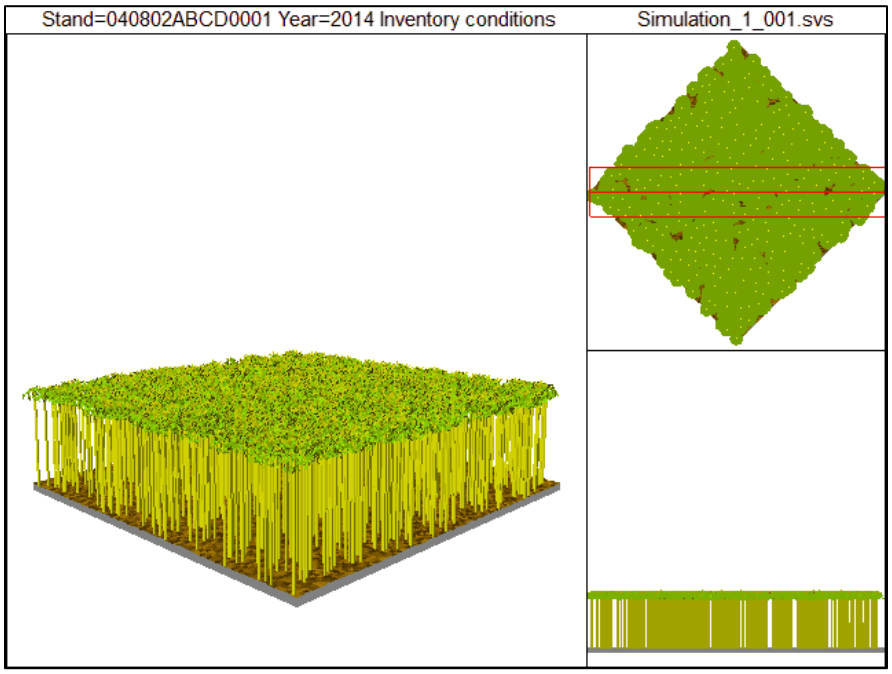


Figure 10. High-density stable aspen (SA1) with 1200 aspen canopy trees per acre. The absence of small-sized trees is due to growth suppression by the dense over-story and should not be viewed as an indication of unhealthy condition.

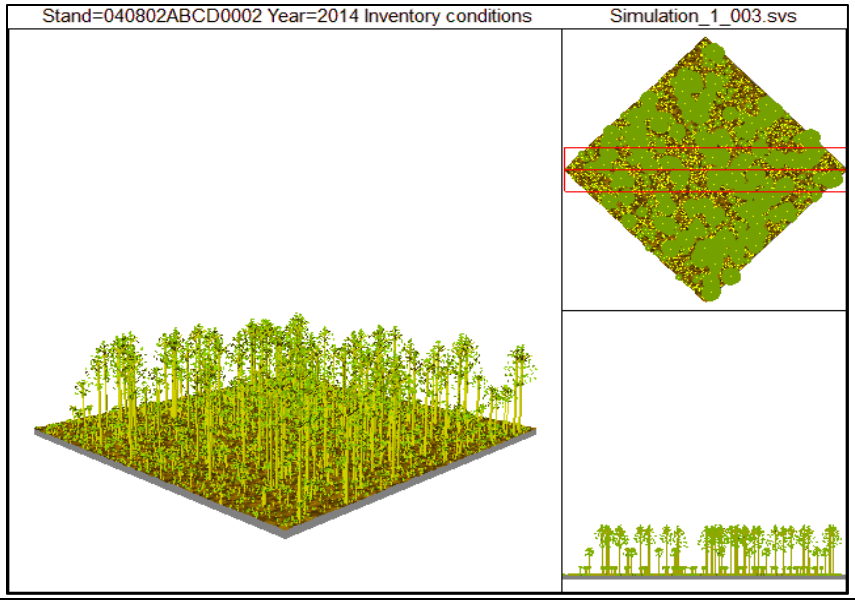


Figure 11. Low-density stable aspen with sufficient small-trees to be classified as fully self-replacing (SA2-F). Canopy tree density is 100 trees per acre with 30 aspen recruits, 220 saplings, and 5000 sprouts per acre.

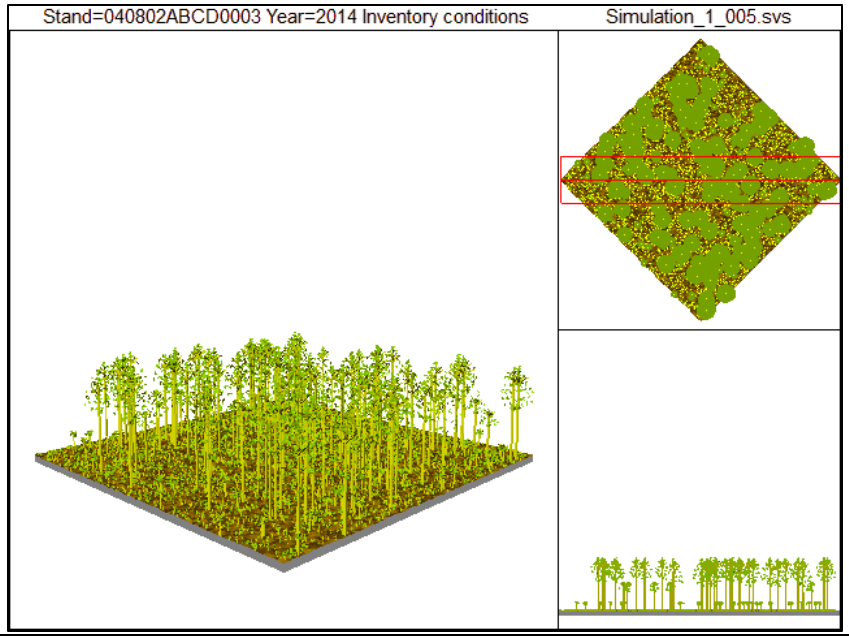


Figure 12. Low-density stable aspen with sufficient small-trees to be classified as transitionally self-replacing (SA2-T). Canopy tree density is 100 trees per acre with 15 aspen recruits, 110 saplings, and 5000 sprouts per acre.

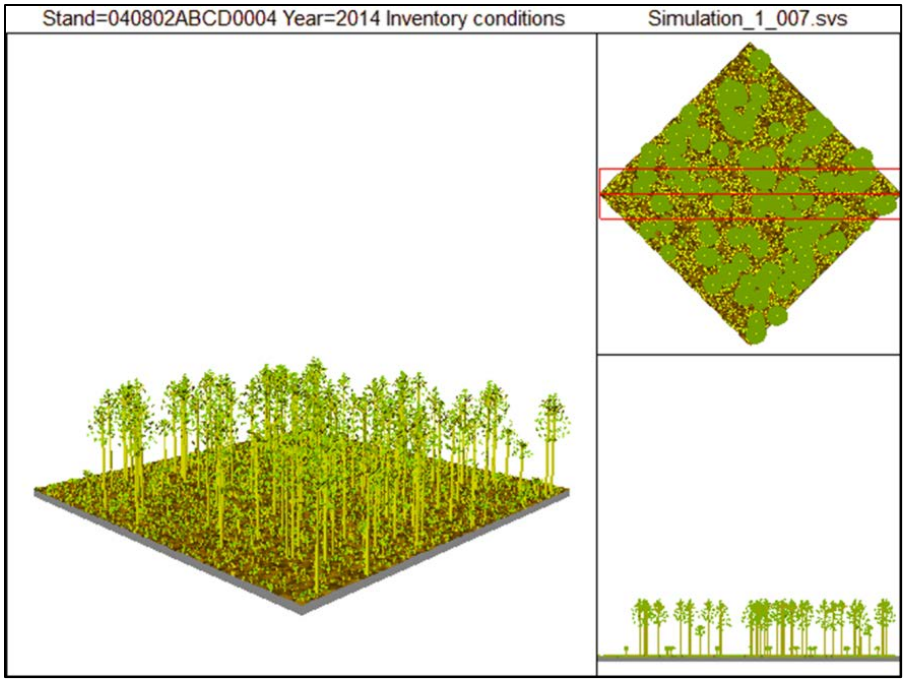


Figure 13. Low-density stable aspen with sufficient small-trees to be classified as marginally self-replacing (SA2-M). Canopy tree density is 100 trees per acre with 8 aspen recruits, 55 saplings, and 5000 sprouts per acre.

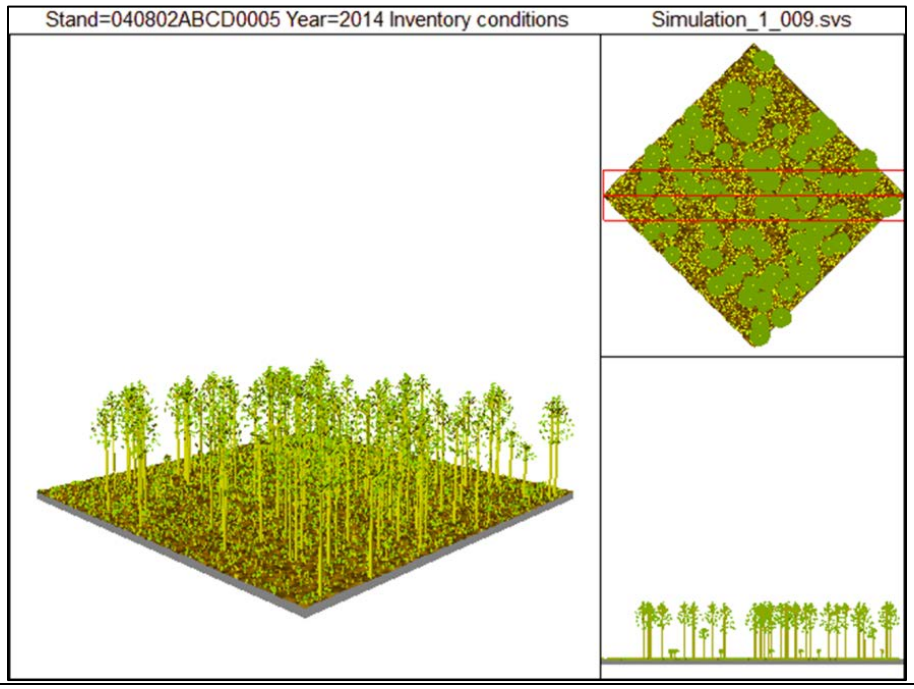


Figure 14. Low-density stable aspen with insufficient small-trees to be capable of self-replacement (SA2-N). Canopy tree density is 100 trees per acre with 4 aspen recruits, 20 saplings, and 5000 sprouts per acre.

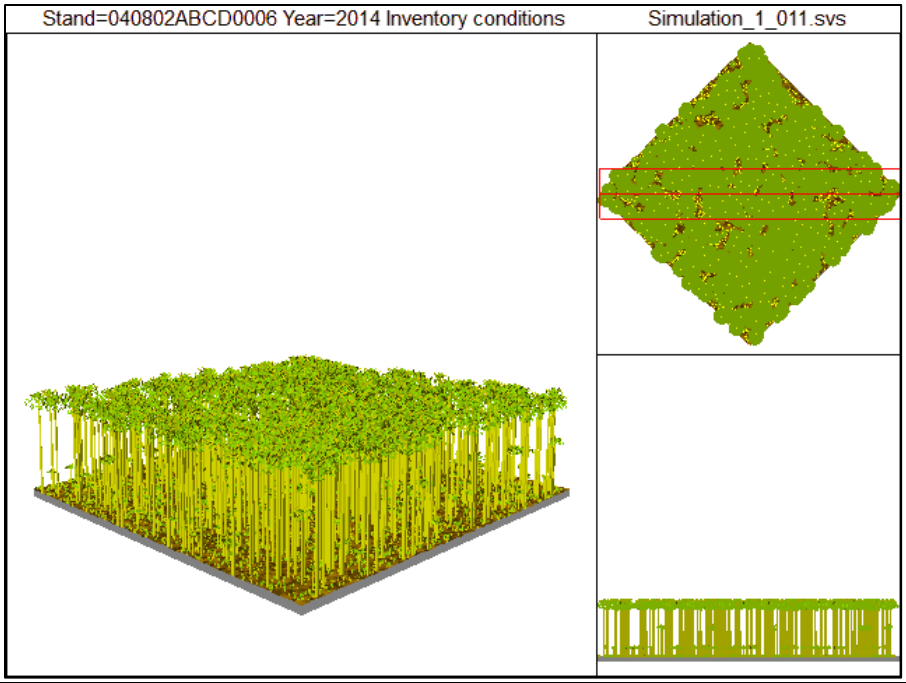


Figure 15. Moderate-density stable aspen with sufficient small-trees to be classified as fully self-replacing (SA3-F). Canopy tree density is 500 trees per acre with 30 aspen recruits, 260 saplings, and 5000 sprouts per acre.

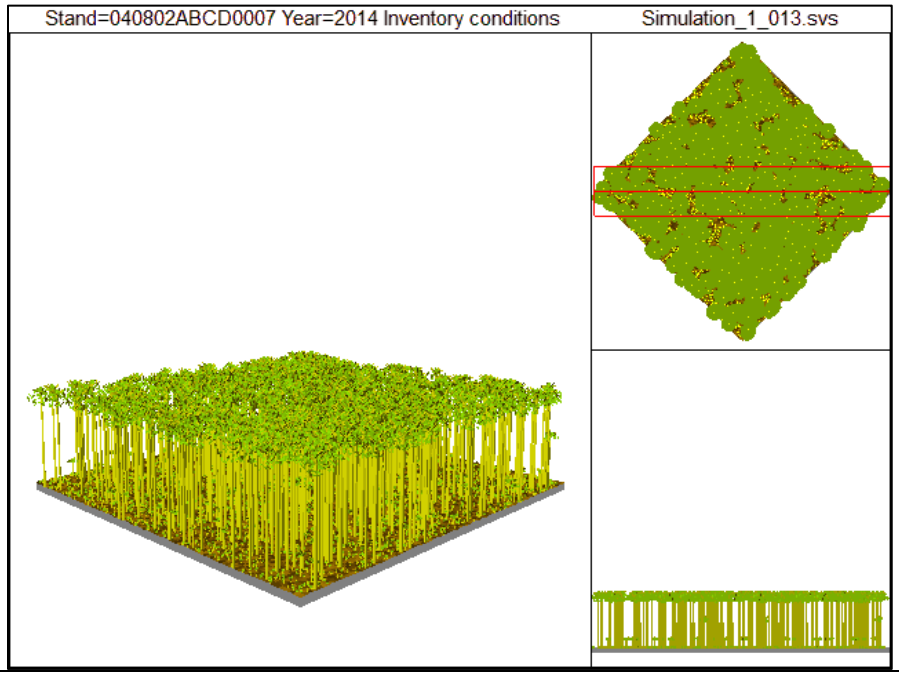


Figure 16. Moderate-density stable aspen with sufficient small-trees to be classified as transitionally self-replacing (SA3-T). Canopy tree density is 500 trees per acre with 15 aspen recruits, 130 saplings, and 5000 sprouts per acre.

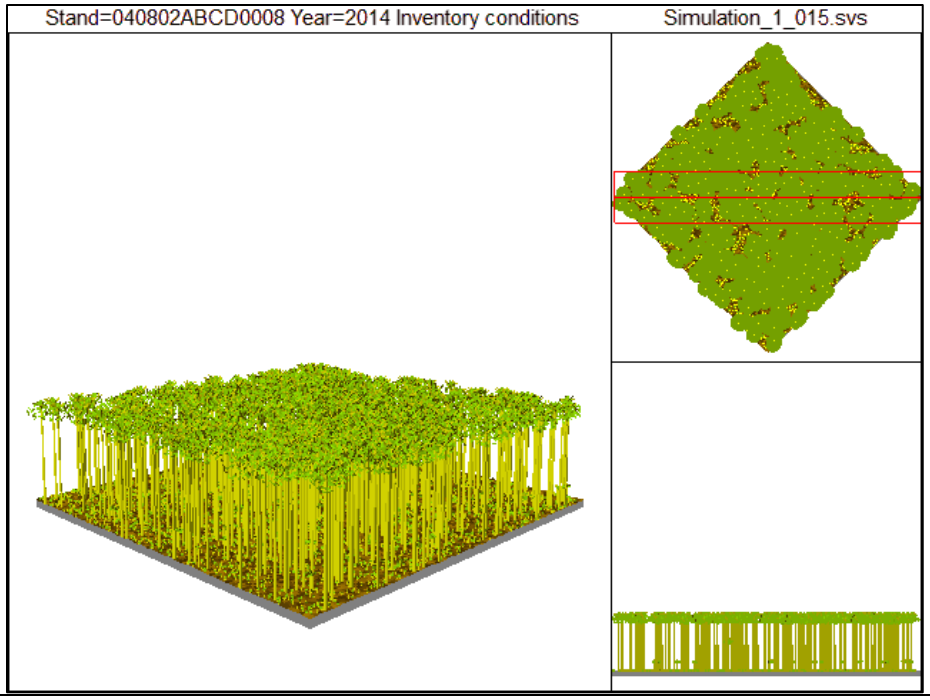


Figure 17. Moderate-density stable aspen with sufficient small-trees to be classified as marginally self-replacing (SA3-M). Canopy tree density is 500 trees per acre with 8 aspen recruits, 65 saplings, and 5000 sprouts per acre.

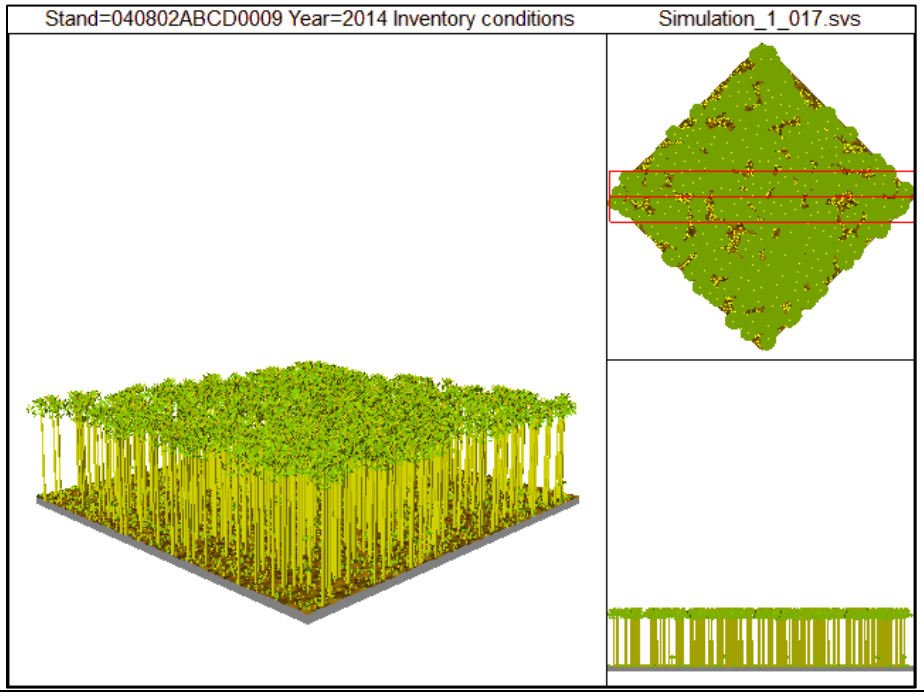


Figure 18. Moderate-density stable aspen with insufficient small-trees to be capable of self-replacement (SA3-N). Canopy tree density is 500 trees per acre with 4 aspen recruits, 32 saplings, and 5000 sprouts per acre.

Largely due to a reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and overbrowsing, most of the aspen ecosystems on Monroe Mountain presently do not meet the desired conditions described above. Most of the aspen stands on Monroe Mountain do not have multi-height stems and adequate recruitment to perpetuate the communities. Big sagebrush in several areas is a major component, and fire regimes have not been adequate to perpetuate aspen in areas that are now seral to conifer. Sustainability of these diverse fire-adapted aspen ecosystems would largely depend on the successful reintroduction of appropriate disturbance processes, and reduction in overbrowsing of aspen. Currently it is difficult for managers to allow fire to play a natural role in the ecosystem due to high stand densities, abundant fuel loading, the forest's proximity to private property, and public and firefighter safety. The desire is for fire to be adequate to perpetuate and sustain aspen stands, approximately every 20 to 60 years (Table 5).

Table 5. Analysis by vegetation cover type (historic range of variability) for Monroe Mountain. This table originated from the Fishlake National Forest's Prescribed Natural Fire Plan (USFS 1998), updated in 2000, and again in 2014. All numbers (with the exception of the Fire Frequency, which is in years) are by 1,000 acres (e.g., The Area in Historic Condition (200 to 400 years ago) for spruce/fir/mixed conifer is 7,000 acres).

Vegetative Cover Type		Spruce/Fir/Mixed Conifer/Seral Aspen	Aspen Dominated	Ponderosa Pine	Other[7]	Mahogany	Gambel Oak	Pinyon/Juniper	Sagebrush/ Grass/Forbs	Totals[8]
Fire Frequency (Years)		10-80[9]	20-60[10]	5-25	20-50[11]	10-30	20-50	10-30	20-40	
Area in Historic Condition (200-400 Years Ago)	1,000 Acres	7	71	3	13	15	8	5	53	175
Area in Existing Condition (As of Year 2000)	1,000 Acres	50[12]	17[13]	0	13	15	7	28	45	175
Net Change from Historical (+/-)	1,000 Acres	43	-54	-3	0	0	-1	23	-8	0

[7] Average fire frequencies for spruce/fir may be 10 to 50 years for white fir/Douglas fir and 50 to 80 years for spruce/subalpine fir.
[8] Average fire frequencies for aspen may be 20 to 40 years at elevations less than 9,000 feet and 40 to 60 years greater than 9,000 feet.
[9] The fire-adapted community most abundant in this group is mountain brush, which as a fire return interval similar to Gambel oak.
[10] Cover type "Other" is a combination of alpine, mountain brush, riparian, and tall forb.
[11] Totals may not be exact because of rounding to the nearest 1,000 acres.
[12] These 50,000 acres also includes seral aspen.
[13] These 50,000 acres also includes seral aspen.

Vegetative Cover Type		Spruce/Fir/Mixed Conifer/Seral Aspen	Aspen Dominated	Ponderosa Pine	Other[7]	Mahogany	Gambel Oak	Pinyon/Juniper	Sagebrush/ Grass/Forbs	Totals[8]
Fire Frequency (Years)		10-80[9]	20-60[10]	5-25	20-50[11]	10-30	20-50	10-30	20-40	
Area of Desired Condition (Start)		28	50	1	13	15	8	10	50	175
Area in PFC[14] (-)		5	2	0	3	11	6	2	8	37
Area Not Suitable for Treatment (-)		0	0	0	0	0	0	3	0	3
Area Available for Treatment[15] (=)		23	48	1	10	4	2	5	42	135
Range of Area to Treat in 5 Year Period[16, 17]		1-12	4-12	<1	1	1-2	<1	1-2	5-10	13-42
1986 Through 1990	Wildland fire	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	Prescribed Fire	0.9	0.0	0.0	0.0	0.2	0.0	0.0	0.9	2.0
	Other	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1991 Through 1995	Wildland fire	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prescribed Fire	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.5
	Other	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.8	1.4
1996 Through 2000	Wildland fire	1.0	0.2	0.0	0.1	0.0	0.1	0.1	0.2	1.7
	Prescribed Fire	0.1	0.0	0.0	0.2	0.0	0.1	0.1	1.1	1.6
	Other	0.7	0.5	0.0	0.0	0.0	0.0	0.1	1.1	2.4

[14]These 17,000 acres only include stable aspen.

[15] PFC stands for properly functioning condition – The on the ground condition termed PFC refers to how well the physical processes are functioning, PFC is a state of resiliency that will allow a riparian-wetland system to hold together during a 25 to 30 year flow event, sustaining that system's ability to produce values related to both physical and biological attributes. It can provide information on whether a riparian-wetland area is physically functioning in a manner that will allow the maintenance or recovery of desired values, e.g. fish habitat, Neotropical birds, or forage, over time.

[16] A 5-year period is the minimum window for planning and monitoring in this analysis.

[17] To calculate the range of area to treat in a 5-year period, divide the area available for treatment (e.g., prescribed fire) by each of the years given for the range in fire frequency and then multiply each quotient by 5 years.

Vegetative Cover Type		Spruce/Fir/Mixed Conifer/Seral Aspen	Aspen Dominated	Ponderosa Pine	Other[7]	Mahogany	Gambel Oak	Pinyon/Juniper	Sagebrush/ Grass/Forbs	Totals[8]
Fire Frequency (Years)		10-80[9]	20-60[10]	5-25	20-50[11]	10-30	20-50	10-30	20-40	
2001 Through 2005	Wildland fire	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8
	Prescribed Fire	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9
	Other	0.7	0.1	0.0	0.0	0.0	0.0	1.4	1.2	3.4
2005 Through 2010	Wildland fire	0.5	0.0	0.0	0.0	0.3	0.1	0.9	0.2	2.0
	Prescribed Fire	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
	Other	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.6	1.3
2011 Through 2013	Wildland fire	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	2.0
	Prescribed Fire	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6
Acres Currently Being Implemented[18]	Prescribed Fire	3.1	1.0	0.0	0.3	1.1	0.4	1.0	3.7	10.6
	Other	2.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.6
Total Area Treated Since 1986 or Currently Being Treated		12.2	3.3	0.0	0.6	1.6	0.7	4.5	11.7	34.6
Area Remaining for Initial Treatments[19]		10.8	44.7	1.0	9.4	2.4	1.3	0.5	30.3	100.4

[18] Cove Area, Box Creek Fuels Reduction Project, Monument Peak Fuels Reduction Project, and Twin Peaks Fuels Reduction Project

[19] Areas need to be retreated sometime within the fire frequency return interval to help facilitate staying in PFC. (e.g., pinyon/juniper: anything treated more than 10 years ago would meet this).

Vegetative Cover Type	Spruce/Fir/Mixed Conifer/Seral Aspen	Aspen Dominated	Ponderosa Pine	Other[7]	Mahogany	Gambel Oak	Pinyon/Juniper	Sagebrush/ Grass/Forbs	Totals[8]
Fire Frequency (Years)	10-80[9]	20-60[10]	5-25	20-50[11]	10-30	20-50	10-30	20-40	
Initial Treatments Completed and Past the Shortest Fire Frequency Return Interval[18]	3.4	0.1	0.0	0.0	0.2	0.0	0.3	0.9	4.9
Maximum Area Proposed in the Aspen Restoration Project EIS	12.2	35.1	0.0	0.0	0.0	0.0	0.0	0.0	47.3
Maximum Area Proposed in the Aspen Restoration Project EIS if Mechanical Treatments Occur and 60% of the Prescribed Fire Acres Get Burned[20]	9.0	27.3	0.0	0.0	0.0	0.0	0.0	0.0	36.3

As stated above, the lack of aspen recruitment is, in part, due to domestic and wild browsing by cattle, sheep, elk, and deer. Figure 5 and Table 1 above outline the total AUMs for cattle, sheep, elk, and deer from 1910 through 2010. Data from 2010 indicate that there were 1,780 sheep and 7,750 cattle AUMs permitted on Monroe Mountain. Cattle and sheep are required to graze in specific allotments and pastures during certain times of the growing season. The numbers of AUMs for cattle and sheep on Monroe Mountain in 2010 are lower on average compared to the period from 1910 through 2000.

Data collected from aerial and ground surveys from 2010 indicates that there were approximately 6,687 deer and 5,403 elk AUMs on Monroe Mountain. Surveys for deer and elk are completed by the UDWR approximately annually. It is important to note that these numbers are estimated

[20] The Northern goshawk (*Accipiter gentilis*) amendment (USFS 2000) require that 40 percent interlocking crown be maintained in foraging habitat. Prescribed fire would occur when 60 percent of the area would be expected to burn, maintaining 40 percent interlocking crowns and a mosaic burn pattern.

by taking the actual numbers counted and inserting them into a model or formula that compensates for those animals that may be missed during the physical surveys.

The UDWR currently has a winter population objective of 1,800 animals for the Monroe Mountain Elk Herd Unit. Populations are estimated annually utilizing harvest surveys, aerial flights, and population modeling. The current estimated winter population on Monroe Mountain Elk Herd Unit use portions of the aspen habitat on Monroe Mountain. From June through September elk tend to concentrate in certain areas of Monroe Mountain (Figure 5). Aspen occurs in much of the area used by elk in the summer. The highest concentration of elk tends to be in the central and north portion of the mountain (the area generally south of Big Lake and north of Langdon Mountain). Many of the aspen stands in this area appear to have heavy browsing pressure. Later in the fall, the elk tend to disperse, with a portion of the herd sometimes leaving Monroe Mountain entirely (MMWG 2012).

In August 2011, four (Tibadore, Burnt Flat, Squaw Springs, and White Ledges) 100-feet by 6-feet digital photographic trail camera belt transections were installed in aspen stands by Utah State University Extension Service. These transects were monitored until November 2012. Two cameras were installed at each transect, each facing each other, one at each end of the 100-foot transect for eight total cameras. Data from these cameras show that elk, deer, cattle, and sheep all browse aspen.

These transects were also read multiple times for browse conditions. The monitoring results show the percent browse at the last reading in 2011 ranged from 13 percent (Tibadore) to 58 percent (Burnt Flat and Squaw Springs), with three of the four transects exhibiting 52 to 58 percent browse. In 2012, percent browse at the last reading ranged from 65 percent (Tibadore) to 91 percent (Burnt Flat). Tibadore exhibited the lowest browse among the four transects in the fall 2011 (13 percent) and 2012 (65 percent) (MMWG 2012). This aspen browse is attributed to cattle, sheep, elk, and deer. The desire is to sufficiently reduce the aspen browse from cattle, sheep, elk, and deer so that persistent aspen communities, with multi-height stems, and adequate recruitment to perpetuate the aspen communities can be achieved.

1.5 Purpose and Need for Action

The purpose of this project is to restore aspen ecosystems on Monroe Mountain by achieving the desired conditions described above. To help accomplish this purpose, the District has identified a need to (1) address the conifer encroachment that occurs due to the reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and (2) address aspen overbrowsing by domestic and wild ungulates. These are two of the primary underlying causes for aspen decline on Monroe Mountain. Restoring aspen communities on Monroe Mountain would result in multiple benefits, which include but are not limited to:

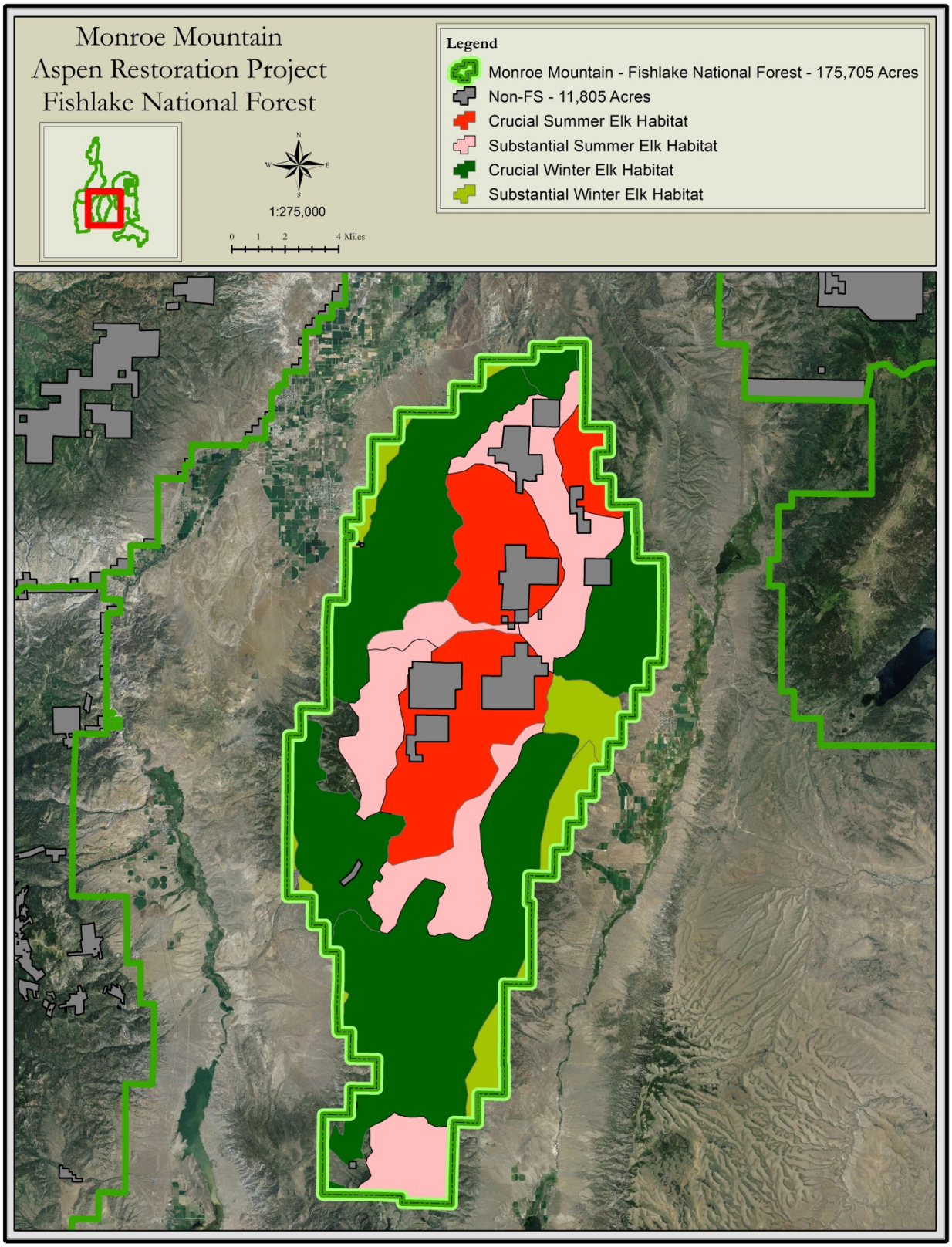


Figure 19. Elk habitat on Monroe Mountain

1. Improving and increasing the amount of habitat for wildlife species dependent upon aspen ecosystems (i.e., mule deer, elk, and Northern goshawk);
2. Improving and increasing the amount of habitat and forage for domestic ungulates (i.e., cattle and sheep);
3. Improving native species diversity;
4. Reducing hazardous fuel accumulations;
5. Reducing the risk for large-scale, intense wildland fires. This results in lower risk to the safety of the public and firefighters. This also results in lower risk to sensitive wildlife species (i.e. Northern goshawk, Western Boreal toad *(Anaxyrus boreas boreas)*, and Bonneville cutthroat trout (*Oncorhynchus clarki utah*)); and,
6. Increasing the probability that future naturally caused fires can be managed (if possible, not suppressed) and allowed to play the greatest feasible natural role in the aspen ecosystems on Monroe Mountain (USFS 2001).

1.6 Management Direction and Guidance

This action responds to the goals and objectives outlined in the LRMP (USFS 1986). The desired conditions described above and the purpose and need for this project are consistent with the Forest's goals, the objectives found in chapter IV of the LRMP, and the Utah Fire Amendment (USFS 2001). The proposed treatment units are within management areas 2B – Rural and Roaded Natural Recreation; 4A – Fish Habitat Improvement; 4B – Habitat for Management Indicator Species; 5A – Big Game Winter Range - Non-forested; 6B – Intensive Livestock Management; 7B – Wood-Fiber Production - Genetics; and 9F – Improved Watershed (Figure 20). The relevant goals and objectives are listed below:

1. Ecosystems are restored and maintained, consistent with land uses and historic fire regimes, through wildland fire use and prescribed fire (Utah Fire Amendment, pg. A-40).
2. Manage forest cover types to provide variety in stand sizes shape, crown closure, edge contrast, age structure and interspersion (LRMP p. IV-99).
3. Prescribed fire is authorized forest-wide (Utah Fire Amendment, pg. A-41).
4. Use prescribed fire to reduce fuel buildup and meet resource objectives (LRMP p. IV-5).
5. Reduce hazardous fuels; the full range of reduction methods is authorized, consistent with forest and MA emphasis and direction (Utah Fire Amendment, pg. A-41).
6. Identify and improve habitat for sensitive, threatened, and endangered species including participation in recovery efforts for both plants and animals (LRMP IV-4).
7. Improve or maintain the quality of habitat on big game winter ranges (LRMP IV-4).
8. Maintain structural diversity of vegetation on management areas dominated by forested ecosystems (LRMP IV-11).
9. Manage aspen for retention where needed for wildlife, watershed, or esthetic purposes (LRMP IV-11).
10. Manage seral aspen stands for a diversity of age classes (LRMP IV-11).
11. Manage aspen to perpetuate the species and improve quality (LRMP IV-4).
12. Provide wood fiber while maintaining or improving other resource values LRMP IV-4).
13. Improve timber age class distribution and maintain species diversity (LRMP IV-4).

14. Manage tree stands using both commercial and noncommercial methods. Enhance visual quality, diversity, and insect and disease control (LRMP IV-62 and IV-84d).
15. Maintain and manage forested inclusions to provide a high level of forage production, wildlife habitat, and diversity (LRMP IV-112).
16. The area would have a mosaic of fully stocked stands that follow natural patterns and avoid straight lines and geometric shapes (LRMP IV-113).
17. Prevent and control insect infestation and disease (LRMP IV-5)

One goal of this project is to re-establish fire regimes to Monroe Mountain. Wildland fire is authorized forest-wide by the Utah Fire Amendment (A-41) under management area goal IV-3 (Diversity), except in the following areas:

1. Administrative sites;
2. Developed recreation sites;
3. Summer home sites;
4. Designated communication sites;
5. Oil and gas facilities;
6. Mining facilities;
7. Above-ground utility corridors; and,
8. High-use travel corridors.

The management response for these locations would be wildland fire suppression if they were threatened. In areas authorized for wildland fire use, the full range of management responses (from full suppression to monitoring of wildland fire activity) may be used. The goal is to "ultimately increase the probability that future naturally caused fires can be managed (if possible, not suppressed) to restore natural processes in these disturbance dependent aspen ecosystems on Monroe Mountain."

The District has also compared the action alternatives with the general direction and standards and guidelines listed in the LRMP to determine compliance, and found that the action alternatives are compliant with the general direction and standards and guidelines listed in the LRMP. The District determined a LRMP amendment would not be required as part of this project. This review, along with supporting rationale is found in the project record.

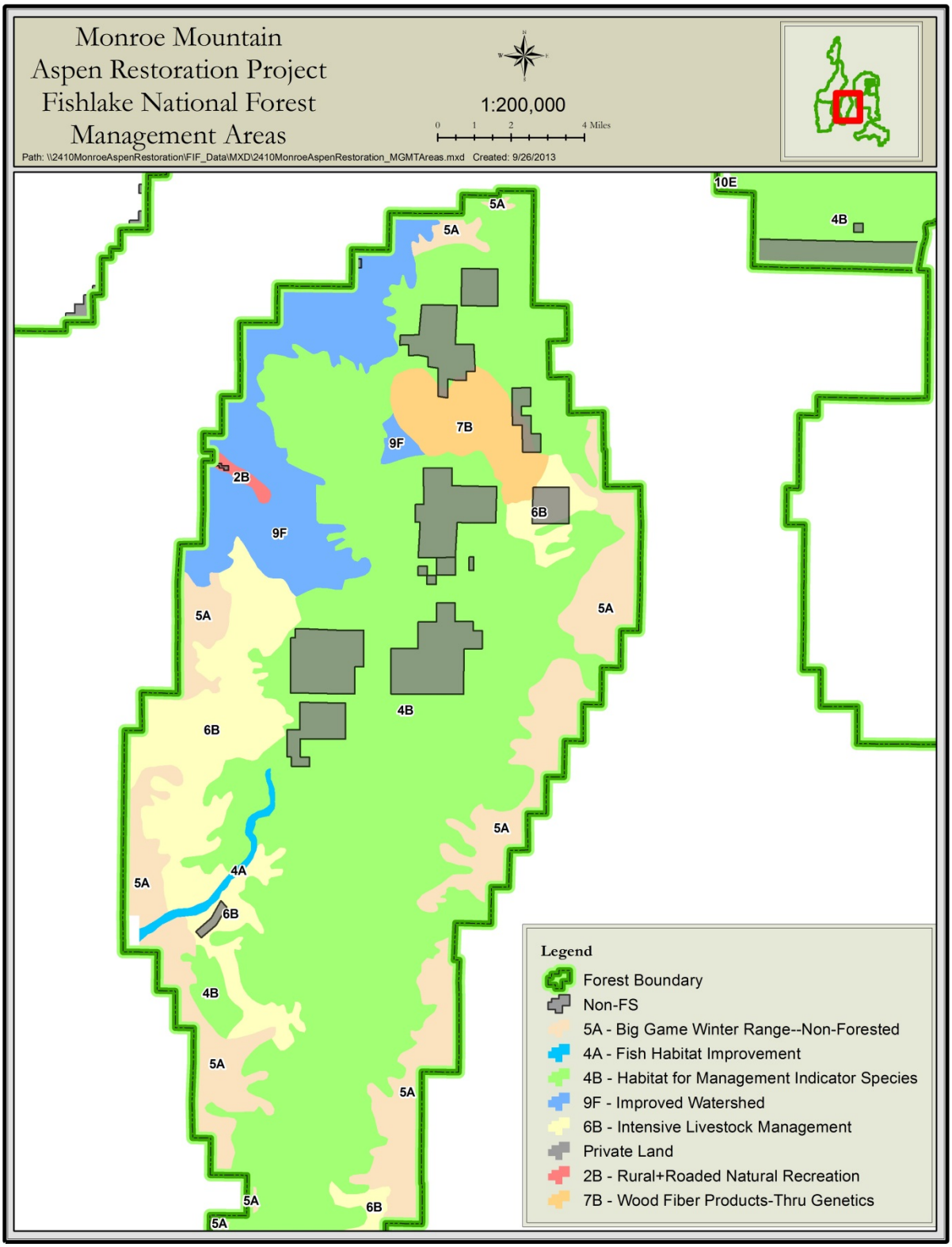


Figure 20. Fishlake National Forest Land and Resource Management Plan Management Areas

1.7 Proposed Action

The action proposed by the District to meet the purpose and need is to conduct a combination of prescribed fire and/or mechanical thinning treatments in stable and seral aspen stands, and spruce/fir and mixed conifer stands to promote the regeneration and recruitment of aspen communities. Some stands currently dominated by spruce/fir and mixed conifer may have been dominated by aspen at some point in the past. As shown in Figure 6 and Table 2, aspen occurs in varying percentages in spruce/fir, mixed conifer, and seral aspen dominated stands. Treating spruce/fir, mixed conifer, and aspen stands would reduce competition for resources, and encourage aspen to regenerate.

The proposed action is similar for all of the alternatives. What vary within the alternatives are the acreages of mechanical thinning verses the acreages of prescribed fire that would be treated depending on the issues (section 1.15), and the mileage of temporary roads proposed for each alternative. The treatment options proposed for the project area are: (1) areas would be mechanically thinned with the associated slash piled and burned, and (2) areas would receive prescribed fire treatments. Please see chapter 2 for detailed descriptions of these treatment options and each alternative.

Addressing the reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression on Monroe Mountain is critical to the long-term restoration of aspen ecosystems. The average fire return intervals for each of the vegetation cover types occurring on Monroe Mountain can be found in Table 5. This table also shows that the maximum area proposed for mechanical and prescribed fire treatments on Monroe Mountain for aspen, spruce/fir, and mixed conifer is 47,274 acres (alternative 4). However, the management guidelines for Northern goshawk require leaving 40 percent interlocking crowns in foraging areas. To be compliant with the guidelines, prescribed burning would only occur when 60 percent of the prescribed fire area is expected to burn. This would leave 40 percent of the area with interlocking crowns intact. As for the areas proposed for mechanical treatments, by removing just conifer and/or removing conifer trees up to 8 inch DBH, using group, and singletree selection, desiring uneven-aged management, and proposing minimal mechanical treatments in the stable aspen stands, 40 percent of the area with interlocking crowns would also remain intact in the mechanical treatment areas. Therefore, the maximum area proposed for mechanical and prescribed fire treatments on Monroe Mountain for aspen, spruce/fir, and mixed conifer (assuming only 60 percent of the prescribed fire treatment areas are burned) is 36,300 acres (alternative 4). The approximate duration of this project is 10 years; therefore, approximately 18,150 acres would be mechanically treated and/or prescribed burned every 5 years. This number is well within the recommended range of area to treat within a 5-year period of 5,000 to 24,000 acres (Table 5). These treatments would allow the Forest to “catch up” to the minimum fire intervals outlined in Table 5. (See chapter 2 for a detailed description of the proposed action and alternatives.)

Mechanical thinning and prescribed fire treatments are proposed within five Inventoried Roadless Areas (IRAs) (Langdon, Little Creek, Marysvale Peak, Signal Peak, and Tibadore) and within five draft Unroaded-Undeveloped Areas (UUAs) (Langdon, Little Creek, Marysvale Peak, Signal Peak, and Tibadore). No roads would be constructed within IRAs. Temporary roads would be constructed in treatment areas located outside of the IRAs (for all alternatives)

including within draft UUAs (see alternatives 4 and 5). The mileage for these temporary roads varies depending on the alternative (see chapter 2 for specific road locations, mileage, and specifications; Figure 36 through Figure 42). In addition, temporary fencing would be installed around Manning Meadows Reservoir and Barney Lake (see chapter 2 for fencing locations, mileage, and specifications; Figure 21)

No active treatments are proposed within the sagebrush cover-type where scattered aspen trees and stands occur in portions of the sagebrush communities. These areas are expected to improve through passive restoration (i.e., by trying to allow naturally ignited fires to burn, and changing grazing and browsing management). See chapter 2 for a detailed description of the District's proposal to address overbrowsing of aspen.

1.8 Fire Severity Definitions

Low soil burn severity: Surface organic layers are not completely consumed and are still recognizable. Structural aggregate stability is not changed from its unburned condition, and roots are generally unchanged because the heat pulse below the soil surface was not great enough to consume or char any underlying organics. The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and the canopy and understory vegetation would likely appear "green."

Moderate soil burn severity: Up to 80 percent of the pre-fire ground cover (litter and ground fuels) may be consumed but generally not all of it. Fine roots (approximately 0.1 inch in diameter) may be scorched but are rarely completely consumed over much of the area. The color of the ash on the surface is generally blackened with possible gray patches. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that would soon fall to the ground. The prevailing color of the site is often "brown" due to canopy needle and other vegetation scorch. Soil structure is generally unchanged.

High soil burn severity: all or nearly all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed, and charring may be visible on larger roots. The prevailing color or the site is often "black" due to extensive charring. Bare soil or ash is exposed and susceptible to erosion, and aggregate structure may be less stable. White or gray ash (up to several inches in depth) indicates that considerable ground cover or fuels were consumed. Sometimes very large tree roots (greater than 3 inches in diameter) are entirely burned extending from a charred stump hold. Soil is often gray, orange, or reddish at the ground surface where large fuels were concentrated and consumed.

1.9 Decision Framework

During the final environmental impact statement process the District Ranger for the District is the Forest Service official responsible for deciding whether to select the preferred alternative, select one of the other action alternatives, select the no action alternative, or select a combination of the alternatives. This decision includes determining: (1) the location and treatment methods

for all restoration activities; (2) design criteria, mitigation, and monitoring requirements; and (3) the browse threshold components.

1.10 Other Planning Efforts

Other restoration activities (actions on private, State, and other non-National Forest System lands) that influence, or are complementary to this analysis are addressed in the cumulative effects section.

1.11 Relationship to the Land and Resource Management Plan (LRMP)

The LRMP sets forth in detail the direction for managing the land and resources of the forest. The desired conditions for the project are based on the objectives, goals, standards, and guidelines outlined in the LRMP. This analysis tiers to the Forest's Final EIS and LRMP (USFS 1986), as encouraged by 40 CFR 1502.20. Best available science was used to develop desired conditions that are consistent with the LRMP.

1.12 Management Direction

The project area includes seven management areas as described in the LRMP (USFS 1986; pages IV-66 to IV-153; Figure 20). Table 6 displays the management areas located within the project area, LRMP emphasis, and the relationship between the management area total acreage to the project. For more information see chapter IV of the LRMP where detailed descriptions of forest-wide resource direction specific to management areas are located. The acreage and percent of the forest-wide management areas that are proposed for treatment are alternative specific and can be found in chapter 2.

Table 6. Fishlake National Forest Land and Resource Management Plan (LRMP) Management Areas (MAs) within the project area

LRMP MA	Description	LRMP Emphasis	Forest-wide MA Acres	Maximum MA Acres Proposed	Maximum Percentage of MA Treated
MA 2B	Rural and Roaded Natural Recreation	Emphasis is for rural and roaded-natural recreation opportunities.	27,855	4	0.0001%
MA 4A	Fish Habitat Improvement	Emphasis is on fish habitat improvement where aquatic habitat is below productive potential.	2,474	171	0.07%
MA 4B	Habitat for Management Indicator Species	Management emphasis is on the habitat needs of one or more management indicator species.	354,732	26,546	0.07%

LRMP MA	Description	LRMP Emphasis	Forest-wide MA Acres	Maximum MA Acres Proposed	Maximum Percentage of MA Treated
MA 5A	Big Game Winter Range – Non-Forested	Treatments are applied to increase forage production of grass, forb, and browse species or to alter plant species composition for winter range for deer, elk, and bighorn sheep (if introduced).	66,720	475	0.007%
MA 6B	Intensive Livestock Management	Range resource management level D (intensive management) is applied.	658,704	4,849	0.007%
MA 7B	Wood Fiber Products – Through Genetics	Manage wood-fiber production and utilization of large roundwood of a size and quality suitable for sawtimber.	6,061	2,610	43%
MA 9F	Improved Watershed	Improving watershed condition to eliminate the watershed improvement backlog, and maintaining projects already completed.	135,842	1,646	0.01%

1.13 Public Involvement

1.13.1 Collaboration

In January 2010, the Utah Forests Aspen Restoration Working Group (UFRWG) finalized the *Guidelines for Aspen Restoration on the National Forests in Utah* (UFRWG 2010). As part of this effort, the UFRWG submitted a call for project proposals that could effectively test the newly created guidelines. The Forest submitted the Monroe Mountain Aspen Ecosystems Restoration project to the UFRWG for their consideration. The proposal was accepted and in April 2011, the working group created the Monroe Mountain Working Group (MMWG) to provide recommendations and feedback to the District as the project was developed.

Since its inception, the District has met with the MMWG almost monthly since May 2011. These meetings were open to the public. This collaboration group has had many discussions on the details of this project, and the District adopted the group's *Browsing Thresholds and Adaptive Management Pursuant to Aspen Restoration on Monroe Mountain* (MMWG 2014; appendix C) recommendations for this analysis. This document addresses the identified overbrowsing issue as it provides quantifiable browsing thresholds and responses options that could be implemented if browsing thresholds are surpassed following project implementation (see chapter 2 for browse thresholds and response options).

The MMWG consist of the following stakeholders: Utah Cattlemen's Association; Utah Woolgrowers Association; Utah State University Extension; Sportsmen for Fish and Wildlife;

Rocky Mountain Elk Foundation; Trout Unlimited; UDWR (UDWR); Piute County Commission; Sevier County Commission; Utah Department of Agriculture and Food; Utah Farm Bureau; Rocky Mountain Research Station; Grand Canyon Trust; Western Aspen Alliance; and Utah Division of Forestry, Fire and State Lands.

In addition, the District supports Utah Forestry Fire and State Lands, and private lands owners conducting fuels reduction treatments on private lands. Many landowners have and continue to implement fuels reduction work on their private lands. Most landowners still need to complete fuels reduction work. Independent of this Monroe Mountain Aspen Ecosystems Restoration Project, the District would continue to encourage and support fuels reduction treatments on private lands. This work on private lands would be included in the cumulative effects analysis under issue 2.

In developing the action alternatives for this project, the District implemented the four fundamental steps outlined in the UFRWG's 2010 *Guidelines for Aspen Restoration on the National Forests in Utah.*

1. Step 1: Assess the condition of aspen;
2. Step 2: Identify problematic aspen conditions and their agents/causes;
3. Step 3: select from among appropriate response options that address the potentially problematic conditions; and
4. Step 4: monitor to assess aspen stand conditions and management/restoration.

By following these four major steps in making a decision about aspen forest restoration on Monroe Mountain, this project is consistent with and following the 2010 *Guidelines for Aspen Restoration on the National Forests in Utah* (UFRWG 2010; appendix B).

1.13.2 Scoping

The project was posted on the Forest's schedule of proposed actions website on October 1, 2012 and the notice of intent (NOI) to prepare an environmental impact statement was published in the Federal Register on October 3, 2012 (FR Doc. 2012-24317). The NOI asked for public comment on the proposal from October 3 until November 19, 2012. The District received comments from 22 entities including individuals, local government, state government, federal and state agencies, and organizations. A scoping report that includes a summary of the scoping comments and associated responses can be found in the project record.

1.13.3 Public Meetings

An open house was conducted on October 10, 2012 for the public to view documents and maps of the proposal, ask questions, and submit comments. The District also held public meetings to discuss the project and answer questions on January 7, 2013 (6 in attendance); January 8, 2013 and January 9, 2013 (16 in attendance); January 11, 2013 (11 in attendance); and February 21, 2013 (9 in attendance). Additionally, the District has almost met monthly since the projects

inception with the MMWG. These MMWG meetings are always open to the public to provide information, ask and answer questions, and discuss the proposal.

1.13.4 Cooperating Agencies

The Utah Division of Wildlife Resources is a cooperating agency. Since overbrowsing of aspen is identified as one of the primary underlying causes for aspen decline on Monroe Mountain, UDWR is a cooperating agency to assist this project with helping address wildlife related issues. The Utah Wildlife Board also supports the aspen browse threshold outlined and adopted in this document, as stated in their letter signed by Jake Albrecht, Chairman of the Utah Wildlife Board (dated August 28, 2014; Albrecht 2014).

1.14 Tribal Consultation

On October 1, 2012, the Paiute Indian Tribe of Utah, the Ute Indian Tribe, and the Hopi Indian Tribe were each sent the NOI to prepare a DEIS for this project. The District did not receive any comments from these tribes regarding this project.

1.15 Issues

The interdisciplinary team reviewed the scoping comments from public individuals, interest groups, local governments, and other agencies, to develop a list of issues to address. The issues were separated into two groups: key and non-key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Non-key issues were identified as those:

1. Addressed through LRMP or implementation of LRMP standards and guidelines and best management practices;
2. Addressed through implementation of project-specific mitigation measures;
3. Addressed during processes or analyses routinely conducted by an interdisciplinary team;
4. Addressed through spatial location of activities during alternative design;
5. Beyond the scope of the project; or
6. General comment.

The Council on Environmental Quality (CEQ) NEPA regulations explain these delineations in Sec. 1501.7, "…identify, and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-key issues and reasons regarding their categorization as non-significant is in the project record. Following are the key issues identified by the public and used to focus the analysis or drive alternative development.

1.15.1 Issue 1 – Impacts to wilderness attributes and roadless area characteristics resulting from mechanical treatments within inventoried roadless areas and draft unroaded-undeveloped areas may result in these areas not being eligible for wilderness designation

There are five IRAs and draft UUAs located within the Monroe Mountain project boundary (Langdon, Little Creek, Marysvale Peak, Signal Peak, and Tibadore). There is concern that mechanical treatments may result in roadless area characteristics and wilderness attributes being impacted to a point that these areas would no longer qualify for future designation as Wilderness.

Indicator: condition of IRAs and unroaded-undeveloped areas post-treatment

1.15.2 Issue 2 – Prescribed fire activities may impact adjacent private property

Prescribed fire activities may result in impacts to private property. Current fuel loads in areas adjacent to private properties generally do not allow prescribed fire activities to be managed safely with low risk of affecting private property. The reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression has contributed to the increased fuel loads over most of Monroe Mountain, including areas adjacent to private property.

Indicator: changing fire behavior (flame length, spotting, and crown fire) adjacent to private lands, via mechanical treatments, to facilitate safer prescribed fire burn conditions

1.15.3 Issue 3 – Project activities may result in Northern goshawks being displaced

Prescribed fire and mechanical thinning activities that occur within or adjacent to Northern goshawk territories may result in nest abandonment, the displacement of goshawks, and potential mortality. Project activities may remove or degrade potential foraging habitat in the short-term.

Indicator: nesting success, recruitment, and percent survival of Northern goshawks

1.15.4 Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded

Prescribed fire and mechanical thinning activities that occur within Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake may result in degraded habitat conditions, and increase chance in mortality for these species.

Indicator: breeding/spawning success, recruitment, and percent survival of Bonneville cutthroat trout and Boreal toads.

1.15.5 Issue 5 – Browsing by domestic and wild ungulates on new aspen shoots post-treatment and/or the continued high levels of aspen browsing in the stable aspen areas may result in complete loss of aspen stands

Wild and domestic ungulates browsing on new aspen shoots post-treatment may result in aspen shoots not reaching 6 feet in height; generally considered the height at which the aspen shoots can survive moderate browsing and grow into mature individuals. Mechanical and prescribed fire treatments would be implemented to disturb aspen stands thus stimulating aspen regeneration. During the period immediately following treatments, and for several years after project activities are conducted, post-treatment areas may be subject to heavy browsing by wild and domestic ungulates, thus increasing the potential for the loss of entire stands of aspen.

Indicator: percent aspen browsed immediately following treatments

1.15.6 Issue 6 – Project activities may result in livestock permittees not having a place to graze their livestock while vegetation is reestablishing on Monroe Mountain (two, or more, growing seasons)

Aspen shoots are susceptible to overbrowsing by domestic and wild ungulates post-treatment. To ensure successful recruitment of aspen shoots, domestic livestock would be removed from treatment areas for two or more growing seasons. This may result in livestock permittees not having a place to graze their livestock on the National Forest for several years post-treatment.

Indicators: growth of aspen shoots and recovery of other forage plants post-treatment; the percent of each pasture being treated; and the timing of when each pasture would be treated

1.15.7 Issue 7 – Project activities may result in adverse impacts to old growth characteristics

There is a concern that mechanical and prescribed fire treatments may result in adverse impacts to old growth characteristics.

Indicators: condition of old growth characteristics post-treatment

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This chapter describes the proposed action and alternatives, and compares the alternatives considered for the Monroe Mountain Aspen Ecosystems Restoration project. It includes the description and maps of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative.

2.2 Proposed Action

2.2.1 Proposed Mechanical Treatments

2.2.1.1 Seral and Stable Aspen Stands

There are two mechanical treatment options being considered in this analysis for seral and stable aspen dominated stands (Photo 13 through Photo 21; appendix A):

1. Conifers would be removed and the existing aspen would be retained regardless of the size of the conifer or if it is located within an IRA or draft UUA. (Photo 14, Photo 17, and Photo 20; appendix A; Table 7). To access the conifer, some incidental cutting of aspen may occur. This option would occur throughout the project area.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH and the existing aspen would be retained (Photo 15, Photo 18, and Photo 21; appendix A; Table 8). In all areas outside the IRAs and draft UUAs, conifers would be removed and the existing aspen would be retained regardless of the size of the conifer.

2.2.1.2 Spruce/Fir and Mixed Conifer Stands – Proposed Mechanical Treatment Methods

There are also two mechanical treatments options being considered in this analysis for spruce/fir and mixed dominated conifer stands (Photo 22 through Photo 30; appendix A):

1. This option would occur throughout the project area (Photo 23, Photo 26, and Photo 28; appendix A; Table 7).

a) If present, beetle killed conifer trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (salvage harvest[21]).
b) If conifer trees are currently infected by beetles and are in the process of dying, the infected trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (sanitation harvest[22]).
c) In areas of spruce/fir or mixed conifer where LRMP stocking levels are below plan guidance due to bark beetle impacts, replanting of spruce or mixed conifer may occur. If the remaining live trees were greater than a BA of 90[23], the remaining live trees would be thinned using uneven-aged management[24] to a BA of 90 with single and group tree selection.
d) If no beetle killed or infested trees are present initially, trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.

2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH (Photo 24, Photo 27, and Photo 29; appendix A; Table 8). In all areas outside the IRAs and draft UUAs, treatments would occur as in option 1 for spruce/fir and mixed conifer dominated stands.

Table 7. Option 1—Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning
Alternative 2	Seral Aspen	3,146
	Stable Aspen	4,025
	Spruce/Fir	918
	Mixed Conifer	97
	Total	8,186
Alternative 3	Seral Aspen	6,422
	Stable Aspen	4,780
	Spruce/Fir	2,355
	Mixed Conifer	91
	Total	13,648
Alternative 4	Seral Aspen	9,492
	Stable Aspen	6,130

[21] Salvage harvest – The removal of dead trees, damaged trees, or dying trees resulting from injurious agents other than competition (Helms 1998).
[22] Sanitation harvest – The removal of trees to improve stand health by stopping or reducing the actual or anticipated spread of insects and disease (Helms 1998).
[23] A BA of 90 helps reduce fuel loads to facilitate prescribed burning. Disturbance from lowering the BA to 90 is expected to help stimulate new aspen growth while maintaining a spruce and conifer presence. A BA of 90 is also expected to reduce the probability of continued Spruce beetle infestation (Jenkins 2014) and is expected to allow for trees to grow bigger.
[24] Uneven-aged management – a planning sequence of treatments designed to maintain and regenerate a stand with three or more age classes (Helms 1998). This is opposed to even-aged management that describes a stand as trees composed of a single age class.

	Spruce/Fir	4,113
	Mixed Conifer	102
	Total	19,837

Table 8. Option 2--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres Outside IRAs and UUAs)	Mechanical and Associated Slash Burning (Acres Inside IRAs and UUAs)	Project Total
Alternative 2	Seral Aspen	2,349	797	3,146
	Stable Aspen	3,643	382	4,025
	Spruce/Fir	472	446	918
	Mixed Conifer	89	8	97
	Total	6,553	1,633	8,186
Alternative 3	Seral Aspen	3,111	3,311	6,422
	Stable Aspen	3,965	815	4,780
	Spruce/Fir	835	1,520	2,355
	Mixed Conifer	90	1	91
	Total	8,001	5,647	13,648
Alternative 4	Seral Aspen	3,991	5,501	9,492
	Stable Aspen	4,196	1,934	6,130
	Spruce/Fir	1,186	2,927	4,113
	Mixed Conifer	91	11	102
	Total	9,464	10,373	19,837
Alternative 5	Seral Aspen	2,547	4,189	6,736
	Stable Aspen	3,830	1,510	5,340
	Spruce/Fir	984	1,921	2,905
	Mixed Conifer	91	1	92
	Total	7,452	7,621	15,073

2.2.2 Proposed Prescribed Fire Treatments

Prescribed fire would be implemented utilizing aerial and/or hand ignition techniques targeting spruce/fir, mixed conifer, and seral aspen with mosaic burn patterns and mixed burn severities as an objective. To maintain LRMP compliance, prescribed fire would occur when 60 percent of the area would be expected to burn (Table 9).

Table 9. Proposed prescribed fire treatments.

	Existing Vegetation	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned
Alternative 2	Seral Aspen	15,159	9,095
	Stable Aspen	7,991	4,795
	Spruce/Fir	5,658	3,395
	Mixed Conifer	4,183	2,510
	Total	32,991	19,795
Alternative 3	Seral Aspen	14,318	8,591
	Stable Aspen	7,861	4,716
	Spruce/Fir	4,988	2,993
	Mixed Conifer	4,190	2,514
	Total	31,357	18,814
Alternative 4	Seral Aspen	12,763	7,658
	Stable Aspen	6,693	4,016
	Spruce/Fir	3,802	2,281
	Mixed Conifer	4,178	2,507
	Total	27,436	16,462
Alternative 5	Seral Aspen	11,676	7,006
	Stable Aspen	6,777	4,066
	Spruce/Fir	3,810	2,286
	Mixed Conifer	4,190	2,514
	Total	26,453	15,872

2.3 Design Criteria and Mitigation Measures Applicable to all Action Alternatives

2.3.1 Mechanical Thinning Treatments and Associated Slash Pile Burning, and Prescribed Fire Treatments

- All applicable LRMP standards and guidelines would be applied and incorporated into all the action alternatives.
- Treated areas would be rested from livestock grazing for at least two growing seasons post implementation, and possibly three to reduce livestock browse pressure on new aspen sprouts.
- Invasive and noxious weeds are not known to occur in the proposed treatment areas; however, treatment areas would be monitored post-implementation. If noxious and/or

invasive weeds were detected, the District would take the appropriate actions to control spread and eliminate the noxious and/or invasive weeds from the treatment areas.

- Equipment would be washed and inspected, prior to entering National Forest System lands, to remove any soil and debris that may contribute to the spread of noxious weeds.
- Equipment would be cleaned and dried before moving from one water source to another to prevent the spread of aquatic invasive species (AIS). If equipment cannot be completely dried, equipment would be decontaminated following the 2014 Region 4 Fire AIS guidelines (USFS 2014a).
- Treatments would target upland, non-riparian areas first. No more than 15 percent of the upland areas within a hydrologic unit code (HUC) 6 would be treated in any one year. After the upland areas have been treated (15 percent) and have recovered [comparable] watershed function, additional upland areas (15 percent) in the same HUC 6 could occur.
- After the upland areas have been treated and have recovered [comparable] watershed function and aspen restocking (1,000 aspen saplings per acre) are being achieved, then the aspen or conifer in riparian areas could be treated.
- No more than 5 to 10 percent of the riparian areas within a HUC 6 would be treated in any one year. After the riparian areas have been treated (5 to 10 percent) and have recovered [comparable] watershed function, additional riparian areas (5 to 10 percent) in the same HUC 6 could occur.
- Following treatments, if determined necessary by the Forest's fish biologist, hydrologist, or soil scientist, wood chips, slash, mulch, straw, and/or silt fences could be installed to help minimize impacts from soil erosion.
- A Spill Prevention Control and Containment Plan would be compiled and in place prior to project implementation.
- Areas for fuel storage, refueling, servicing, and parking of equipment would occur outside riparian areas in designated locations.
- Significant historical and cultural sites identified by the Forest archaeologist would be protected from prescribed fire treatments by the construction of a control line observing a 100-foot buffer from the site. These sites would also be protected from mechanical treatments by observing the same 100-foot buffer from the site.
- To provide for firefighter and public safety, some roads and dispersed camping areas may be temporarily closed during prescribed fire and/or mechanical treatment implementation. Temporary closures would be determined by implementation personnel and would be based on the hazards present at the time of implementation.
- Within Northern goshawk areas, all applicable Fishlake LRMP Amendment Northern Goshawk Guidelines (USFS 2000) would be followed. For example:
    - Forest vegetative manipulation (timber harvest, prescribed burning, fuelwood, thinnings, weedings, etc.) would not occur within active nest areas (NA) (approximately 30 acres; i.e. guideline O.) during the active nesting period. The active nesting period would normally occur between March 1 and September 30.
    - Vegetative treatments are designed to maintain or promote VSS (Table 3); the percent of the group acreage covered by clumps of trees with interlocking crowns should typically range from 40 to 70 percent in PFAs areas (PFAs) and foraging areas, and 50 to 70 percent in NAs. To manage outside this range, it would either be shown that the range is not within PFC for the site and the biological evaluation process determines that managing outside the range would be

consistent with the landscape needs of the Northern goshawk and its prey. The best and most reliable information would be used to make determinations. The District is not proposing to manage outside this range. Groups are made up of multiple clumps of trees. Groups would be of a size and distribution in a landscape that is consistent with disturbance patterns defined in regional or local PFC assessments. Clumps typically have two to nine trees with interlocking crowns.

- Within the aspen areas, a minimum of 200 snags per 100 acres: 8 inch DBH – 15 feet tall would be retained. Within the mixed conifer and spruce/fir areas, a minimum of 300 snags per 100 acres: 18 inch DBH – 30 feet tall would be retained.
- Within the aspen areas, a minimum of 50 down logs per 10 acres, 6-inch diameter at 8 feet long, and 30 tons per 10 acres would be retained. Within the mixed conifer and spruce/fir areas, a minimum of 50 down logs per 10 acres, 12-inch diameter at 8 feet long, and 100 tons per 10 acres would be retained.
- Livestock grazing permittees would be notified at least 1 year in advance of the treatments that would take place on their allotments. Discussions on to how to best rest the treated areas would occur directly with the permittees. The District would ensure the resting of treatment areas, herding, and electric fences are incorporated into Annual Operating Instructions. These actions will help ensure that permittees are in the communication loop and will give them enough time to plan for the resources they need to continue their operations.
- Impacts to permittees would be minimized by the use of herding and temporary electric fences so that treatment areas and/or stable aspen stands can be rested while non-treatment areas can continue to be grazed.

2.3.2 Mechanical Thinning Treatments and Associated Slash Pile Burning

- Ground based mechanical treatments would only occur on slopes less than 40 percent.
- Within riparian areas, equipment operations would occur when soils are dry, frozen or snow levels are sufficient to prevent wheels or tracks from coming in contact with soil.
- Cutting methods would include, but are not limited to, feller bunchers, skid-steers attached with saws, and/or hand crews equipped with chainsaws, bow saws, or loppers.
- Merchantable wood and biomass removal methods to the nearest road would include, but are not limited to, skid-steers, skidders, horses, helicopters, and/or cables. The most likely areas for helicopter use would be near Manning Meadows Reservoir and Barney Lake.
- Within riparian areas, low ground pressure equipment (i.e. skid-steers) would be used where possible to help minimize soil impacts.
- Trees located on rocky ridges, or in other areas that are not as susceptible to fire would not be cut.
- A combination of skid trails, temporary roads, and existing roads would be used to facilitate the mechanical treatments that occur outside IRAs. Temporary roads would be reclaimed upon completion of the mechanical treatments.

- Inside the IRAs, skid trails and existing roads would be used to facilitate the mechanical treatments. No temporary roads would be constructed inside the IRAs. For areas that cannot be accessed via existing roads, cross-country travel would be allowed to facilitate access to specific stands.
- No temporary roads would be constructed in Northern goshawk PFAs or NAs.
- No skid trails or landings would be constructed inside riparian areas.
- Efforts would be made to cut trees as close to the ground as possible.
- Efforts would be made to have merchantable trees removed from Monroe Mountain.
- Non-merchantable trees and slash would be consolidated and either piled and burned, or hauled off-site. Non-merchantable trees could also be made available for firewood cutting.
- Inside IRAs, if existing roads and skid trails do not allow for the removal of biomass, trees and slash may be consolidated, piled, and burned on-site.
- No mechanical treatments using feller bunchers or skid-steers would occur in the stable aspen stands that have little to no conifer presence (less than 40 conifer stems per acre) in the aspen understory. These areas may still be mechanically treated with hand crews equipped with chainsaws, bow saws, or loppers.
- Jack-strawing on a small scale, in site-specific areas to help impede ungulate access may occur.

2.3.3 Prescribed Fire Treatments

- Prescribed fire would be implemented utilizing aerial and/or hand ignition techniques targeting spruce/fir, mixed conifer, and seral aspen with mosaic burn patterns and mixed burn severities as an objective.
- No direct fire ignitions would occur in the stable aspen stands that have little to no conifer presence (less than 40 conifer stems per acre) in the aspen understory.
- No direct fire ignitions would occur in riparian areas on side slopes greater than 40 percent. On side slopes less than 40 percent in riparian areas, prescribed burning would occur when low to moderate fire severities would be expected. Riparian areas would be ignited on the outside edge so that the prescribed fire could back towards the interior of the riparian area.
- Pile burning would be limited in riparian areas. Pile burning that does occur within riparian areas would occur when fuel moisture levels are sufficient to limit creep.
- Within the spruce/fir and mixed conifer dominated stands that have little to no aspen presence (less than 15 aspen recruits per acre), prescribed burning would occur when low to moderate fire severities would be expected.
- For prescribed fire implementation, if water needs to be drafted, all water intakes would be equipped with a screen to prevent intake of fish and amphibian species. Drafting sites would be approved by the Forest's fish biologist prior to use.
- Prior to ignition, control lines may need to be constructed around the perimeter of the prescribed fire treatment areas.
- Control lines would be constructed with chainsaws, hand tools, and/or skid-steer equipment attached with a fecon head, Marshall saw and/or grapple hooks to primarily

remove smaller diameter trees averaging less than 8 inch DBH, limb larger diameter trees, remove 1000 hour fuels, and dig handline. Trees larger than 8 inch DBH that may pose a threat to the effectiveness of the control lines would also be removed.

- Efforts would be made to cut trees as close to the ground as possible.
- Control lines would be feathered[25] on the edges. Depending on slope, topography, and fuel loading, control lines may vary in width.
- Control lines would be reclaimed upon completion of the prescribed fire treatments.
- Prescribed fires would comply with the Utah State air quality standards. Prior to prescribed fire implementation, the District would obtain approval from Utah Smoke Management.
- Interested parties would be notified prior to implementing any prescribed burning.
- No broadcast prescribed burning would occur in Northern goshawk PFAs or NAs. Burning in PFAs or NAs would be limited to pile burning of slash material.
- No direct fire ignitions would occur during the nesting season (usually between May 15 and August 1) in areas where cavity nesting birds such as three-toed woodpeckers *(Picoides tridactylus)* are found.
- No fire ignitions that would likely result in moderate to high fire severities in Douglas fir dominated areas would occur to preserve Flammulated owl (*Otus flammeolus*) habitat and populations on Monroe Mountain. Low severity fire in the Douglas fir dominated stands during the non-nesting season (usually before May 15 and after August 1) would be allowed.

2.3.4 Boreal Toad Specific Design Features

Definition: Boreal toad mapped habitat is defined as the area within 328 feet from either side of streams that are known to be occupied by Boreal toad, have been occupied by Boreal toad, or are adjacent to occupied habitat and suitable for use by Boreal toad and the area within 984 feet of documented breeding sites.

- Utilize BT Riparian Habitat Conservation Areas (RHCAs) of 328 feet from each side of streams as buffers for vegetation treatments. Utilize RHCAs of 984 feet from known boreal toad breeding ponds.
- In order to protect Boreal toads and hibernacula[26] from being crushed, no ground-based mechanized harvesting equipment would be permitted within the RHCAs.
- Within the RHCAs, treatments would be limited to hand-thinning, horse, or helicopter thinning up to 100 feet from the stream or up to 328 feet from the known boreal toad breading ponds. No treatments (hand treatment, horse, or helicopter thinning) would be allowed within 100 feet of perennial streams or within 328 feet of breeding ponds unless such treatments are coordinated with and approved by the Forest's fisheries biologist.
- Within the RHCAs, no pile/slash burning would occur within 100 feet from the stream or breeding sites edge. Within the remainder of the RHCAs, pile or slash burning would

[25] Feathering is described as the following: as control lines are constructed, the amount of fuel removed would decrease as distance from the control lines edge increases. By feathering the control lines, impacts related to visuals can be reduced.
[26] An opening where Boreal toads can go underground.

occur during the Boreal toad dormant season (October 1 through April 15) unless coordinated with and approved by the Forest's fisheries biologist.

- Within the RHCAs, snags (200 per 100 acres in aspen, 300 per 100 acres in mixed conifer spruce/fir, and large downed logs (50 per 10 acres; a minimum of 15 tons per acre) would be retained as cover for toads.
- Within the RHCAs, thinning treatments (hand treatment, horse, or helicopter thinning) would target less than or equal to 60 percent of the stands if treated for complete conifer removal (aspen cover type) or thinning to BA 90 (spruce/fir and mixed conifer cover types); or would target less than or equal to 80 percent of aspen, spruce/fir, or mixed conifer stands if treated by thinning conifer from below up to 8 inch DBH.
- If any unmapped perennial streams or water sources in Boreal toad supporting habitat were encountered during project implementation, these areas would be protected by a 100-foot buffer. No treatments (hand treatment, horse, or helicopter thinning) would be allowed within this buffer unless treatments are coordinated with and approved by the Forest's fisheries biologist.
- If any Boreal toad hibernacula were encountered during project implementation, these areas would be protected by a 328-foot buffer. No treatments (hand treatment, horse, or helicopter thinning) would be allowed within this buffer unless treatments are coordinated with and approved by the Forest's fisheries biologist.
- Temporary roads within the RHCAs would have toad passage friendly culverts installed where culverts are needed (buried culverts or bottomless arched structures) for the duration of the project.
- Dipping or drafting water for fire activities from smaller boreal toad breeding sites that may show a change in water levels from the use would be avoided, except for emergencies.
- Monitoring of Boreal toad populations (in addition to current levels by the UDWR would be implemented to document project effects and to help plan future vegetation management projects in Boreal toad habitat. This would include breeding site monitoring to document use and relative densities of populations.
- Within the RHCAs, prescribed burning would occur when generally low to moderate fire intensity and severities would be expected. Prescribed fire personnel would attempt to implement prescribed burning during the Boreal toad dormant season (1 October through April 15).
- No direct fire ignitions would occur within 100 feet from the streams and 328 feet from Boreal toad breeding ponds unless coordinated with and approved by the Forest's fisheries biologist. Fire ignitions could occur outside these buffers and allowed to back into these areas.

2.3.5 Temporary and Existing Roads and Skid Trails

Temporary roads would feature a finished road width of approximately 15 feet and may include turnouts at regular intervals. Road cut slopes would be constructed at a 1:1 vertical-to-horizontal ration and fill slopes at a 1:1.5 ratio. Road surfaces would be outsloped at a 3 to 5 percent slope. The primary road drainage feature would be drain drips, which shall be constructed at regular intervals. Culverts would be installed at any proposed stream crossings.

Upon project completion, temporary roads would be reclaimed. Reclaiming efforts would adhere to standard engineering best management practices and would be accomplished by ripping the roadbed and/or scarifying (scratching) the road surface with mechanical equipment. Litter and debris that is available in the area (primarily slash and large rocks) would be scattered over the ripped or scarified road surface and placed at or near the temporary road origins in order to deter traffic.

2.3.5.1 Criteria and Mitigation Measures Applicable to Existing Roads and Skid Trails within Inventoried Roadless Areas (IRAs) for All Action Alternatives

- Skid trails and existing roads would be used to facilitate the mechanical treatments. No temporary roads would be constructed inside the IRAs. For areas that cannot be accessed via existing roads, cross-country travel would be allowed to facilitate access to specific stands.
- If existing roads and skid trails do not allow for the removal of biomass, trees and slash may be consolidated, piled, and burned on-site.

2.3.5.2 Criteria and Mitigation Measures Applicable to Temporary and Existing Roads and Skid Trails outside Inventoried Roadless Areas for All Action Alternatives

- A combination of skid trails, temporary roads, and existing roads would be used to facilitate mechanical treatments. Temporary roads would be reclaimed upon completion of mechanical treatments.

2.3.5.3 Criteria and Mitigation Measures Applicable to Temporary and Existing Roads and Skid Trails Whether they are inside or outside of Inventoried Roadless Areas

- No temporary roads would be constructed in Northern goshawk NAs or PFAs.
- No skid trails or landings would be constructed inside riparian areas.
- To provide for firefighter and public safety, some roads and dispersed camping areas may be temporarily closed during prescribed fire and mechanical treatment implementation. Temporary closures would be determined by implementation personnel and would be based on the hazards present at the time of implementation.

2.4 Temporary Fencing around Manning Meadows Reservoir and Barney Lake

Regardless of which alternative is selected, treatment areas adjacent to Manning Meadows Reservoir and Barney Lake would be fenced to exclude both wildlife and livestock browsing. With fencing, the amount of time needed to acquire a minimum of 1,000 aspen saplings per acre is expected to be quicker. Other vegetation and cover types are also expected to benefit from fencing.

The District is proposing to construct approximately 7.8 miles (602 acres) of temporary fence in the Manning Meadows Reservoir and Barney Lake areas (Figure 21). This fence would be approximately 8 feet tall and constructed with net wire, t-post, and wooden post. Maintenance of the temporary fence would occur for 4 to 6 years until the aspen shoots are greater than 6 feet tall, after which the fence would be removed.

2.5 Treatment Sequencing

Treatment sequencing is primarily based on the current distribution of wild browsers on Monroe Mountain. Mechanical and prescribed fire treatments would probably begin in the southerly portion of the project area (area 1; Figure 22) where visually, current browse pressures on aspen appear to be less than the northerly and central portions of the project area. Following treatments in Area 1, treatments in the northerly portion of the project (area 2; Figure 22) would likely be conducted. Browse pressures in the north appear to be higher than what is occurring in the south, but less than the central portion of the project area. Following treatments in areas 1 and 2, treatments in the central portion of the project area (area 3; Figure 22) would likely be initiated next. By generally sequencing the project in this order, browse pressure may be more directed away from newly treated areas; this is expected to increase the probability of recruiting aspen to reach 6 feet tall after treatment. This sequencing regime is general and may change due to on the ground conditions. This sequence may be conducted out of order, or portions of each sequence may be worked on out of sequence depending upon the conditions during project implementation.

Mechanical treatments are proposed in areas adjacent to private lands, and within/adjacent to Northern goshawk, Boreal toad, and Bonneville cutthroat trout habitat. These aspen, spruce/fir, and mixed conifer areas would be treated first within each sequence area (areas 1, 2, and 3). Implementing these mechanical treatments first would help reduce the risk of impacts from prescribed fire to private property, Northern goshawk, Boreal toad, and Bonneville cutthroat trout.

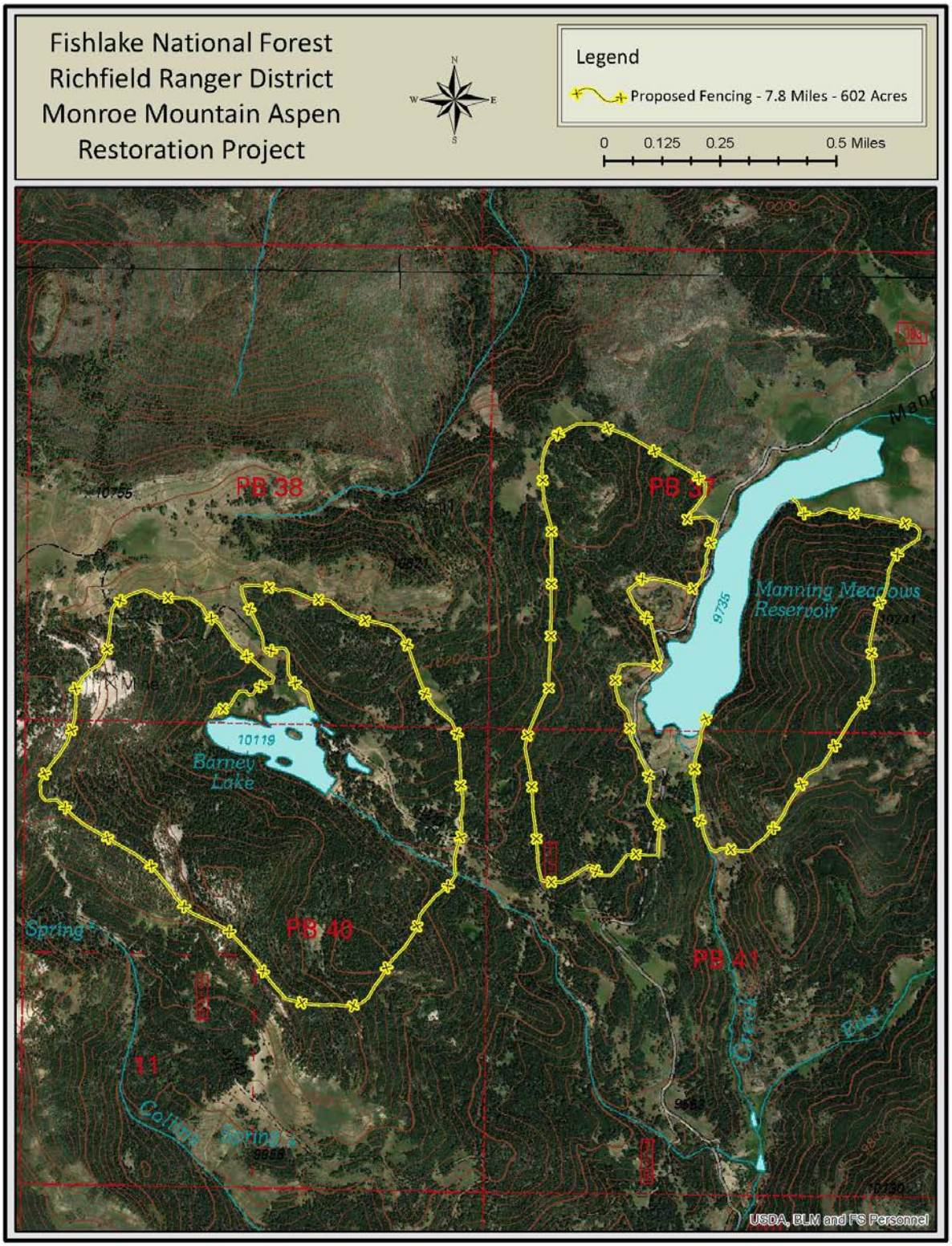
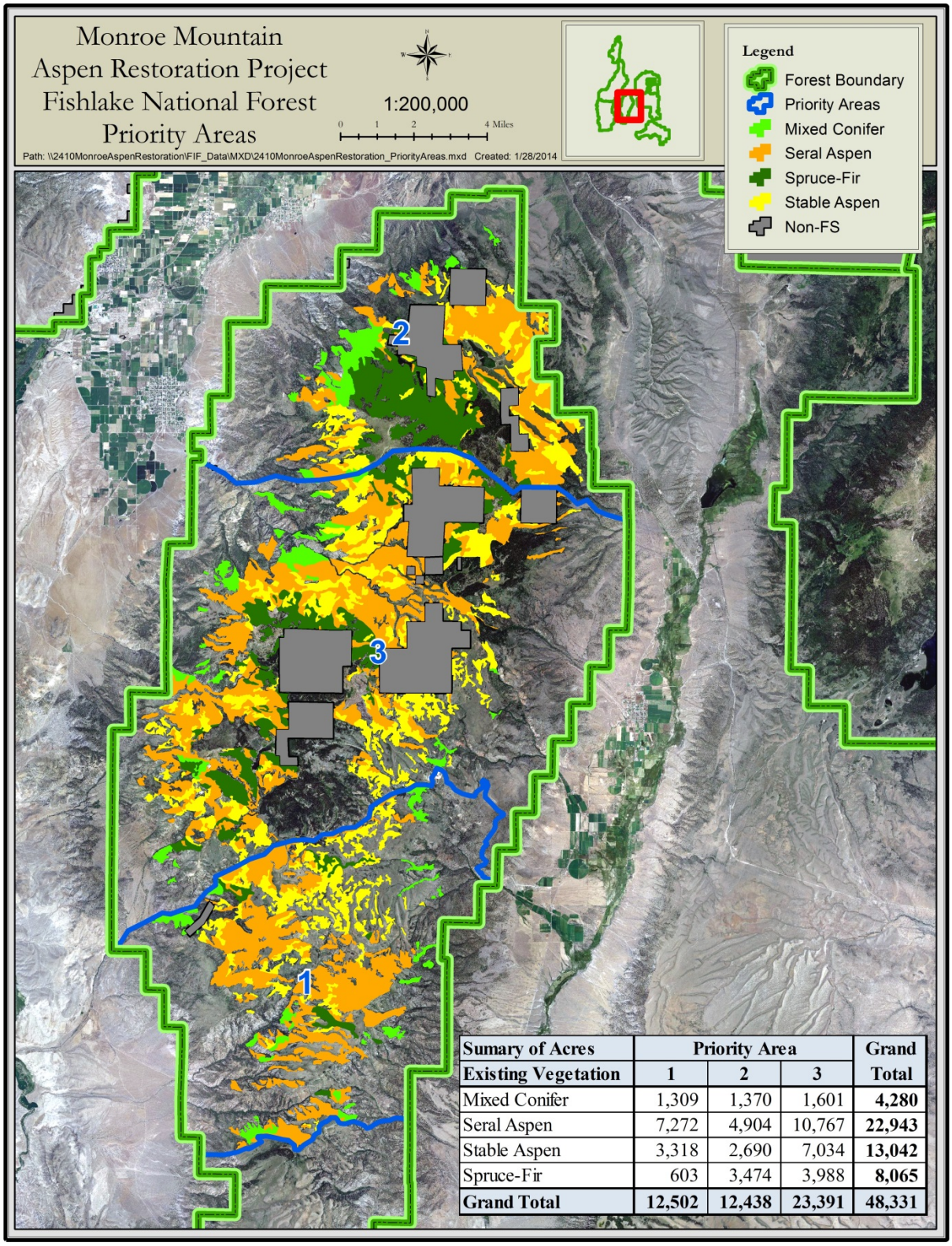


Figure 21. Proposed fencing near Manning Meadows Reservoir and Barney Lake



Sumary of Acres	Priority Area			Grand
Existing Vegetation	1	2	3	Total
Mixed Conifer	1,309	1,370	1,601	**4,280**
Seral Aspen	7,272	4,904	10,767	**22,943**
Stable Aspen	3,318	2,690	7,034	**13,042**
Spruce-Fir	603	3,474	3,988	**8,065**
Grand Total	**12,502**	**12,438**	**23,391**	**48,331**

Figure 22. General treatment sequencing

2.6 Treatment Monitoring, Aspen Overbrowsing Thresholds, and Response Options for All Action Alternatives

Approximately 120 to 140 long-term aspen transects would be used to monitor status and trend of aspen following implementation of the selected alternative. Sixty, to seventy transects would be in the seral aspen, spruce/fir, and mixed conifer areas, and 60 to 70 in the stable aspen areas. Monitoring would address aspen regeneration/recruitment and understory conditions. Monitoring would be in conjunction and coordinated with aspen monitoring/research currently being done on Monroe Mountain by Dr. Sam St. Clair from Brigham Young University.

The MMWG submitted to the Fishlake National Forest a document titled *Browsing Thresholds and Adaptive Management Pursuant to Aspen Restoration on Monroe Mountain* (MMWG 2014). The MMWG recommended this document for inclusion and analysis in this EIS. The Forest has reviewed this document and is proposing to adopt the browse thresholds and response options recommended by the MMWG. The document in its entirety is located in appendix C and is hereby incorporated by reference. The UDWR and the Utah Wildlife Board have reviewed and support this document. The following is a summary of the document with a description of the goals, thresholds, monitoring techniques, and response options.

The goals of the *Browsing Thresholds and Adaptive Management Pursuant to Aspen Restoration on Monroe Mountain* document are three-fold: (1) establish thresholds of maximum percent aspen browse that would be acceptable following mechanical and/or prescribed fire treatments in the seral aspen, spruce/fir, and mixed conifer areas; (2) establish thresholds for the stable aspen areas where passive treatments are proposed; and (3) establish timely response options that would take place if the thresholds are not met. The thresholds and response options are expected to result in adequate recruitment to perpetuate both seral and stable aspen stands in order to move toward the desired conditions described above.

2.6.1 Areas Proposed for Mechanical and/or Prescribed Fire Treatments

Following mechanical and prescribed fire treatments, healthy aspen roots systems typically are able to sustain vigorous shoot growth for a limited time (2 to 3 years), providing a brief opportunity to modify management if browsing exceeds threshold levels. Therefore, the following responses have been identified as timely management responses.

To aid attainment of at least 1,000 to 2,000 aspen saplings[27] per acre and 400 to 600 aspen recruits[28] per acre (Mueggler 1989; Campbell and Bartos 2001) in areas where mechanical and/or prescribed fire treatments are proposed, (Table 2) the District is proposing the annual

[27] A sapling is defined as an aspen shoot that has successfully reached sub-canopy height; 6 to 12 feet.
[28] A recruit is defined as an aspen shoot that has successfully reached full canopy height; greater than 12 feet.

aspen browse thresholds listed in Table 10 and Figure 23 following prescribed fire and mechanical treatments. These thresholds are proposed from an estimation of the maximum annual browse of the aspen sprouts that would assure the conservative outcome of at least 1,000 aspen saplings per acre and 400 to 600 aspen recruits per acre following treatments. Please refer to appendix C for further information.

Implementation of these browse thresholds would require selecting the appropriate number of years (i.e., 4 to 6) the District anticipates for aspen sprouts[29] to reach greater than or equal to 6 feet in height. The District anticipates the number of years for aspen sprouts to reach greater than or equal to 6 feet in height would vary throughout the project area depending on site productivity and weather conditions. To be conservative, the District proposes to start with thresholds corresponding with 6 years. If aspen responses within the first few years following treatments suggest 6 feet height would be attained sooner, then thresholds corresponding with 4 and 5 years could be used. The thresholds are also dependent upon the number of initial aspen sprouts per acre that grow immediately following the prescribed fire and/or mechanical treatments.

Monitoring at 60 to 70 sites in the mechanical and/or prescribed fire treatment areas would consist of establishing two perpendicular belt transects (e.g., 6 feet by 100 feet) per transect, and would include pellet counts for insight into use by elk, deer, cows, and/or sheep. A minimum of one transect per 300 acres treated mechanically or with prescribed fire would be established, with a greater number of transects established as needed to assess percent browse. Transects would also be established in locations that reflect the variability of the treatments area. Care would be taken to adequately represent areas of known higher use and/or vulnerability (e.g., less than 30 percent slope, less than 30 pre-treatment aspen trees per acre among the conifer).

Table 10. Proposed annual browse thresholds

Years after which 1,000 aspen saplings (≥6 feet tall) per acre would be present	5,000 initial sprouts per acre	10,000 initial sprouts per acre	20,000 initial sprouts per acre	30,000 initial sprouts per acre	40,000 initial sprouts per acre
	percent browse				
4	32	43	52	57	60
5	27	36	45	49	52
6	23	31	39	43	45

[29] A sprout is defined as an aspen shoot that is less than 6 feet in height.

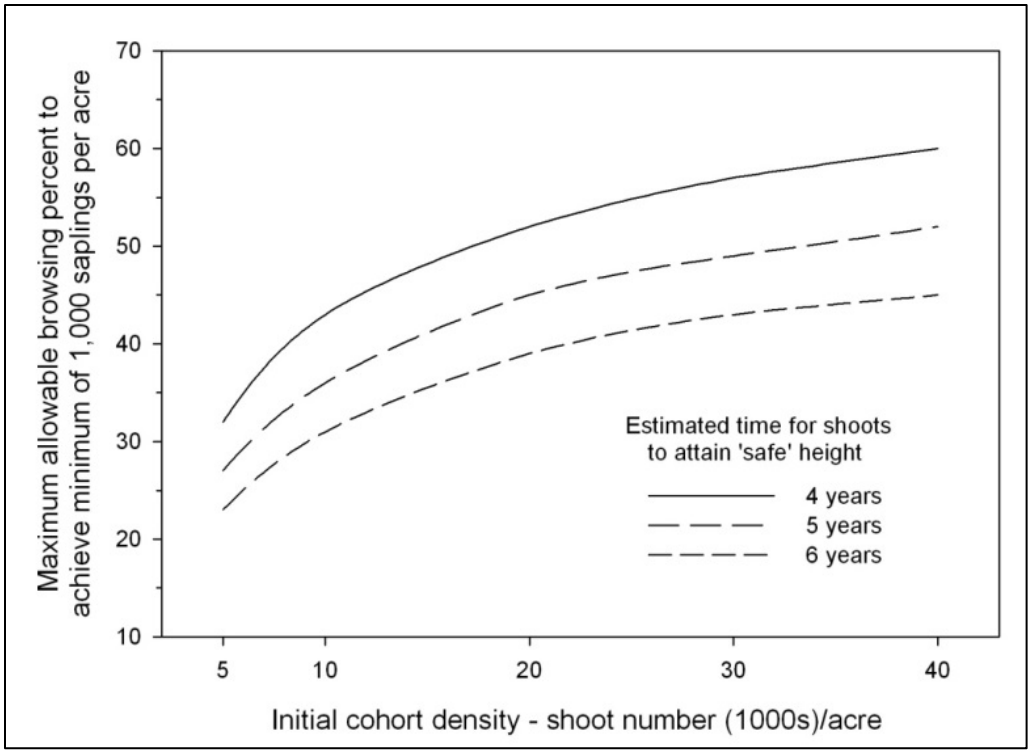


Figure 23. Projected maximum browse pressure in relation to initial aspen shoot density and time (years) needed for shoots to reach 6 feet height

The browse thresholds for a specific treatment are exceeded when: (1) across all transects within the treatment area, the average transect browse percentages exceeds the browse percentages displayed in Table 10 and Figure 23; or (2) at least 40 percent of the individual transects associated with the treatment area exceed the browse percentages displayed in Table 10 and Figure 23. The allowable browse percentages could be adjusted as necessary based on observed success in aspen stand recruitment.

The scale and timing of the mechanical and prescribed fire treatments are likely to affect the level of impacts that both wild and domestic grazers have on aspen response to treatments. For this reason, as described in section 2.5, the District is proposing to initiate treatments in the southerly portion, followed by the northerly portion, and finishing in the central portion of Monroe Mountain. The District is also proposing to conduct mechanical treatments adjacent to private property, within or adjacent to Northern goshawk areas, and possibly adjacent to Manning Meadows Reservoir and Barney Lake areas first so that prescribed fire can occur at the largest practical scale while minimizing impacts to other resources. The District anticipates that if prescribed fire treatments are able to occur at a large scale (i.e., 5,000 acres), the level of overall impacts that both wild and domestic grazers may have on new aspen sprouts would be less.

Prior to the mechanical and prescribed fire treatments being implemented, if the District anticipates aspen browse thresholds are likely to be exceeded (e.g., the central portion of Monroe Mountain), the District would recommend to the UDWR, their Resource Advisory Council

(RAC), and Utah Wildlife Board a pre-approved antlerless hunt that could be implemented, if deemed necessary, immediately following mechanical and/or prescribed fire treatments in order to reduce browse pressure adequately to facilitate greater aspen recruitment. This recommendation would be subject to the Wildlife Board and RAC approval process. If approved, the UDWR, in coordination with the District, would initiate implementation of the antlerless hunt following treatments. This recommendation is supported by the UDWR and the Utah Wildlife Board.

As described above, areas treated mechanically and/or with prescribed fire would be rested from livestock use for 2 to 3 growing seasons. During this timeframe, if aspen browse thresholds are exceeded, the District would implement one or more of the following responses in order to achieve balanced livestock and wildlife use, and to ensure aspen browse thresholds are not continually being exceeded:

- If not already being implemented, the District may recommend to the UDWR, RAC and the Utah Wildlife Board a reduction of wild ungulate browsing pressure using antlerless hunts as needed at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds. This recommendation is supported by the UDWR and the Utah Wildlife Board.
- The District may coordinate with the UDWR to hire or contract an adequate number of seasonal employees and/or coordinate the use of volunteers (i.e., Dedicated Hunter Program) to spend time in treatment areas hazing wildlife at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds.
- The District may coordinate with the UDWR to fence treatment areas for 4 to 6 years until the aspen new shoots reach 6 feet height.
- The District may restrict livestock use longer than 2 to 3 growing seasons until aspen recovery objectives are met.
- After livestock are allowed to return to treatment areas, if browse thresholds are exceeded in a treatment area(s) that is grazed by both wild ungulates and livestock, the District would implement one or more of the following responses in order to achieve balanced livestock and wildlife use, and to ensure aspen browse thresholds are not continually being exceeded:
- The District may recommend to the UDWR, RAC, and the Utah Wildlife Board a reduction of wild ungulate browsing pressure using antlerless hunts as needed at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds. This recommendation is supported by the UDWR and the Utah Wildlife Board (Albrecht 2014).
- The District may coordinate with the UDWR to hire/contract an adequate number of seasonal employees and/or coordinate the use of volunteers (i.e. Dedicated Hunter Program) to spend time in treatment areas hazing wildlife at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds.
- The District may coordinate with the UDWR to fence treatment areas for 4 to 6 years until the aspen new shoots reach 6 feet height.
- The District may seek opportunities to improve time, timing, and intensity of livestock grazing. This may include resting treatment areas again from livestock use, temporary

reductions in livestock numbers, reducing the length of time that livestock are in certain pastures, and/or adjusting the timeframe of when livestock are in certain pastures.

- The District may coordinate with the UDWR to utilize their Grass Bank Program on state Wildlife Management Areas to help offset temporary loss of livestock opportunities.

Although management changes that reduce wild or domestic ungulate numbers may be necessary to restore healthy aspen communities on Monroe Mountain, such changes are viewed by the District as temporary and should not be interpreted as permanent or long-term reductions in stocking levels or population objectives. The District would continue to be actively engaged in the UDWR's elk management plan revision process in order to promote understanding and consideration of aspen resource conditions.

If responses are needed, the number and type of responses are anticipated to vary depending on location and timing of treatments. Considering the location, size, and timing of treatments, responses and their probability of success are expected to vary. Decision authorities for these responses also vary. For these reasons, continued and close communication between the District, UDWR, RAC, Utah Wildlife Board, and all other interested stakeholders is critical. These responses are intended to avoid surpassing or continuous surpassing of the browse thresholds and to achieve 1,000 saplings per acre.

2.6.2 Stable Aspen Stand Areas

As described in section 1.4, 58 transects have already been established in various stable aspen stands on Monroe Mountain. Data have been collected on overstory condition, aspen regeneration and recruitment (including browse use), fecal pellets and cow pies. These data provide a baseline dataset from which to detect change in subsequent years. The District proposes to continue monitoring aspen shoot density, height, and percent browse on an annual basis at these sites. Overstory and understory data would continue to be collected at longer intervals (3 to 5 years). Additional transects could be added as needed.

In section 1.4, the aspen stands associated with each of the 58 transects are classified as stable aspen stand type 1 (SA1), type 2 (SA2), or type 3 (SA3). Stable Aspen 1, SA2, and SA3 stands differ in the relationship of recruitment density to overstory (Figure 10 through Figure 18). For example, within SA2 and SA3, the stands are defined as currently being full self-replacing (F), transitional self-replacing (T), marginal self-replacing (M), or non-self-replacing (N). To have adequate recruitment to perpetuate the aspen stands, the desire is for these stable aspen stands to move towards SA1, SA2-F, or SA3-F.

The stable aspen classes and recruitment levels are thus based directly upon the densities of stems that reach heights relatively safe from browsing of top leaders, and do not initially take into account the browse intensity values that clearly influence those aspen stem densities. Patterns in annual browse data would be analyzed over time in the stable aspen areas with the objective of determining how they might be incorporated to improve assessments of stable aspen condition and determine the trajectory of the stable aspen stands on Monroe Mountain.

The District anticipates that mechanical and prescribed fire treatments in seral aspen, spruce/fir, and mixed conifer areas would have an indirect beneficial effect related to aspen browse in the stable aspen areas within three years following treatments. As mechanical and prescribed fire treatments occur in adjacent areas, the stable aspen stands would continue to be monitored. For the stable aspen stands not already in SA1, SA2-F, or in SA3-F, a minimum benchmark of success in restoring stable aspen on Monroe Mountain would be an average improvement for all eligible stands (SA2 and SA3 levels T, M, and N) that is equal to one full level increase as a benefit of doing mechanical and prescribed fire treatments in adjacent areas. Thus, for every stand that fails to move up a level, another would have to move up two levels. Stand degradation (drop in levels) would also be factored in.

The District proposes the stable aspen responses be proportional (percentage) to the area treated mechanically and/or with prescribed fire. Accurately predicting how browse relief would be distributed spatially following treatments would be difficult. Therefore, the District proposes that stable aspen improvement be interpreted at the broadest spatial scale (all 58 stands). For example, one year might allow that 10 percent of the project area be treated mechanically and/or with prescribed fire. Of the 58 stable aspen stands, 47 stands are classified as being eligible for improvement (section 1.4); therefore, a threshold for reclassification to at least one level higher would be needed in 4 to 5 stands (10 percent) of the 47 eligible stands, with no stands being downgraded in response to the mechanical and/or prescribed fire treatments or any other factors. The District anticipates the stable aspen stand level changes may be detectable within 3 years of treatment.

If monitoring does not detect sufficient improvement of stable aspen stands after an appropriate lag time (within approximately 3 years following treatments in adjacent areas; allowing some flexibility for unknowns such as extreme weather events), the District would implement one or more of the following responses in order to achieve balanced livestock and wildlife use, and to ensure stable aspen stand conditions improve:

- The District may recommend to the UDWR, RAC, and the Utah Wildlife Board a reduction of wild ungulate browsing pressure using antlerless hunts as needed at levels expected to result in sufficient reduction in browse to avoid surpassing the stable aspen stand thresholds. This recommendation is supported by the UDWR and the Utah Wildlife Board.
- The District may coordinate with the UDWR to hire or contract an adequate number of seasonal employees and/or coordinate the use of volunteers (i.e. Dedicated Hunter Program) to spend time in stable aspen stand areas hazing wildlife at levels expected to result in sufficient reduction in browse to avoid surpassing stable aspen stand thresholds.
- The District may coordinate with the UDWR to fence stable aspen areas until 1,000 new aspen shoots reach 6 feet height.
- The District may seek opportunities to improve time, timing, and intensity of livestock grazing. This may include resting stable aspen areas from livestock use, temporary reductions in livestock numbers, reducing the length of time that livestock are in certain pastures, and/or adjusting the timeframe of when livestock are in certain pastures.
- The District may coordinate with the UDWR to utilize their Grass Bank Program on state Wildlife Management Areas to help offset temporary loss of livestock opportunities.

These responses are viewed by the District as temporary and should not be interpreted as permanent or long-term reductions in stocking levels or population objectives. As additional areas are treated mechanically and/or with prescribed fire, a proportionate improvement would be expected in the stable aspen stands. A lag period of approximately 3 years would continue to be employed for each treatment. Hypothetically, this could result in responses to reduce browse pressure after mechanical and/or prescribed fire treatments in seral aspen stands even when aspen recovery within the treatment area(s) are satisfactory but where there is no corresponding improvement in stable aspen stands. The opposite is also possible, that is the District could have improvement in stable aspen stands but unsatisfactory results in the treated areas. Either way, under these conditions one or more of the responses described above to reduce browse pressure would be implemented. If thresholds were exceeded, response efforts would be based on achieving aspen ecosystem restoration and achieving the desired conditions described above.

To complement the above monitoring plan and associated responses that could occur if thresholds are exceeded, and to gain a better understanding of wildlife use on aspen in the absence of livestock, the District proposes to rest from livestock the Dairies pasture in the Koosharem Allotment for the duration of this project. Stable and seral aspen stands occur in the Dairies pasture and it is an area regularly used by both livestock and wild ungulates. Part of the 2012 Box Creek Fire also occurred in the Dairies pasture. After the Box Creek Fire, approximately 400 acres of aspen were fenced inside the Dairies pasture. This 8-foot high fence was built to exclude all animals from entering the 400 acres. By resting the Dairies from livestock, considering the 400 acres that is fenced to exclude all animals, much can be learned about wildlife use on aspen in the absence of livestock. This would also provide an opportunity to monitor stable aspen in the absence of livestock.

2.7 Alternative Development Process

As a result of extensive collaboration over a 2-year timeframe and additional analysis, the proposed action was modified as allowed by 36 CFR 220.7(b)(2)(iii), which states that “the description of the proposal and alternative(s) may include a brief description of modifications and incremental design criteria developed through the analysis process to develop the range of alternatives considered.”

Minor modifications included adopting the MMWG’s 2014 *Browsing Thresholds and Adaptive Management Pursuant to Aspen Restoration on Monroe Mountain* for browse thresholds, gathering more stand exam data, and finalizing road acreages and miles.

Those concerns that could not be addressed through minor modification to the proposal were considered key issues and drove the development of an additional alternative to consider Northern goshawk information (see section 1.15 for additional information). The minor modifications incorporated into the final proposed action were carried forward into the other alternatives. Each alternative provides a response as to how the Forest would address the key issues. The key issues driving each alternative are:

1. Issue 1 - *Impacts to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation.*
2. Issue 2 – *Prescribed fire activities may impact adjacent private property.*
3. Issue 3 – *Project activities may result in Northern goshawks being displaced.*
4. Issue 4 – *Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.*

In addition to the above issues, each alternative differs in the alignment and distance of temporary roads outside of the IRAs. The responses to key issues 1 through 4 are located within the description for each action alternative. The response to key issues 5 through 7 are the same for all alternatives.

2.8 Response to Issues 5 through 7

2.8.1 Issue 5 – Browsing by domestic and wild ungulates on new aspen shoots post-treatment and/or the continued high levels of aspen browsing in the stable aspen areas may result in complete loss of aspen stands.

If post-treatment monitoring indicates that response options are needed, the number and type of responses are anticipated to vary depending on location and timing of treatments. Considering the location, size, and timing of treatments, responses and their probability of success are expected to vary. Decision authorities for these responses also vary. For these reasons, continued and close communication between the District, UDWR, RAC, Utah Wildlife Board, and all other interested stakeholders is critical. These responses are intended to avoid surpassing or continuous surpassing of the browse thresholds and to achieve 1,000 saplings per acre (see section 2.6 for an in depth discussion on the treatment monitoring, aspen overbrowsing thresholds, and response options). These response options would be utilized for all of the action alternatives.

2.8.2 Issue 6 – Project activities may result in livestock permittees not having a place to graze their livestock while vegetation is reestablishing on Monroe Mountain (two, or more, growing seasons)

Post-treatment monitoring would occur to make sure that aspen are recovering and new shoots are not being overbrowsed. Domestic livestock (cattle and sheep) would be removed from the post-treatment areas for two or more growing seasons to reduce livestock browse pressure on new aspen sprouts (see section 2.6). As discussed in section 2.5 and shown on Figure 22, Area 1 would be treated first, followed by Area 2, and finishing in Area 3. Mechanical treatments would also occur prior to prescribe burning occurring. This treatment sequence is expected to help minimize impacts to permittee operations. Impacts to permittee operations are discussed in the range section in chapter 3. The range analysis in chapter 3 discloses the acres of mechanical and prescribed fire treatments occurring in each allotment/pasture and the percentages of each pasture receiving active treatments. Some pastures may need to be completely rested thus having a bigger impact on permittee operations. The range analysis also considers the potential for resting stable aspen stands. In summary, the range analysis and associated impacts for each action alternative are disclosed in the range section in chapter 3.

2.8.3 Issue 7 – Project activities may result in adverse impacts to old growth characteristics.

Prescribed fire would be implemented utilizing aerial and/or hand ignition techniques targeting spruce/fir, mixed conifer, and seral aspen with mosaic burn patterns and mixed burn severities as an objective. To maintain LRMP compliance, prescribed fire would occur when 60 percent of the area would be expected to burn, thus maintaining any old growth characteristics that may occur in the 40 percent not being treated with prescribed fire. This is the same for all the action alternatives.

In the stable and seral aspen areas proposed for mechanical treatment, conifer would be removed while maintaining the aspen and/or conifer would be removed from below up to 8 inch DBH. Trees located on rocky ridges (these trees are generally large and older), or in other areas that are not as susceptible to fire would also not be cut. In the spruce/fir and mixed conifer areas, live trees would be thinned using uneven-aged management thus ensuring all size classes are maintained and/or conifer trees would be removed from below up to 8 inch DBH. No clear-cutting is proposed. This mechanical approach is the same for all the action alternatives. This mechanical proposal is expected to minimize impacts and help maintain any old growth characteristics that may occur in the areas proposed for mechanical treatments. This old growth analysis and associated impacts for each action alternative are disclosed in the silviculture section in chapter 3.

2.9 Alternatives Considered in Detail

The Forest Service developed five alternatives, including the no action alternative, in response to issues raised internally and by the public (section 1.15).

2.9.1 Alternative 1 (No Action)

The no action alternative is required by 40 CFR 1502.14(c). There would be no changes in current management under the LRMP and amendments. No mechanical thinning or prescribed fire treatments would be implemented to accomplish project goals. Aspen decline would continue because conifer encroachment from reduced occurrence of wildland fire due to increased wildland fire suppression, and impacts from extensive wild and domestic ungulate browsing would continue. In addition, the chances of uncharacteristic wildland fire would increase with the continued build-up of fuel loads. This increases the threat to human life and private property, increases the risk of watershed degradation with impacts on capacity to deliver clean water, increases the threats to Boreal toad, Bonneville cutthroat trout, Northern goshawk, and other wildlife and habitat, and increases the potential for further loss of aspen sprouts and entire aspen stands following wildland fires. Alternative 1 is the point of reference for assessing action alternatives 2 through 5.

2.9.2 Alternative 2

Seral and Stable Aspen Stands – Proposed Mechanical Treatment Methods

There are two mechanical treatment options being analyzed for alternative 2 for seral and stable aspen dominated stands (Photo 13 through Photo 21; appendix A):

1. Conifers would be removed and the existing aspen would be retained regardless of the size of the conifer or if it is located within an IRA or draft UUA. (Photo 14, Photo 17, and Photo 20; appendix A; Table 11). To access the conifer, some incidental cutting of aspen may occur. This option would occur throughout the project area.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH and the existing aspen would be retained (Photo 15, Photo 18, and Photo 21; appendix A; Table 12). In all areas outside the IRAs and draft UUAs, conifers would be removed and the existing aspen would be retained regardless of the size of the conifer.

Spruce/Fir and Mixed Conifer Stands – Proposed Mechanical Treatment Methods

There are also two mechanical treatments options being analyzed for alternative 2 for spruce/fir and mixed conifer dominated stands (Photo 22 through Photo 30; appendix A):

1. This option would occur throughout the project area (Photo 23, Photo 26, and Photo 28; appendix A; Table 11).

a. If present, beetle killed conifer trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (salvage harvest).
b. If conifer trees are currently infected by beetles and are in the process of dying, the infected trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (sanitation harvest).
c. In areas of spruce/fir or mixed conifer where LRMP stocking levels are below plan guidance due to bark beetle impacts, replanting of spruce or mixed conifer may occur. If the remaining live trees were greater than a BA of 90, the remaining live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
d. If no beetle killed or infected trees are present initially, live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.

2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH (Photo 24, Photo 27, and Photo 29; appendix A; Table 12). In all areas outside the IRAs and draft UUAs, treatments would occur as in option 1 for spruce/fir and mixed conifer.

Roads: This alternative proposes to create 8.8 miles of temporary roads for access to mechanical treatment areas (Figure 36 through Figure 42).

The purpose of this alternative is to address issues 1 through 4 (section 1.15).

Issue 1 – Impact to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation

Alternative 2 proposes to treat approximately 27,981 acres (Figure 24) of aspen and spruce/fir/mixed conifer (8,186 acres of mechanical with associated slash burning and 19,795 acres of prescribed burns with mixed burn severities factoring that approximately 60 percent of the total area treated with prescription fire burns, leaving 40 percent of the crown intact; Table 14 and Table 15). Of the 27,981 acres, this alternative proposes to treat approximately 16,888 acres within all IRAs (20 percent of all IRAs are proposed to be treated; Table 16), and 15,672 acres within draft UUAs (17 percent of all draft UUAs are proposed to be treated; Table 17). Again, these acreages and percentages are calculated factoring that approximately 60 percent of the total area treated with prescription fire burns leaving 40 percent of the crown intact. Although the proposed treatments may have an immediate impact on the visual quality of the IRA and draft UUA, these impacts would be short-term. As the area recovers from the treatments, and aspen start to regrow, wilderness attributes and roadless area characteristics would recover, and would most probably increase in quality in the long-term. This alternative proposes to mechanically treat 1,633 acres within IRAs and/or draft UUAs (Table 18). This alternative proposes to mechanically treat the least amount of acres within IRAs and draft UUAs.

Table 11. Alternative 2; Option 1--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning
Alternative 2	Seral Aspen	3,146
	Stable Aspen	4,025
	Spruce/Fir	918
	Mixed Conifer	97
	Total	8,186

Table 12. Alternative 2; Option 2--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres Outside IRAs and UUAs)	Mechanical and Associated Slash Burning (Acres Inside IRAs and UUAs)	Project Total
Alternative 2	Seral Aspen	2,349	797	3,146
	Stable Aspen	3,643	382	4,025
	Spruce/Fir	472	446	918
	Mixed Conifer	89	8	97
	Total	6,553	1,633	8,186

Issue 2 – Prescribed fire activities may impact adjacent private property

The IRAs (Figure 25) and draft UUAs (Figure 26) adjacent to private property would have a 300-foot mechanical treatment buffer completed first (Figure 24). This 300-foot buffer of mechanical treatments would be completed first to prepare for the application of prescription fire. The 300-foot buffer may be sufficient to minimize impacts from prescribed fire to private property. The specific acreages and percentages of each of the LRMP management areas are listed in Table 13. It is important to note that the 300-foot buffer distance was suggested by the public and was drawn on the maps (Figure 24 through Figure 26) without regard to topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas or wildland fires, existing roads and trails, etc.

Issue 3 – Project activities may result in Northern goshawks being displaced

No mechanical or prescribed fire treatments would be conducted within Northern goshawk PFAs or NAs. A 300-foot mechanical treatment buffer would be created around the outside edge of the Northern goshawk PFAs (Figure 24). This 300-foot buffer of mechanical treatments would be completed first to prepare for the application of prescription fire. It is important to note that the 300-foot buffer distance was suggested by the public and was drawn on the maps (Figure 24 through Figure 26 without regard to topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas or wildland fires, existing roads and trails, etc. The

300-foot buffer may be sufficient to minimize impacts from prescribed fire to Northern goshawk PFAs and NAs.

Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.

The areas around Manning Meadows Reservoir and Barney Lake would be treated with prescribed fire only (Figure 24). No mechanical thinning treatments or temporary roads are proposed in these areas.

Table 13. Alternative 2 acreage and percentage by the Forest's Land and Resource Management Plan (LRMP) management areas (MAs) on Monroe Mountain

LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
Mechanical & Slash Burning (Acres)	0	13	7,526	3	215	367	61
Mechanical & Slash Burning Percent of Management Area being Treated	0%	2%	7%	0%	1%	7%	0%
Prescribed Fire Mixed Burn Severities (Acres)	6	189	20,238	784	7,110	2,151	2,512
Prescribed Fire Mixed Burn Severities Factoring 60 percent of Acres Get Treated	4	113	12,143	470	4,266	1,291	1,507
Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	14%	12%	2%	21%	23%	9%
All Treatments Combined Percent of MA Being Treated	1%	15%	19%	2%	22%	30%	10%

Table 14. Alternative 2 acreage and temporary road mileage

Mechanical Treatments and Associated Slash Burning	Prescribed Fire - Mixed Burn Severities	Prescribed Fire – Mixed Burn Severities Factoring 60 percent of the Acres Get Burned	Total Acres	Total Acres Factoring 60 percent of Acres Get Burned	Miles of Temporary Roads
8,186	32,991	19,795	41,177	27,981	8.8

Table 15. Alternative 2 acreage by dominant vegetative type

Existing Vegetation	Mechanical and Associated Slash Burning (Acres)	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60 percent of the Acres Get Burned
Mixed Conifer	97	4,183	2,510
Seral Aspen	3,146	15,159	9,095
Stable Aspen	4,025	7,991	4,795
Spruce/Fir	918	5,658	3,395
Total	**8,186**	**32,991**	**19,795**

Table 16. Alternative 2 Inventoried Roadless Area (IRA) acreage and percent treated.

IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
Mechanical & Slash Burning (Acres)	42	327	217	862	61	1,509[1]
Mechanical & Slash Burning Percent of IRA being Treated	0%	3%	1%	3%	1%	2%
Prescribed Fire Mixed Burn Severities (Acres)	816	2,615	6,707	13,492	2,001	25,632
Prescribed Fire Mixed Burn Severities Factoring 60 percent of Acres Get Treated	490	1,569	4,024	8,095	1,201	15,379
Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	14%	18%	26%	13%	18%
All Treatments Combined Percent of IRA Being Treated	4%	17%	19%	29%	14%	20%

[1] This includes 3,045 acres that overlap with draft UUAs.

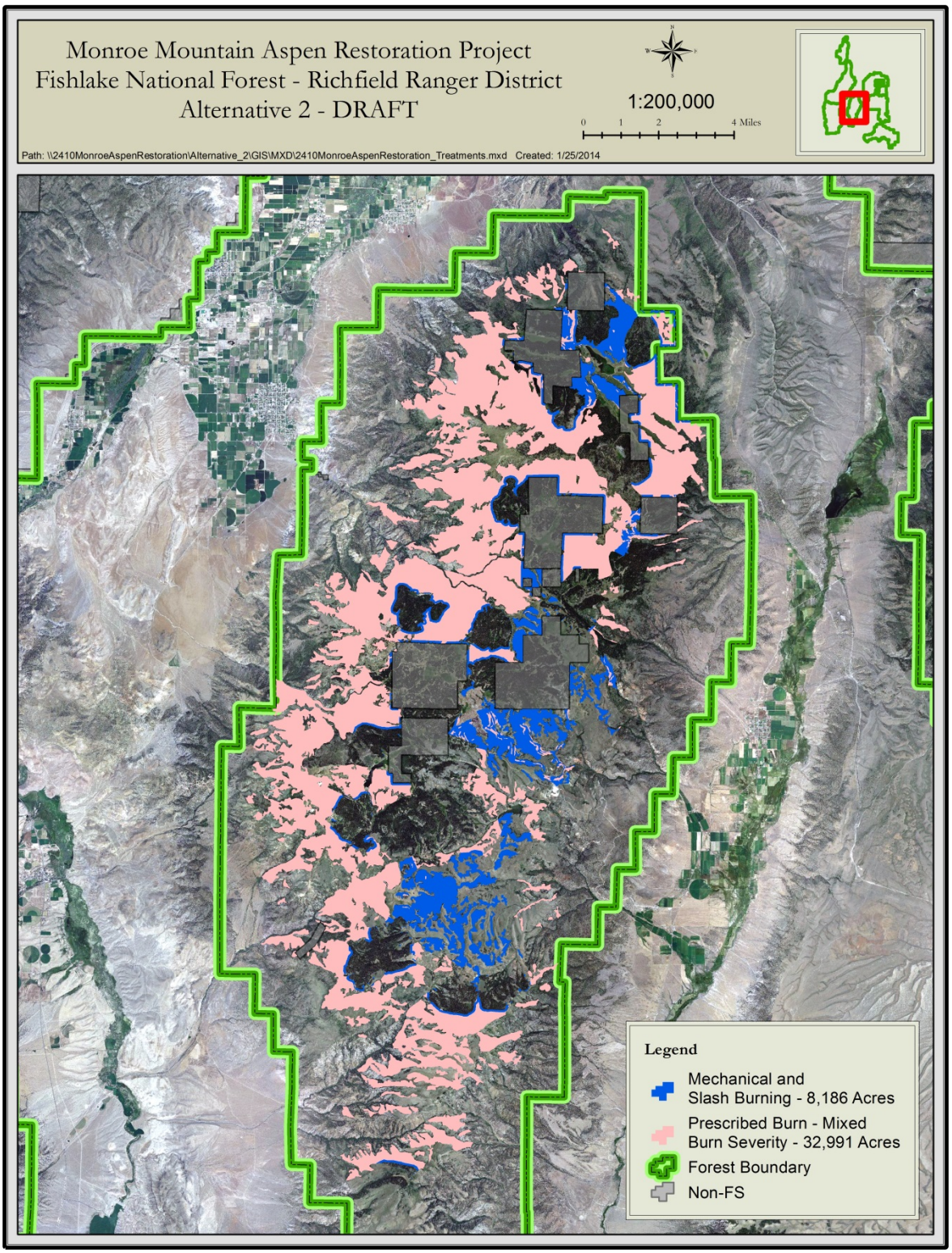


Figure 24. Alternative 2 treatment areas

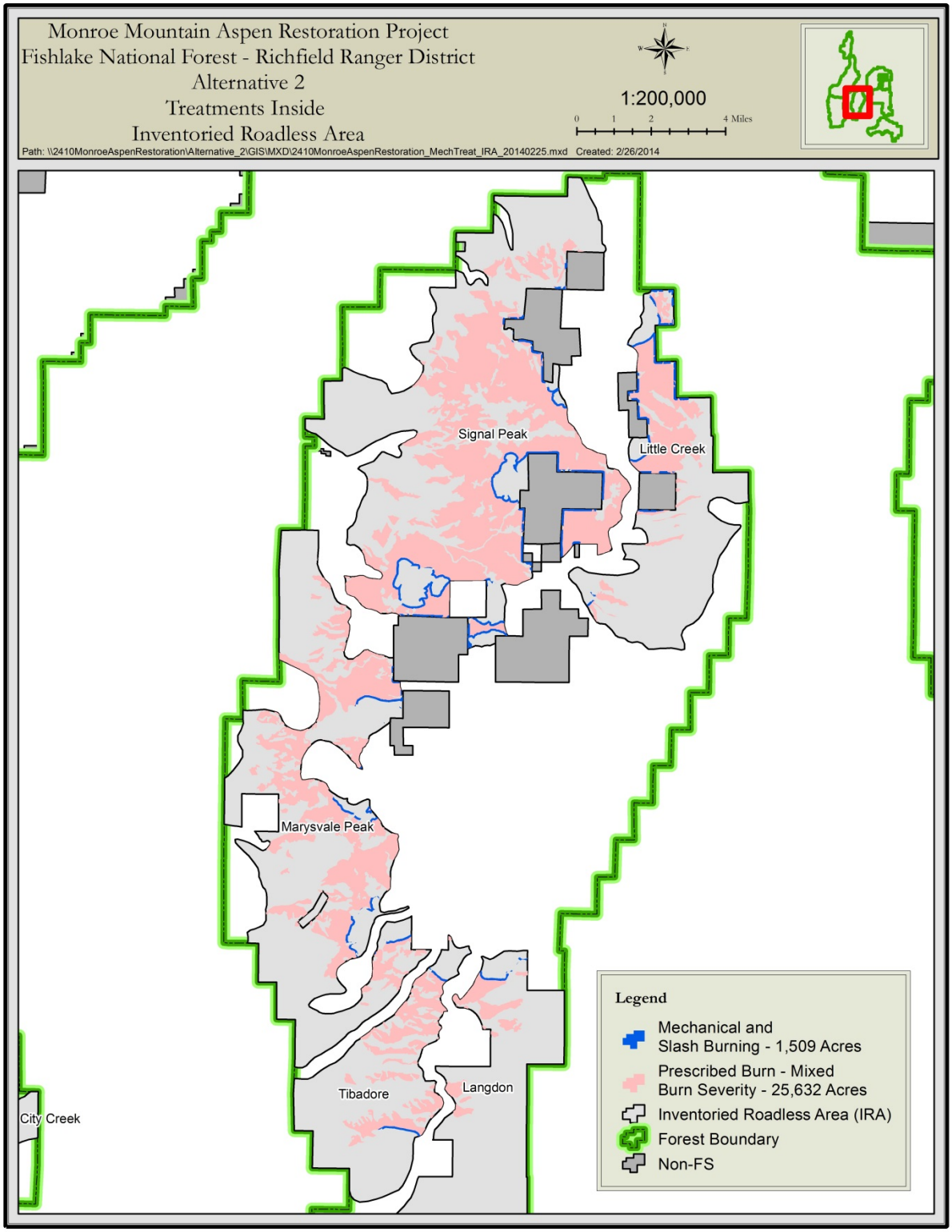


Figure 25. Alternative 2 treatment areas within Inventoried Roadless Areas

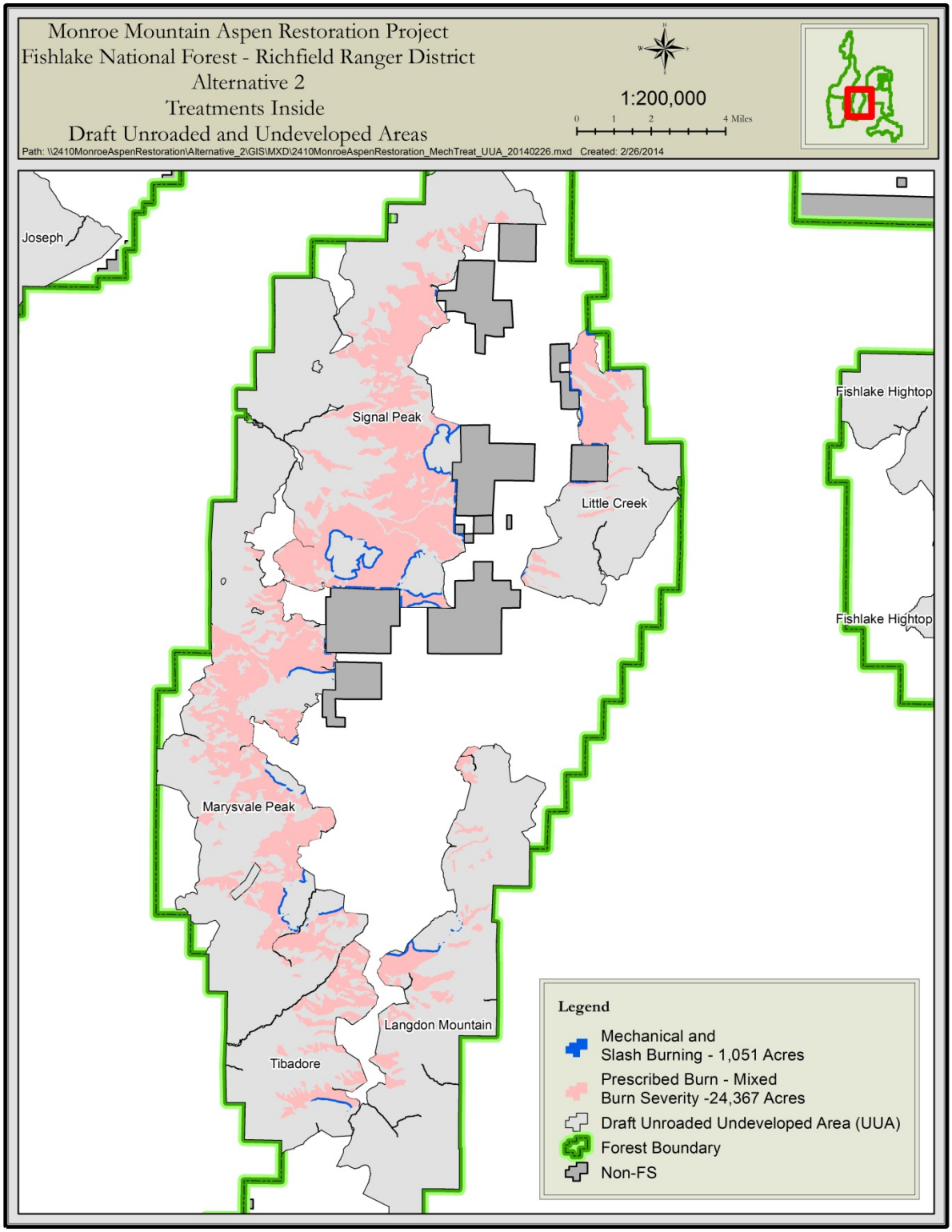


Figure 26. Alternative 2 treatment areas within draft Unroaded/Undeveloped Areas

Table 17. Alternative 2 draft Unroaded-Undeveloped Area (UUA) acreage and percent treated.

Draft UUA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
Total Draft UUA Acres	18,183	9,529	27,168	29,900	8,074	92,854
Mechanical & Slash Burning (Acres)	79	127	220	583	42	1,051[1]
Mechanical & Slash Burning Percent of UUA being Treated	0%	1%	1%	2%	1%	1%
Prescribed Fire Mixed Burn Severities (Acres)	1,645	2,033	8,296	10,530	1,864	24,368
Prescribed Fire Mixed Burn Severities Factoring 60 percent of Acres Get Treated	987	1,220	4,978	6,318	1,118	14,621
Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	5%	13%	18%	21%	14%	16%
All Treatments Combined Percent of UUA Being Treated	6%	14%	19%	23%	14%	17%

[1]This includes 3,045 acres that overlaps with IRAs.

Table 18. Alternative 2 Inventoried Roadless Area (IRA) and Draft Unroaded-Undeveloped Area (UUA) acreage and overlap for mechanical treatments only.

Stable Aspen IRA Only (Acres)	148
Stable Aspen UUA Only (Acres)	14
Stable Aspen IRA & UUA Overlap (Acres)	220
Seral Aspen IRA Only (Acres)	223
Seral Aspen UUA Only (Acres)	81
Seral Aspen IRA & UUA Overlap (Acres)	493
Spruce/Fir IRA Only (Acres)	211
Spruce/Fir UUA Only (Acres)	29
Spruce/Fir IRA & UUA Overlap (Acres)	206
Mixed Conifer IRA Only (Acres)	0
Mixed Conifer UUA Only (Acres)	1
Mixed Conifer IRA & UUA Overlap (Acres)	7
Total (Acres)	1,633

2.9.3 Alternative 3

Seral and Stable Aspen Stands – Proposed Mechanical Treatment Methods

There are two mechanical treatment options being analyzed for alternative 3 for seral and stable aspen dominated stands (Photo 13 through Photo 21; appendix A):

1. Conifers would be removed and the existing aspen would be retained regardless of the size of the conifer or if it is located within an IRA or draft UUA. (Photo 14, Photo 17, and Photo 20; appendix A; Table 19). To access the conifer, some incidental cutting of aspen may occur. This option would occur throughout the project area.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH and the existing aspen would be retained (Photo 15, Photo 18, and Photo 21; appendix A; Table 20). In all areas outside the IRAs and draft UUAs, conifers would be removed and the existing aspen would be retained regardless of the size of the conifer.

Spruce/Fir and Mixed Conifer Stands – Proposed Mechanical Treatment Methods

There are also two mechanical treatments options being analyzed for alternative 3 for spruce/fir and mixed conifer stands (Photo 22 through Photo 30; appendix A):

1. This option would occur throughout the project area (Photo 23, Photo 26, and Photo 28; appendix A; Table 19).
   a. If present, beetle killed conifer trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (salvage harvest).
   b. If conifer trees are currently infected by beetles and are in the process of dying, the infected trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (sanitation harvest).
   c. In areas of spruce/fir or mixed conifer where LRMP stocking levels are below plan guidance due to bark beetle impacts, replanting of spruce or mixed conifer may occur. If the remaining live trees were greater than a BA of 90, the remaining live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
   d. If no beetle killed or infected trees are present initially, live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.

2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH (Photo 24, Photo 27, and Photo 29; appendix A; Table 20). In all areas outside the IRAs and draft UUAs, treatments would occur as in option 1 for spruce/fir and mixed conifer.

Roads: This alternative proposes to create 8.8 miles of temporary roads for access to mechanical treatment areas (same as alternative 2; Figure 36 through Figure 42).

Table 19. Alternative 3; Option 1--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning
Alternative 3	Seral Aspen	6,422
	Stable Aspen	4,780
	Spruce/Fir	2,355
	Mixed Conifer	91
	Total	13,648

Table 20. Alternative 3; Option 2--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres Outside IRAs and UUAs)	Mechanical and Associated Slash Burning (Acres Inside IRAs and UUAs)	Project Total
Alternative 3	Seral Aspen	3,111	3,311	6,422
	Stable Aspen	3,965	815	4,780
	Spruce/Fir	835	1,520	2,355
	Mixed Conifer	90	1	91
	Total	8,001	5,647	13,648

The purpose of this alternative is to address issues 1 through 4 (section 1.15).

Issue 1 – Impacts to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation

Alternative 3 proposes to treat approximately 32,461 acres (Figure 27) of aspen and spruce/fir and mixed conifer (13,648 acres of mechanical with associated slash burning and 18,814 acres of prescribed burns with mixed burn severities factoring that approximately 60 percent of the total area treated with prescription fire burns leaving 40 percent of the crown intact (Table 22 and Table 23). Of the 31,461 acres, this alternative proposes to treat 19,608 acres within all IRAs (23 percent of all IRAs are proposed to be treated; Table 24), and 17,862 acres within draft UUAs (19 percent of all draft UUAs are proposed to be treated; Table 25). Again, these acreages and percentages are calculated factoring that approximately 60 percent of the total area treated with prescription fire burn, leaving 40 percent of the crown intact. Although the proposed treatments may have an immediate impact on the visual quality of the IRA and draft UUA, these impacts would be short-term. As the area recovers from the treatments, and aspen start to regrow, wilderness attributes and roadless area characteristics would recover, and would most probably increase in quality in the long-term. This alternative proposes to mechanically treat 5,647 acres within IRAs and/or draft UUAs (Table 26). This acreage is greater than that proposed for alternative 2, but less than what is proposed for alternatives 4 and 5 (Table 22 and Table 23).

Issue 2 – Prescribed fire activities may impact adjacent private property

The IRAs (Figure 28) and draft UUAs (Figure 29) adjacent to private property would have a wider mechanical treatment buffer than alternative 2 at approximately 0.5 mile wide (Figure 27). This wider buffer of mechanical treatments would be completed first in preparation for being able to implement prescribed fire on National Forest Lands while minimizing impacts to private property. The mechanical treatment buffers for this alternative were developed using topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas and

wildland fires, existing roads and trails, etc. The specific acreages and percentages of each of the LRMP management areas are listed in Table 21.

Issue 3 – Project activities may result in Northern goshawks being displaced

Mechanical thinning treatments and the associated slash burning would occur within 16 Northern goshawk PFAs; however, no treatments would occur within the 16 NAs (Figure 27; Table 49). These mechanical treatments within the 16 PFAs would be completed first in preparation for being able effectively implement pile burning inside the 16 PFAs and implement prescribed burning outside the 16 PFAs on National Forest Lands while minimizing impacts to the Northern goshawk PFAs and NAs. This would reduce the probability of impacts to Northern goshawk PFAs or NAs from prescribed fire activities. Impacts from mechanical treatments would be less than those in alternative 4, but greater than the impacts from alternatives 2 and 5.

Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.

Mechanical treatments with associated slash burning and prescription fire treatments would occur around the areas of Manning Meadows Reservoir and Barney Lake (Figure 27). However, no temporary roads would be constructed to facilitate the mechanical treatments and associated slash burning activity in these areas. For this alternative, the mechanical treatments adjacent to Manning Meadows Reservoir and Barney Lake would be accomplished by hand and/or with the use of horses, helicopters, and/or cables.

Table 21. Alternative 3 acreage and percentage of the Forest's Land and Resource Management Plan (LRMP) management areas (MAs) on Monroe Mountain

LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
Mechanical & Slash Burning (Acres)	0	37	12,210	3	466	854	77
Mechanical & Slash Burning Percent of MA being Treated	0%	4%	12%	0%	2%	16%	0%
Prescribed Fire Mixed Burn Severities (Acres)	6	201	18,785	787	7,000	2,027	2,551
Prescribed Fire Mixed Burn Severities Factoring 60 percent of Acres Get Treated	4	121	11,271	472	4,200	1,216	1,531

Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	15%	11%	2%	20%	22%	10%
All Treatments Combined Percent of MA Being Treated	1%	19%	22%	2%	23%	38%	10%

Table 22. Alternative 3 acreage and temporary road mileage

Mechanical Treatments and Associated Slash Burning	Prescribed Fire - Mixed Burn Severities	Prescribed Fire – Mixed Burn Severities Factoring 60 percent of the Acres Get Burned	Total Acres	Total Acres Factoring 60 percent of Acres Get Burned	Miles of Temporary Roads
13,648	31,357	18,814	45,004	32,461	8.8

Table 23. Alternative 3 acreage by dominant vegetative type

Existing Vegetation	Mechanical and Associated Slash Burning (Acres)	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60 percent of the Acres Get Burned
Mixed Conifer	91	4,190	2,514
Seral Aspen	6,422	14,318	8,591
Stable Aspen	4,780	7,861	4,717
Spruce/Fir	2,355	4,988	2,993
Total	**13,648**	**31,357**	**18,814**

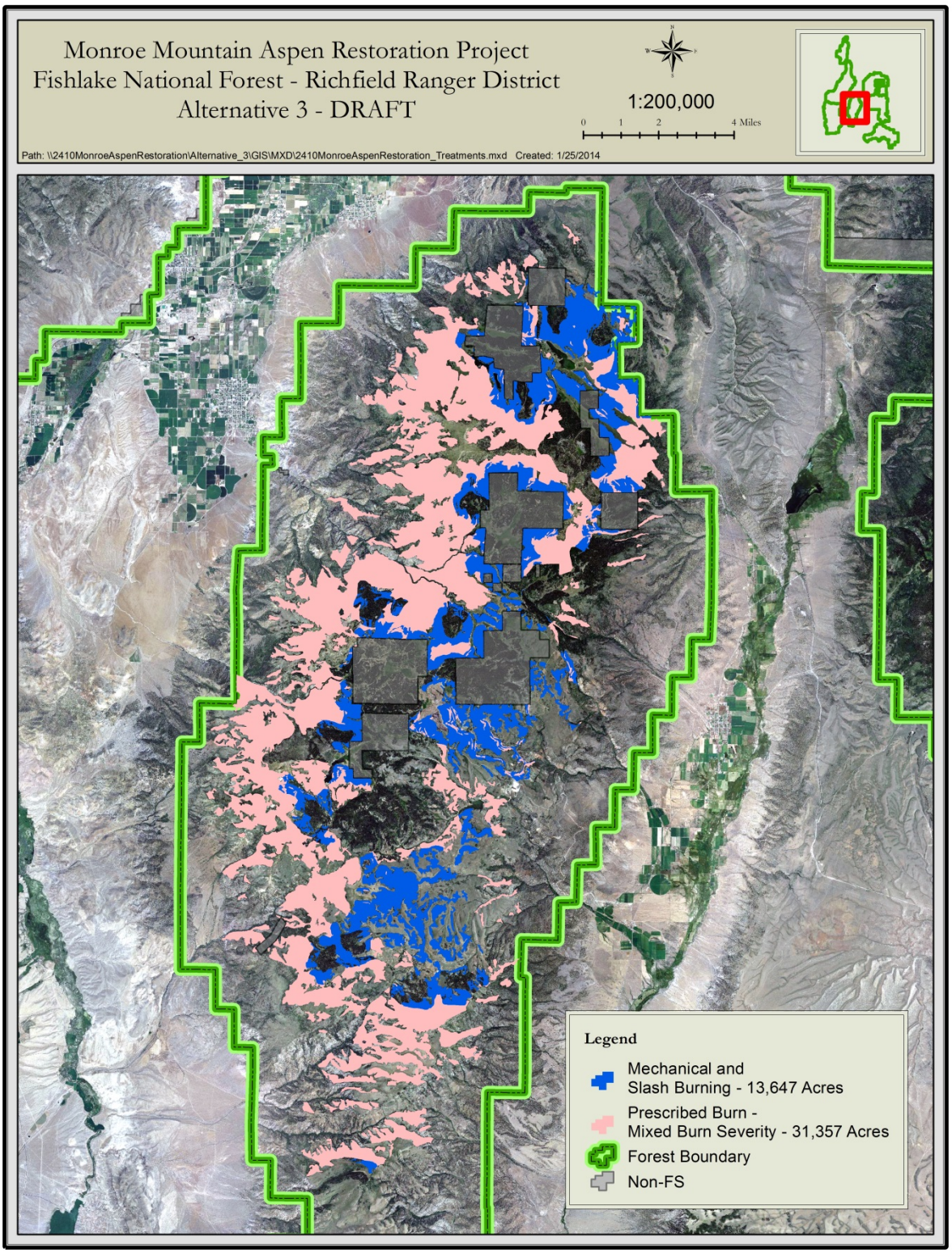


Figure 27. Alternative 3 treatment areas

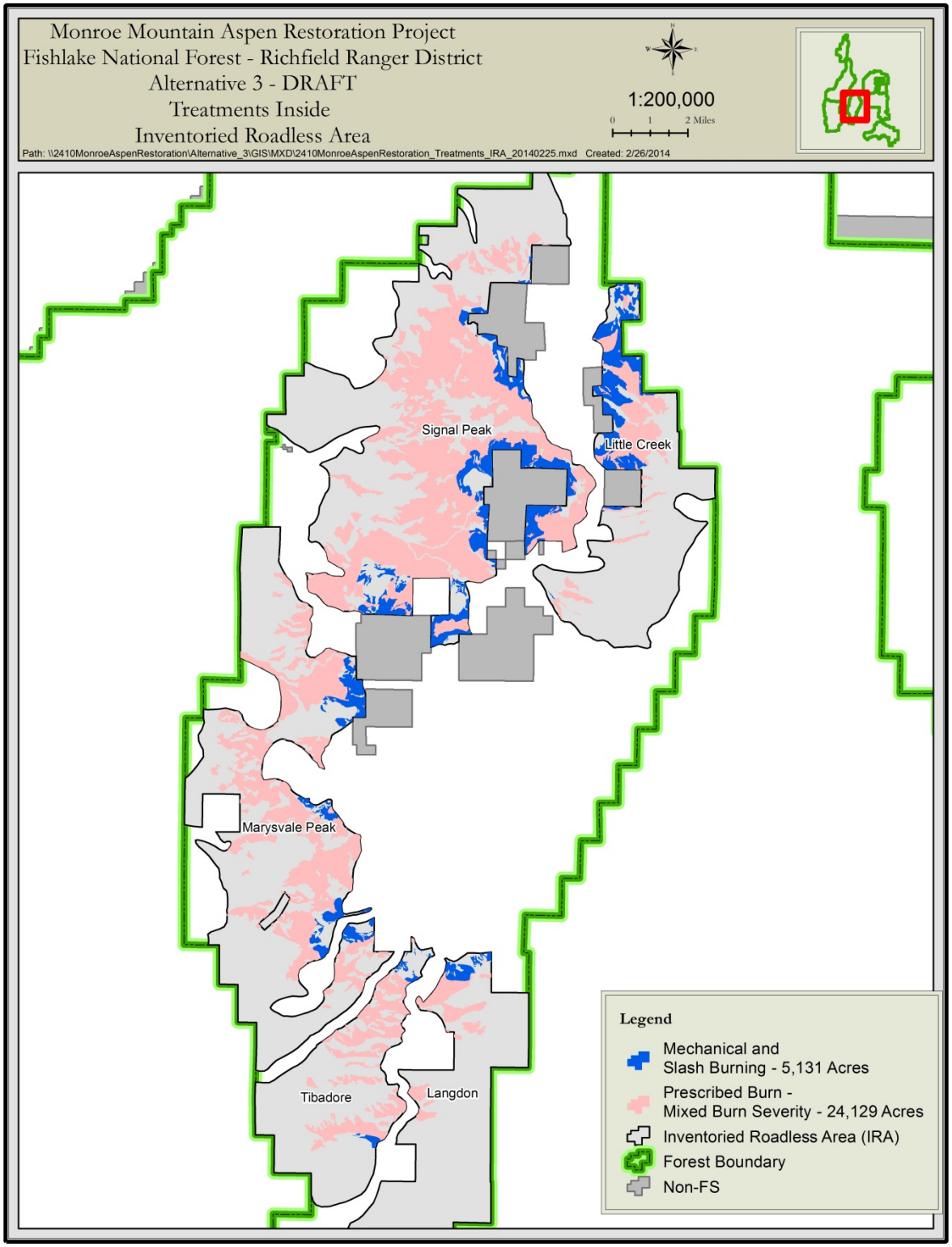


Figure 28. Alternative 3 treatment areas within Inventoried Roadless Areas

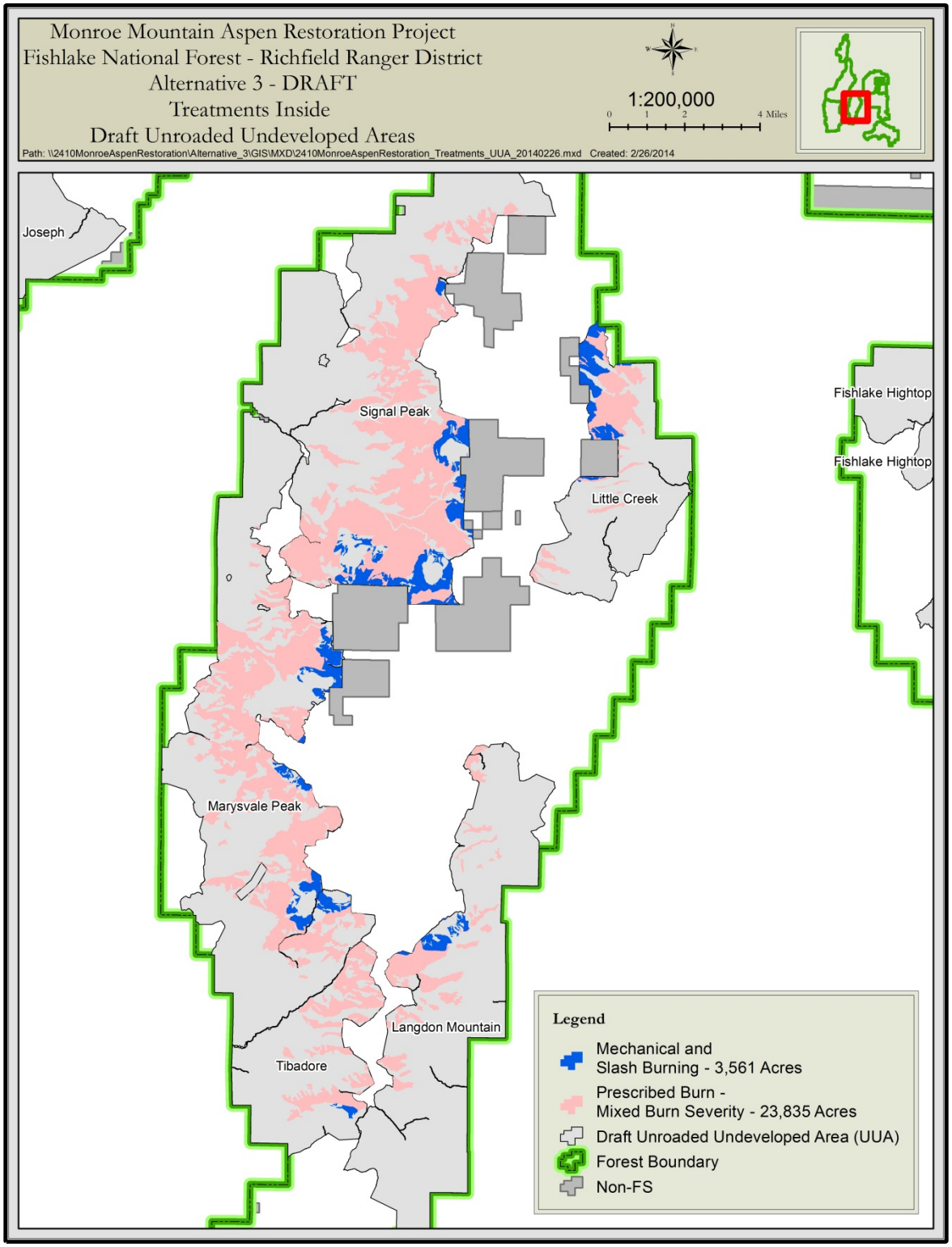


Figure 29. Alternative 3 treatment areas within draft Unroaded/Undeveloped Areas

Table 24. Alternative 3 Inventoried Roadless Area (IRA) acreage and percent treated.

IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
Mechanical & Slash Burning (Acres)	223	1,422	925	2,439	122	5,131[1]
Mechanical & Slash Burning Percent of IRA being Treated	2%	12%	4%	8%	1%	6%
Prescribed Fire Mixed Burn Severities (Acres)	857	1,814	6,679	12,718	2,061	24,129
Prescribed Fire Mixed Burn Severities Factoring 60 percent of Acres Get Treated	514	1,088	4,007	7,631	1,237	14,477
Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	9%	18%	25%	13%	17%
All Treatments Combined Percent of IRA Being Treated	6%	22%	22%	33%	15%	23%

[1] This includes 3,045 acres that overlap with draft UUAs.

Table 25. Alternative 3 draft Unroaded-Undeveloped Area (UUA) acreage and percent treated.

Draft UUA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
Total Draft UUA Acres	18,183	9,529	27,168	29,900	8,074	92,854
Mechanical & Slash Burning (Acres)	268	685	1,016	1,536	56	3,561[1]
Mechanical & Slash Burning Percent of UUA being Treated	1%	7%	4%	5%	1%	4%
Prescribed Fire Mixed Burn Severities (Acres)	1,722	1,490	8,263	10,454	1,906	23,835
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	1,033	894	4,958	6,272	1,144	14,301
Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	6%	9%	18%	21%	14%	15%
All Treatments Combined Percent of UUA Being Treated	7%	17%	22%	26%	15%	19%

[1]This includes 3,045 acres that overlap with draft IRAs.

Table 26. Alternative 3 Inventoried Roadless Area (IRA) and Draft Unroaded-Undeveloped Areas (UUA) acreage and overlap for mechanical treatments only.

Stable Aspen IRA Only (Acres)	403
Stable Aspen UUA Only (Acres)	46
Stable Aspen IRA & UUA Overlap (Acres)	366
Seral Aspen IRA Only (Acres)	929
Seral Aspen UUA Only (Acres)	361
Seral Aspen IRA & UUA Overlap (Acres)	2,021
Spruce/Fir IRA Only (Acres)	754
Spruce/Fir UUA Only (Acres)	109
Spruce/Fir IRA & UUA Overlap (Acres)	657
Mixed Conifer IRA Only (Acres)	0
Mixed Conifer UUA Only (Acres)	0
Mixed Conifer IRA & UUA Overlap (Acres)	1
Total (Acres)	5,647

2.9.4 Alternative 4

Seral and Stable Aspen Stands – Proposed Mechanical Treatment Methods

There are two mechanical treatment options being analyzed for alternative 4 for seral and stable aspen dominated stands (Photo 13 through Photo 21; appendix A):

1. Conifers would be removed and the existing aspen would be retained regardless of the size of the conifer or if it is located within an IRA or draft UUA. (Photo 14, Photo 17, and Photo 20; appendix A; Table 27). To access the conifer, some incidental cutting of aspen may occur. This option would occur throughout the project area.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH and the existing aspen would be retained (Photo 15, Photo 18, and Photo 21; appendix A; Table 28). In all areas outside the IRAs and draft UUAs, conifers would be removed and the existing aspen would be retained regardless of the size of the conifer.

Spruce/Fir and Mixed Conifer Stands – Proposed Mechanical Treatment Methods

There are also two mechanical treatments options being analyzed for alternative 4 for spruce/fir and mixed conifer dominated stands (Photo 22 through Photo 30; appendix A):

1. This option would occur throughout the project area (Photo 23, Photo 26, and Photo 28; appendix A; Table 11).
    a. If present, beetle killed conifer trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (salvage harvest).

   b. If conifer trees are currently infected by beetles and are in the process of dying, the infected trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (sanitation harvest).
   c. In areas of spruce/fir or mixed conifer where LRMP stocking levels are below plan guidance due to bark beetle impacts, replanting of spruce or mixed conifer may occur. If the remaining live trees were greater than a BA of 90, the remaining live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
   d. If no beetle killed or infected trees are present initially, live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH (Photo 24, Photo 27, and Photo 29; appendix A; Table 28). In all areas outside the IRAs and draft UUAs, treatments would occur as in option 1 for spruce/fir and mixed conifer.

Roads: This alternative proposes to create 13.3 miles of temporary roads for access to mechanical treatment areas (Figure 36 through Figure 42); 0.3 miles of these roads are proposed within the draft UUAs (Figure 32).

The purpose of this alternative is to address issues 1 through 4 (section 1.15).

Issue 1 – Impact to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation

Alternative 4 proposes to treat approximately 36,300 acres (Figure 30) of aspen and spruce/fir and mixed conifer (19,837 acres of mechanical and associated slash burning and 16,462 acres of prescribed burns with mixed burn severities factoring that approximately 60 percent of the total area treated with prescription fire burns, leaving 40 percent of the crown intact; Table 30 and Table 31). Of the 36,300 acres, this alternative proposes to treat 21,894 acres within all IRAs (25 percent of all IRAs are proposed to be treated; Table 32), and 19,642 acres within draft UUAs (21 percent of all draft UUAs are proposed to be treated; Table 33). Again, these acreages and percentages are calculated factoring that approximately 60 percent of the total area treated with prescription fire burn, leaving 40 percent of the crown intact. Although the proposed treatments may have an immediate impact on the visual quality of the IRA and draft UUA, these impacts would be short-term. As the area recovers from the treatments, and aspen start to regrow, wilderness attributes and roadless area characteristics would recover, and would most probably increase in quality in the long-term. This alternative proposes to mechanically treat 10,373 acres within IRAs and/or draft UUAs (Table 34). This acreage is the most proposed for this project and is greater than alternatives 2, 3, and 5 (Table 30 and Table 31).

Table 27. Alternative 4; Option 1--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning
Alternative 4	Seral Aspen	9,492
	Stable Aspen	6,130
	Spruce/Fir	4,113
	Mixed Conifer	102
	Total	19,837

Table 28. Alternative 4; Option 2--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres Outside IRAs and UUAs)	Mechanical and Associated Slash Burning (Acres Inside IRAs and UUAs)	Project Total
Alternative 4	Seral Aspen	3,991	5,501	9,492
	Stable Aspen	4,196	1,934	6,130
	Spruce/Fir	1,186	2,927	4,113
	Mixed Conifer	91	11	102
	Total	9,464	10,373	19,837

Issue 2 – Prescribed fire activities may impact adjacent private property

The IRAs (Figure 31) and draft UUAs (Figure 32) adjacent to private property would have a wider mechanical treatment buffer than alternatives 2 and 3, but similar to alternative 5 at approximately 1.3 miles wide (Figure 30). This wider buffer of mechanical treatments would be completed first in preparation for being able effectively implement prescribed fire on National Forest Lands while minimizing impacts to private property. The mechanical treatment buffers for this alternative were developed using topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas and wildland fires, existing roads and trails, etc. The specific acreages and percentages of each of the LRMP management areas are listed in Table 29.

Issue 3 – Project activities may result in Northern goshawks being displaced

Mechanical thinning treatments and the associated slash burning would occur within 17 Northern goshawk PFAs and within the 17 nest areas (Figure 30; Table 49). These mechanical treatments within the 17 PFAs and NAs would be completed first in preparation for being able to effectively implement pile burning inside the 17 PFAs and NAs and implement prescribed burning outside the 17 PFAs and NAs on National Forest Lands while minimizing impacts to the Northern goshawk PFAs and NAs. This would reduce the probability of impacts to Northern goshawk

PFAs or NAs from prescribed fire activities. The potential impacts from mechanical treatment activities would be greatest in this alternative.

Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.

Mechanical treatments with associated slash burning and prescription fire treatments would occur around the areas of Manning Meadows Reservoir and Barney Lake, and treatment areas are larger than proposed in alternative 3 (Figure 30). In addition, temporary roads would be constructed to facilitate the mechanical treatments and associated slash burning activity in these areas Figure 36 through Figure 42).

Table 29. Alternative 4 acreage and percentage of the Forest's Land and Resource Management Plan management areas (MAs) on Monroe Mountain

LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
Mechanical & Slash Burning (Acres)	0	53	17,141	3	778	1,728	135
Mechanical & Slash Burning Percent of MA being Treated	0%	6%	16%	0%	4%	31%	1%
Prescribed Fire Mixed Burn Severities (Acres)	6	196	15,675	787	6,785	1,469	2,518
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	118	9,405	472	4,071	881	1,511
Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	14%	9%	2%	20%	16%	9%
All Treatments Combined Percent of MA Being Treated	1%	21%	25%	2%	23%	47%	10%

Table 30. Alternative 4 acreage and temporary road mileage

Mechanical Treatments and Associated Slash Burning	Prescribed Fire - Mixed Burn Severities	Prescribed Fire – Mixed Burn Severities Factoring 60% of the Acres Get Burned	Total Acres	Total Acres Factoring 60% of Acres Get Burned	Miles of Temporary Roads
19,837	27,436	16,462	47,274	36,300	13.3

Table 31. Alternative 4 acreage by dominant vegetative type

Existing Vegetation	Mechanical and Associated Slash Burning (Acres)	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned
Mixed Conifer	102	4,178	2,507
Seral Aspen	9,492	12,763	7,658
Stable Aspen	6,130	6,693	4,016
Spruce/Fir	4,113	3,802	2,281
Total	**19,837**	**27,436**	**16,462**

Table 32. Alternative 4 Inventoried Roadless Area (IRA) acreage and percent treated.

IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
Mechanical & Slash Burning (Acres)	278	2,142	1,637	5,009	196	9,262[1]
Mechanical & Slash Burning Percent of IRA being Treated	2%	19%	7%	16%	2%	11%
Prescribed Fire Mixed Burn Severities (Acres)	857	1,228	6,246	10,661	2,061	21,053
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	514	737	3,748	6,397	1,237	12,632
Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	6%	17%	21%	13%	15%
All Treatments Combined Percent of IRA Being Treated	7%	25%	24%	37%	15%	25%

[1] This includes 5,543 acres that overlap with draft UUAs.

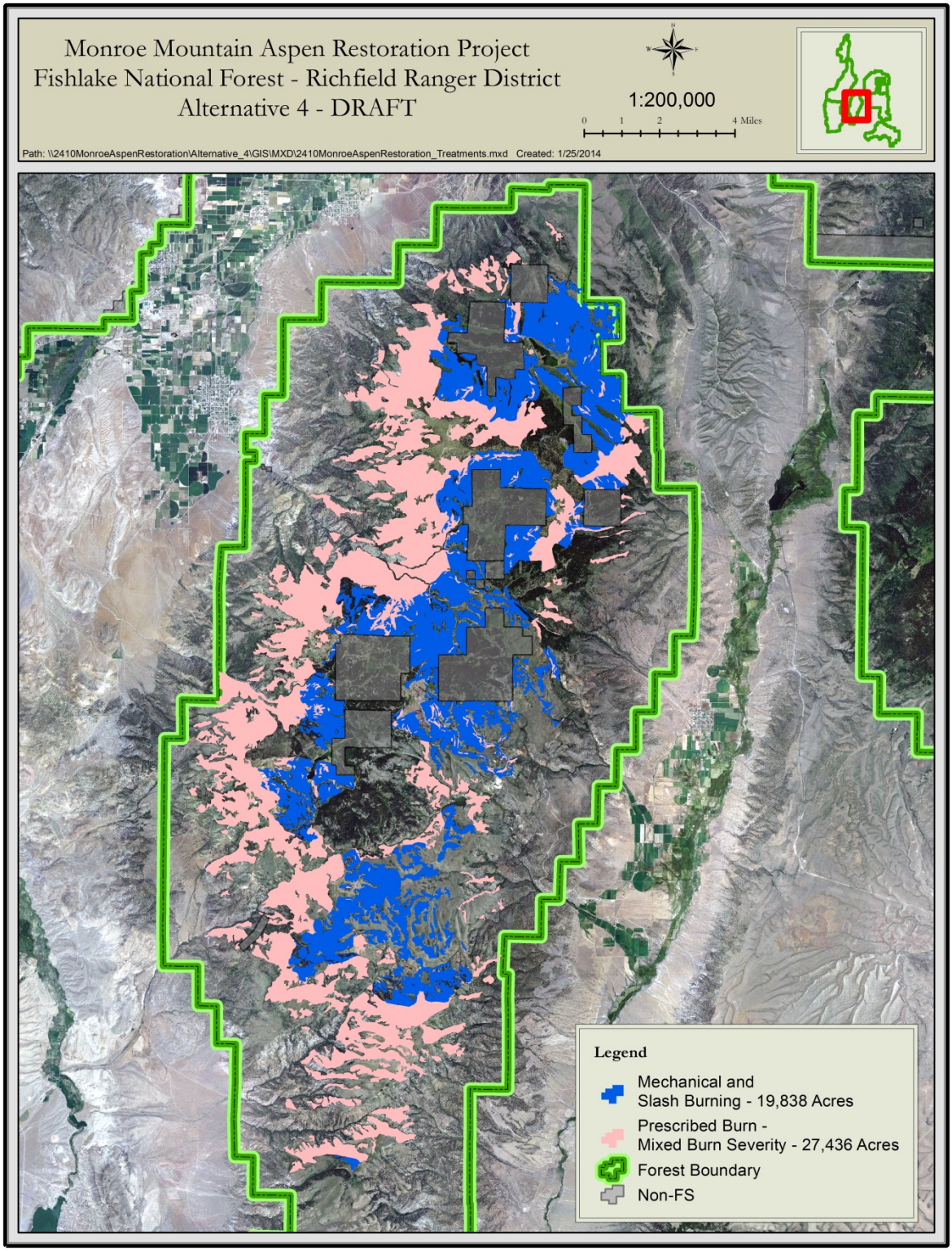


Figure 30. Alternative 4 treatment areas

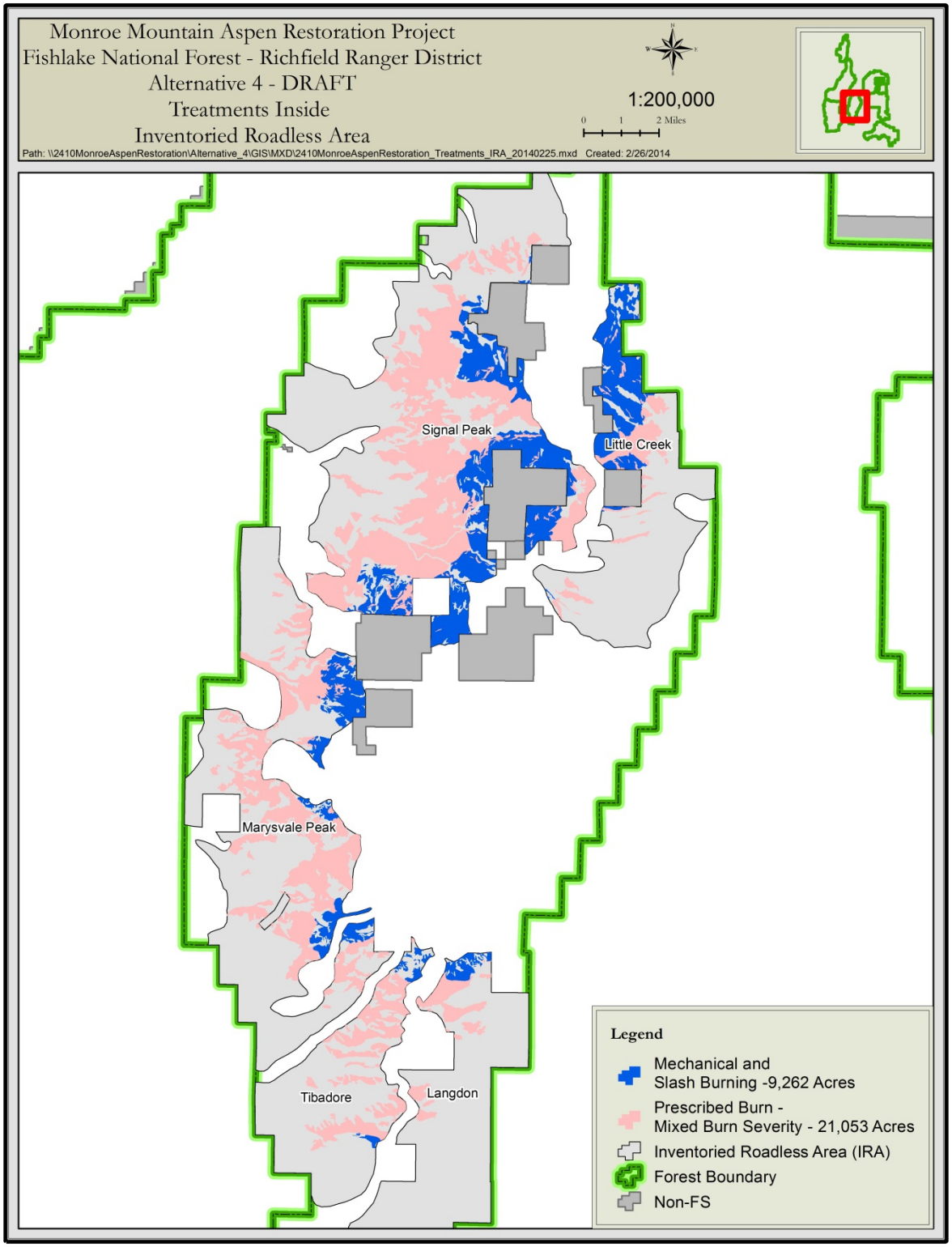


Figure 31. Alternative 4 treatments within Inventoried Roadless Areas

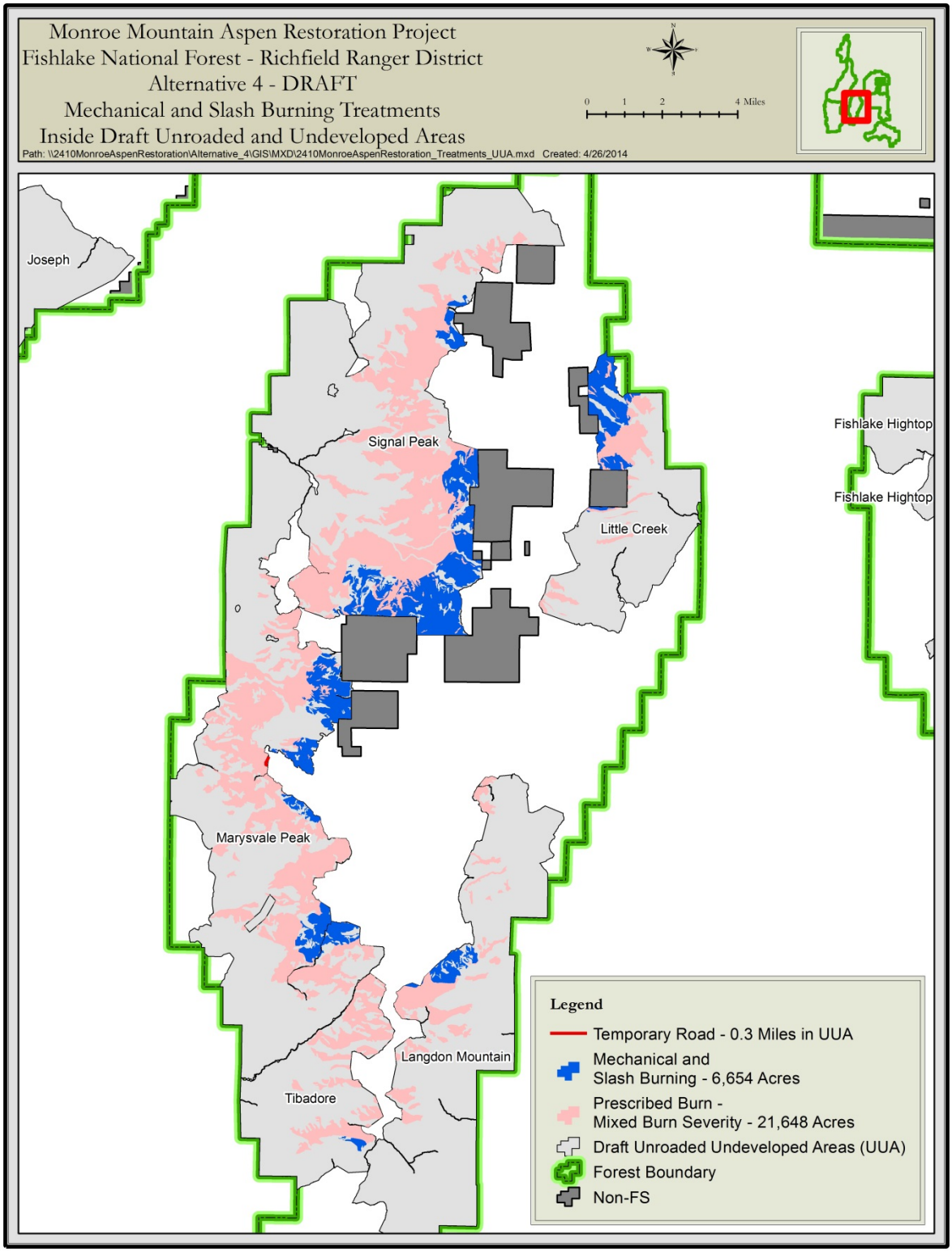


Figure 32. Alternative 4 treatments within draft Unroaded-Undeveloped Areas (UUAs)

Table 33. Alternative 4 draft Unroaded-Undeveloped Area (UUA) acreage and percent treated.

UUA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
Total Draft UUA Acres	18,183	9,529	27,168	29,900	8,074	92,854
Mechanical & Slash Burning (Acres)	363	1,033	1,918	3,283	56	6,653[1]
Mechanical & Slash Burning Percent of UUA being Treated	2%	11%	7%	11%	1%	7%
Prescribed Fire Mixed Burn Severities (Acres)	1,722	1,141	7,706	9,174	1,906	21,649
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	1,033	685	4,624	5,504	1,144	12,989
Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	6%	7%	17%	18%	14%	14%
All Treatments Combined Percent of UUA Being Treated	8%	18%	24%	29%	15%	21%

[1]This includes 5,543 acres that overlap with IRAs.

Table 34. Alternative 4 Inventoried Roadless Area (IRA) and Draft Unroaded-Undeveloped Area (UUA) acreage and overlap for mechanical treatments only.

Stable Aspen IRA Only (Acres)	901
Stable Aspen UUA Only (Acres)	153
Stable Aspen IRA & UUA Overlap (Acres)	880
Seral Aspen IRA Only (Acres)	1,384
Seral Aspen UUA Only (Acres)	732
Seral Aspen IRA & UUA Overlap (Acres)	3,385
Spruce/Fir IRA Only (Acres)	1,434
Spruce/Fir UUA Only (Acres)	226
Spruce/Fir IRA & UUA Overlap (Acres)	1,267
Mixed Conifer IRA Only (Acres)	0
Mixed Conifer UUA Only (Acres)	0
Mixed Conifer IRA & UUA Overlap (Acres)	11
Total (Acres)	10,373

2.9.5 Alternative 5

Seral and Stable Aspen Stands – Proposed Mechanical Treatment Methods

There are two mechanical treatment options being analyzed for alternative 5 for seral and stable aspen dominated stands (Photo 13 through Photo 21; appendix A):

1. Conifers would be removed and the existing aspen would be retained regardless of the size of the conifer or if it is located within an IRA or draft UUA. (Photo 14, Photo 17, and Photo 20; appendix A; Table 35). To access the conifer, some incidental cutting of aspen may occur. This option would occur throughout the project area.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH and the existing aspen would be retained (Photo 15, Photo 18, and Photo 21; appendix A; Table 36). In all areas outside the IRAs and draft UUAs, conifers would be removed and the existing aspen would be retained regardless of the size of the conifer.

Spruce/Fir and Mixed Conifer Stands – Proposed Mechanical Treatment Methods

There are also two mechanical treatments options being analyzed for alternative 5 for spruce/fir and mixed conifer dominated stands (Photo 22through Photo 30; appendix A):

1. This option would occur throughout the project area (Photo 23, Photo 26, and Photo 28; appendix A; Table 35).
    a. If present, beetle killed conifer trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (salvage harvest).
    b. If conifer trees are currently infected by beetles and are in the process of dying, the infected trees would be removed while ensuring consistency with the LRMP for snags and down woody debris (sanitation harvest).
    c. In areas of spruce/fir or mixed conifer where LRMP stocking levels are below plan guidance due to bark beetle impacts, replanting of spruce or mixed conifer may occur. If the remaining live trees were greater than a BA of 90, the remaining live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
    d. If no beetle killed or infected trees are present initially, live trees would be thinned using uneven-aged management to a BA of 90 with single and group tree selection.
2. Within IRAs and draft UUAs, conifer would be thinned from below up to 8 inch DBH (Photo 24, Photo 27, and Photo 29; appendix A; Table 36). In all areas outside the IRAs and draft UUAs, treatments would occur as in option 1 for spruce/fir and mixed conifer.

Roads: This alternative proposes to create 12.8 miles of temporary roads for access to treatment areas (Figure 36 through Figure 42); 1.3 miles of roads are proposed within draft UUAs (Figure 35).

Table 35. Alternative 5; Option 1--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning
Alternative 5	Seral Aspen	6,736
	Stable Aspen	5,340
	Spruce/Fir	2,905
	Mixed Conifer	91
	Total	15,072

The purpose of this alternative is to address issues 1 through 4 (section 1.15).

Issue 1 – Impact to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation

Alternative 5 proposes to treat approximately 30,944 acres (Figure 33) of aspen and spruce/fir and mixed conifer (15,072 acres of mechanical and associated slash burning and 15,872 acres of prescribed burns with mixed burn severities factoring that approximately 60 percent of the total area treated with prescription fire burn; leaving 40 percent of the crown intact; Table 38 and Table 39). Of the 30,944 acres, this alternative proposes to treat 19,245 acres within all IRAs (22 percent of all IRAs are proposed to be treated; Table 40), and 17,675 acres within draft UUAs (19 percent of all draft UUAs are proposed to be treated; Table 41). Again, these acreages and percentages are calculated factoring that approximately 60 percent of the total area treated with prescription fire burn, leaving 40 percent of the crown intact. Although the proposed treatments may have an immediate impact on the visual quality of the IRA and draft UUA, these impacts would be short-term. As the area recovers from the treatments, and aspen start to regrow, wilderness attributes and roadless characteristics would recover, and would most probably increase in quality in the long-term. This alternative proposes to mechanically treat 7,621 acres within IRAs and/or draft UUAs (Table 42). This acreage is greater than that proposed for alternatives 2 and 3, but less than what is proposed for alternative 4 (Table 38 and Table 39).

Issue 2 – Prescribed fire activities may impact adjacent private property

The IRAs (Figure 34) and draft UUAs (Figure 35) adjacent to private property would have a similar mechanical treatment buffer to alternative 3 with variations occurring where Northern goshawk PFAs and NAs occur adjacent to private property (Figure 33). The buffer adjacent to private property would be wider than alternatives 2 and 3, but similar to alternative 4 at approximately 1.3 miles wide. Where Northern goshawk PFAs and NAs occur, the mechanical treatment buffers mostly occur along the outside edge of the PFAs (the exception being with two of the PFAs located adjacent to private property that are proposed for treatment; no NAs would be treated) (Figure 33; Table 49) This buffer of mechanical treatment would be completed first in preparation for being able to implement prescribed fire on National Forest Lands while minimizing impacts to private property and Northern goshawk areas. The mechanical treatment

buffers for this alternative were developed using topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas and wildland fires, existing roads and trails, etc. The specific acreages and percentages of each of the LRMP management areas are listed in Table 37.

Table 36. Alternative 5; Option 2--Mechanical treatments with associated slash burning for seral and stable aspen, spruce/fir, and mixed conifer dominated stands

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres Outside IRAs and UUAs)	Mechanical and Associated Slash Burning (Acres Inside IRAs and UUAs)	Project Total
Alternative 5	Seral Aspen	2,547	4,189	6,736
	Stable Aspen	3,830	1,510	5,340
	Spruce/Fir	984	1,921	2,905
	Mixed Conifer	90	1	91
	Total	7,451	7,621	15,072

Issue 3 – Project activities may result in Northern goshawks being displaced

Mechanical thinning treatments and the associated slash burning would occur within 2 of the 17 Northern goshawk PFAs that occur in proposed treatment areas, and no treatments would occur in any of the 17 NAs (Figure 33). Mechanical treatment buffers around the outside edge of the other 15 PFAs would be approximately 0.6 miles wide. The mechanical treatment buffers for this alternative were developed using topography (slope, ridgetops, drainage bottoms, etc.), natural fuel breaks, previous treatment areas and wildland fires, existing roads and trails, etc. These mechanical treatments within the 2 PFAs and around the outside edge of the other 15 PFAs would be completed first in preparation for implementation of pile burning inside the 2 PFAs and prescribed burning outside the PFAs on National Forest Lands to minimize impacts to Northern goshawk PFAs and NAs. Impacts from mechanical treatments would be less than that in alternatives 3 and 4 but greater than those in alternative 2.

Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.

Mechanical treatments with associated slash burning and prescription fire treatments would occur around the areas of Manning Meadows Reservoir and Barney Lake, and treatment areas are similar to those proposed in alternative 3 (Figure 33). In addition, temporary roads would be constructed to facilitate the mechanical treatments and associated slash burning activity in and adjacent to these areas.

Table 37. Alternative 5 acreage and percentage of the Forest's Land and Resource Management Plan (LRMP) management areas (MAs) on Monroe Mountain

LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
Mechanical & Slash Burning (Acres)	0	70	13,162	0	602	1,142	96
Mechanical & Slash Burning Percent of MA being Treated	0%	8%	13%	0%	3%	21%	1%
Prescribed Fire Mixed Burn Severities (Acres)	6	132	14,769	787	6,850	1,377	2,532
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	79	8,861	472	4,110	826	1,519
Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	10%	8%	2%	20%	15%	10%
All Treatments Combined Percent of MA Being Treated	1%	18%	21%	2%	23%	36%	10%

Table 38. Alternative 5 acreage and temporary road mileage

Mechanical Treatments and Associated Slash Burning	Prescribed Fire - Mixed Burn Severities	Prescribed Fire – Mixed Burn Severities Factoring 60% of the Acres Get Burned	Total Acres	Total Acres Factoring 60% of Acres Get Burned	Miles of Temporary Roads
15,072	26,453	15,872	41,525	30,944	12.8

Table 39. Alternative 5 acreage by dominant vegetative type

Existing Vegetation	Mechanical and Associated Slash Burning (Acres)	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned
Mixed Conifer	91	4,190	2,514
Seral Aspen	6,736	11,676	7,006
Stable Aspen	5,340	6,777	4,066
Spruce/Fir	2,905	3,810	2,286
Total	**15,072**	**26,453**	**15,872**

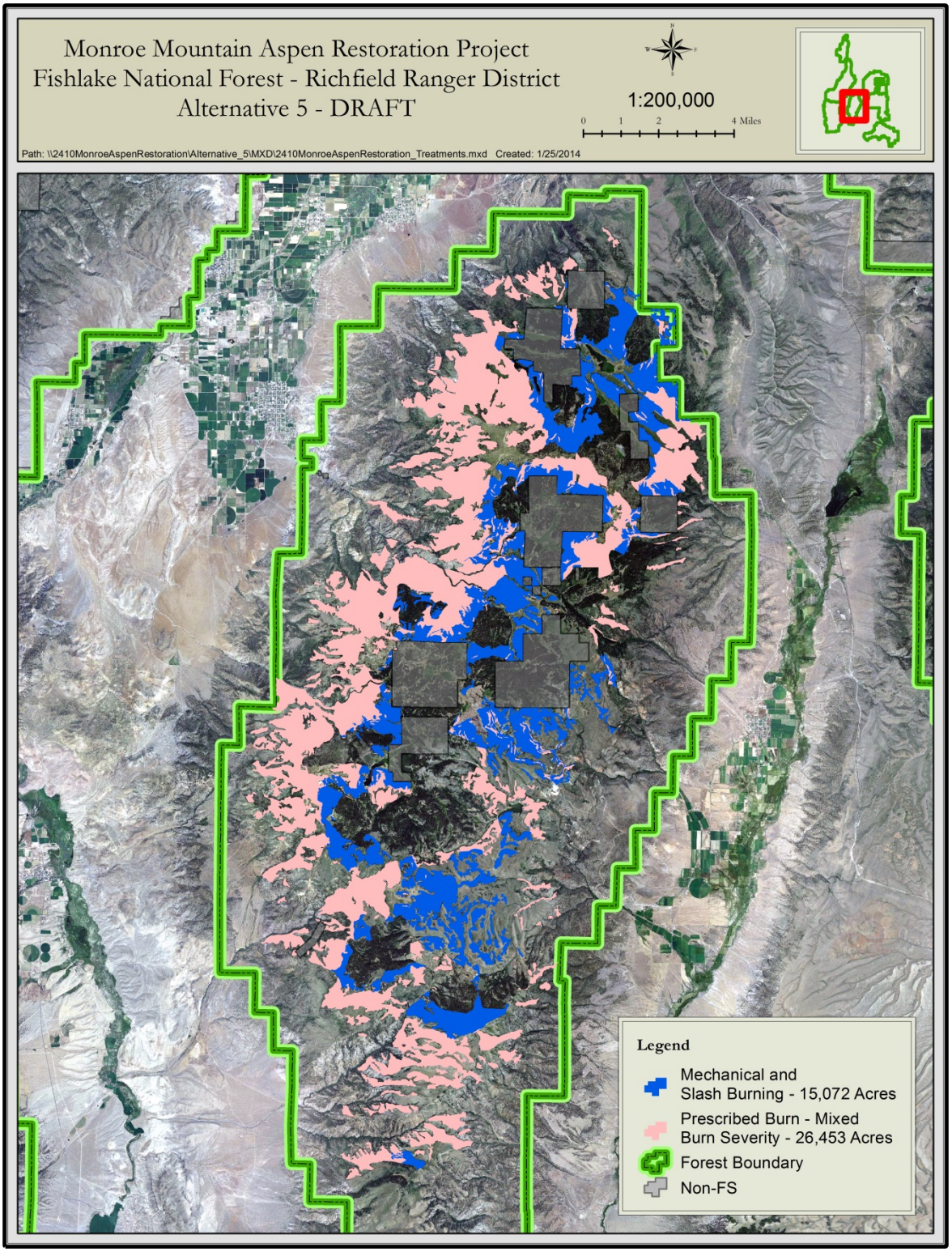


Figure 33. Alternative 5 treatment areas

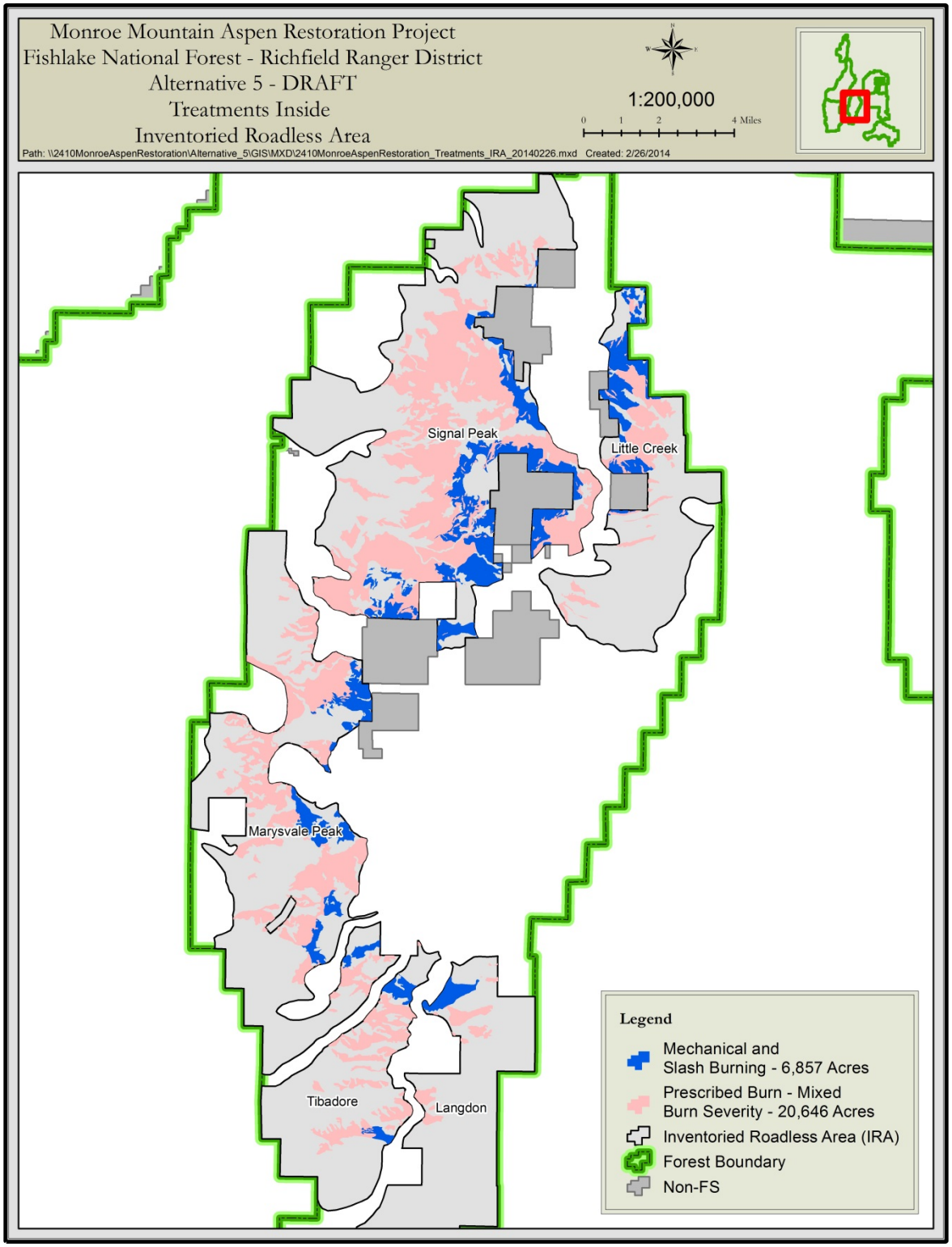


Figure 34. Alternative 5 treatment areas within Inventoried Roadless Areas

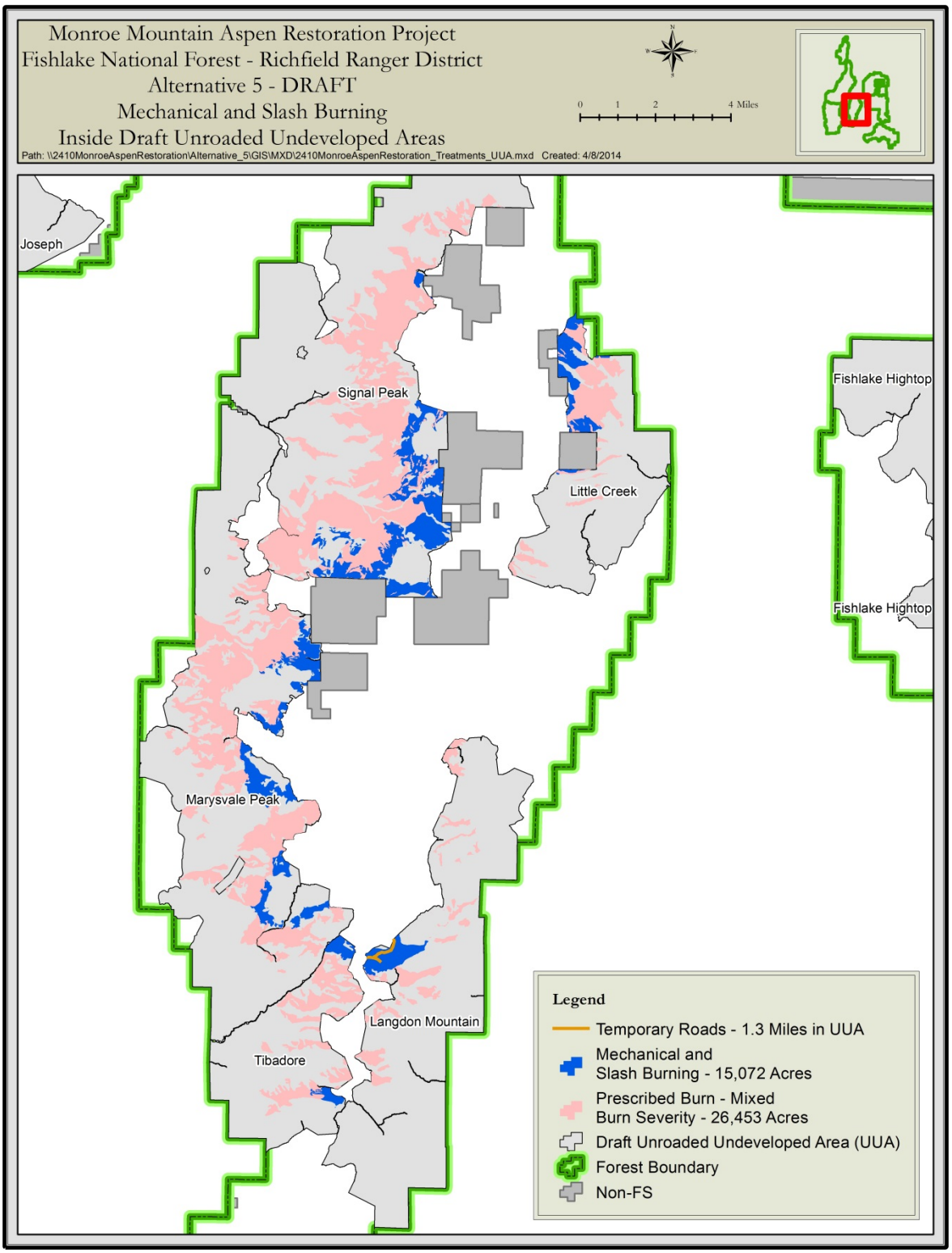


Figure 35. Alternative 5 treatment areas within draft Unroaded/Undeveloped Areas with associated roads

Table 40. Alternative 5 Inventoried Roadless Areas (IRA) acreage and percent treated.

IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
Mechanical & Slash Burning (Acres)	317	1,228	1,517	3,478	317	6,857[1]
Mechanical & Slash Burning Percent of IRA being Treated	3%	11%	7%	11%	3%	8%
Prescribed Fire Mixed Burn Severities (Acres)	540	1,714	5,593	11,055	1,744	20,646
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	324	1,028	3,356	6,633	1,046	12,388
Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	3%	9%	15%	21%	11%	14%
All Treatments Combined Percent of IRA Being Treated	5%	20%	22%	33%	15%	22%

[1] This includes 4,751 acres that overlap with draft UUAs.

Table 41. Alternative 5 draft Unroaded-Undeveloped Area (UUA) acreage and percent treated.

UUA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
Total Draft UUA Acres	18,183	9,529	27,168	29,900	8,074	92,854
Mechanical & Slash Burning (Acres)	513	669	1,621	2,426	285	5,514[1]
Mechanical & Slash Burning Percent of UUA being Treated	3%	7%	6%	8%	4%	6%
Prescribed Fire Mixed Burn Severities (Acres)	1,209	1,490	7,085	8,864	1,620	20,268
Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	725	894	4,251	5,318	972	12,161
Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	4%	9%	16%	18%	12%	13%
All Treatments Combined Percent of UUA Being Treated	7%	16%	22%	26%	16%	19%

[1]This includes 4,751 acres that overlap with IRAs.

Table 42. Alternative 5 Inventoried Roadless Area (IRA) and Draft Unroaded-Undeveloped Area (UUA) acreage and overlap for mechanical treatments only.

Stable Aspen IRA Only (Acres)	478
Stable Aspen UUA Only (Acres)	139
Stable Aspen IRA & UUA Overlap (Acres)	893
Seral Aspen IRA Only (Acres)	713
Seral Aspen UUA Only (Acres)	483
Seral Aspen IRA & UUA Overlap (Acres)	2,993
Spruce/Fir IRA Only (Acres)	916
Spruce/Fir UUA Only (Acres)	141
Spruce/Fir IRA & UUA Overlap (Acres)	864
Mixed Conifer IRA Only (Acres)	0
Mixed Conifer UUA Only (Acres)	0
Mixed Conifer IRA & UUA Overlap (Acres)	1
Total (Acres)	7,621

2.10 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. The major issues driving the alternatives and analysis include:

1. Impacts to wilderness attributes and roadless area characteristics resulting from mechanical treatments within IRAs and draft UUAs may result in these areas not being eligible for wilderness designation;
2. Prescribed fire activities may impact adjacent private property;
3. Project activities may result in Northern goshawks being displaced;
4. Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded.
5. Browsing by domestic and wild ungulates on new aspen shoots post-treatment and/or the continued high levels of aspen browsing in the stable aspen areas may result in complete loss of aspen stands;
6. Project activities may result in livestock permittees not having a place to graze their livestock while vegetation is reestablishing on Monroe Mountain (two, or more growing seasons); and
7. Project activities may result in adverse impacts to old growth characteristics.

The following tables and figures show the acreage comparisons between alternatives based on the acreages and miles of temporary roads (Table 43; Figure 36 through Figure 42); acreages by dominant vegetative types (Table 44); acreages by LRMP management areas (Table 45); acreages and percentages by IRA (Table 46); acreages and percentages by draft UUA (Table 47);

mechanical treatment acreages by IRA and draft UUA that overlap (Table 48), and number of Northern goshawk PFA and NA areas being mechanically treated (Table 49).

Table 43. Comparison of alternatives by acreages and miles of temporary roads

	Mechanical Treatments and Associated Slash Burning	Prescribed Fire - Mixed Burn Severities	Prescribed Fire – Mixed Burn Severities Factoring 60% of the Acres Get Burned	Total Acres	Total Acres Factoring 60% of Acres Get Burned	Miles of Temp Roads/Acres Disturbed
Alternative 1	0	0	0	0	0	0
Alternative 2	8,186	32,991	19,795	41,177	27,981	8.8/21
Alternative 3	13,647	31,357	18,814	45,004	32,461	8.8/21
Alternative 4	19,838	27,436	16,462	47,274	36,300	13.3/32
Alternative 5	15,072	26,453	15,872	41,525	30,944	12.8/31

Table 44. Comparison of alternatives by dominant vegetative type

	Existing Vegetation	Mechanical and Associated Slash Burning (Acres)	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned
Alternative 1	****	0	0	0
Alternative 2	Mixed Conifer	97	4,183	2,510
	Seral Aspen	3,146	15,159	9,095
	Stable Aspen	4,025	7,991	4,795
	Spruce/Fir	918	5,658	3,395
	Total	**8,186**	**32,991**	**19,795**
Alternative 3	Mixed Conifer	91	4,190	2,514
	Seral Aspen	6,422	14,318	8,591
	Stable Aspen	4,780	7,861	4,717
	Spruce/Fir	2,355	4,988	2,993
	Total	**13,648**	**31,357**	**18,814**
Alternative 4	Mixed Conifer	102	4,178	2,507
	Seral Aspen	9,492	12,763	7,658
	Stable Aspen	6,130	6,693	4,016
	Spruce/Fir	4,113	3,802	2,281
	Total	**19,837**	**27,436**	**16,462**
Alternative 5	Mixed Conifer	91	4,190	2,514
	Seral Aspen	6,736	11,676	7,006
	Stable Aspen	5,340	6,777	4,066
	Spruce/Fir	2,905	3,810	2,286
	Total	**15,072**	**26,453**	**15,872**

Table 45. Comparison of Alternatives by LRMP MA on Monroe Mountain

	LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
	Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
Alternative 1	Acres Being Treated	0	0	0	0	0	0	0
Alternative 2	Mechanical & Slash Burning (Acres)	0	13	7,526	3	215	367	61
	Mechanical & Slash Burning Percent of MA being Treated	0%	2%	7%	0%	1%	7%	0%
	Prescribed Fire Mixed Burn Severities (Acres)	6	189	20,238	784	7,110	2,151	2,512
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	113	12,143	470	4,266	1,291	1,507
	Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	14%	12%	2%	21%	23%	9%
	All Treatments Combined Percent of MA Being Treated	1%	15%	19%	2%	22%	30%	10%
Alternative 3	Mechanical & Slash Burning (Acres)	0	37	12,210	3	466	854	77
	Mechanical & Slash Burning Percent of MA being Treated	0%	4%	12%	0%	2%	16%	0%
	Prescribed Fire Mixed Burn Severities (Acres)	6	201	18,785	787	7,000	2,027	2,551
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	121	11,271	472	4,200	1,216	1,531
	Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	15%	11%	2%	20%	22%	10%
	All Treatments Combined Percent of MA Being Treated	1%	19%	22%	2%	23%	38%	10%
Alternative 4	Mechanical & Slash Burning (Acres)	0	53	17,141	3	778	1,728	135
	Mechanical & Slash Burning Percent of MA being Treated	0%	6%	16%	0%	4%	31%	1%
	Prescribed Fire Mixed Burn Severities (Acres)	6	196	15,675	787	6,785	1,469	2,518
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	118	9,405	472	4,071	881	1,511

	LRMP MA on Monroe Mountain	2B - Rural + Roaded Natural Recreation	4A - Fish Habitat Improvement	4B - Habitat for Management Indicator Species	5A - Big Game Winter Range-Non-Forested	6B - Intensive Livestock Management	7B - Wood Fiber Products-Through Genetics	9F - Improved Watershed
	Total MA Acres on Monroe Mountain	434	831	104,798	27,279	20,661	5,496	15,920
	Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	14%	9%	2%	20%	16%	9%
	All Treatments Combined Percent of MA Being Treated	1%	21%	25%	2%	23%	47%	10%
Alternative 5	Mechanical & Slash Burning (Acres)	0	70	13,162	0	602	1,142	96
	Mechanical & Slash Burning Percent of MA being Treated	0%	8%	13%	0%	3%	21%	1%
	Prescribed Fire Mixed Burn Severities (Acres)	6	132	14,769	787	6,850	1,377	2,532
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	4	79	8,861	472	4,110	826	1,519
	Prescribed Fire Mixed Burn Severities Percent of MA Being Treated	1%	10%	8%	2%	20%	15%	10%
	All Treatments Combined Percent of MA Being Treated	1%	18%	21%	2%	23%	36%	10%

Table 46. Comparison of Alternatives by Inventoried Roadless Area (IRA)

	IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
	Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
Alternative 1	Acres Being Treated	0	0	0	0	0	0
Alternative 2	Mechanical & Slash Burning (Acres)	42	327	217	862	61	1,509
	Mechanical & Slash Burning Percent of IRA being Treated	0%	3%	1%	3%	1%	2%
	Prescribed Fire Mixed Burn Severities (Acres)	816	2,615	6,707	13,492	2,001	25,632
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	490	1,569	4,024	8,095	1,201	15,379

	IRA	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All IRAs Combined
	Total IRA Acres	12,152	11,472	22,611	30,870	9,261	86,366
	Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	14%	18%	26%	13%	18%
	All Treatments Combined Percent of IRA Being Treated	4%	17%	19%	29%	14%	20%
Alternative 3	Mechanical & Slash Burning (Acres)	223	1,422	925	2,439	122	5,131
	Mechanical & Slash Burning Percent of IRA being Treated	2%	12%	4%	8%	1%	6%
	Prescribed Fire Mixed Burn Severities (Acres)	857	1,814	6,679	12,718	2,061	24,129
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	514	1,088	4,007	7,631	1,237	14,477
	Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	9%	18%	25%	13%	17%
	All Treatments Combined Percent of IRA Being Treated	6%	22%	22%	33%	15%	23%
Alternative 4	Mechanical & Slash Burning (Acres)	278	2,142	1,637	5,009	196	9,262
	Mechanical & Slash Burning Percent of IRA being Treated	2%	19%	7%	16%	2%	11%
	Prescribed Fire Mixed Burn Severities (Acres)	857	1,228	6,246	10,661	2,061	21,053
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	514	737	3,748	6,397	1,237	12,632
	Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	4%	6%	17%	21%	13%	15%
	All Treatments Combined Percent of IRA Being Treated	7%	25%	24%	37%	15%	25%
Alternative 5	Mechanical & Slash Burning (Acres)	317	1,228	1,517	3,478	317	6,857
	Mechanical & Slash Burning Percent of IRA being Treated	3%	11%	7%	11%	3%	8%
	Prescribed Fire Mixed Burn Severities (Acres)	540	1,714	5,593	11,055	1,744	20,646
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	324	1,028	3,356	6,633	1,046	12,388
	Prescribed Fire Mixed Burn Severities Percent of IRA Being Treated	3%	9%	15%	21%	11%	14%
	All Treatments Combined Percent of IRA Being Treated	5%	20%	22%	33%	15%	22%

Table 47. Comparison of Alternatives by draft UUA

	Draft Unroaded-Undeveloped Area (UUA)	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
	Total Draft UUA Acres	18,183	9,529	27,168	29,900	8,074	92,854
Alternative 1	Acres Being Treated	0	0	0	0	0	0
Alternative 2	Mechanical & Slash Burning (Acres)	79	127	220	583	42	1,051
	Mechanical & Slash Burning Percent of UUA being Treated	0%	1%	1%	2%	1%	1%
	Prescribed Fire Mixed Burn Severities (Acres)	1,645	2,033	8,296	10,530	1,864	24,368
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	987	1,220	4,978	6,318	1,118	14,621
	Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	5%	13%	18%	21%	14%	16%
	All Treatments Combined Percent of UUA Being Treated	6%	14%	19%	23%	14%	17%
Alternative 3	Mechanical & Slash Burning (Acres)	268	685	1,016	1,536	56	3,561
	Mechanical & Slash Burning Percent of UUA being Treated	1%	7%	4%	5%	1%	4%
	Prescribed Fire Mixed Burn Severities (Acres)	1,722	1,490	8,263	10,454	1,906	23,835
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	1,033	894	4,958	6,272	1,144	14,301
	Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	6%	9%	18%	21%	14%	15%
	All Treatments Combined Percent of UUA Being Treated	7%	17%	22%	26%	15%	19%
Alternative 4	Mechanical & Slash Burning (Acres)	363	1,033	1,918	3,283	56	6,653
	Mechanical & Slash Burning Percent of UUA being Treated	2%	11%	7%	11%	1%	7%
	Prescribed Fire Mixed Burn Severities (Acres)	1,722	1,141	7,706	9,174	1,906	21,649
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	1,033	685	4,624	5,504	1,144	12,989

	Draft Unroaded-Undeveloped Area (UUA)	Langdon	Little Creek	Marysvale Peak	Signal Peak	Tibadore	All Draft UUAs Combined
	Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	6%	7%	17%	18%	14%	14%
	All Treatments Combined Percent of UUA Being Treated	8%	18%	24%	29%	15%	21%
Alternative 5	Mechanical & Slash Burning (Acres)	513	669	1,621	2,426	285	5,514
	Mechanical & Slash Burning Percent of UUA being Treated	3%	7%	6%	8%	4%	6%
	Prescribed Fire Mixed Burn Severities (Acres)	1,209	1,490	7,085	8,864	1,620	20,268
	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	725	894	4,251	5,318	972	12,161
	Prescribed Fire Mixed Burn Severities Percent of UUA Being Treated	4%	9%	16%	18%	12%	13%
	All Treatments Combined Percent of UUA Being Treated	7%	16%	22%	26%	16%	19%

Table 48. IRA and draft UUA Acreage Overlap

Acreages	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Stable Aspen IRA Only	0	148	403	901	478
Stable Aspen UUA Only	0	14	46	153	139
Stable Aspen IRA & UUA Overlap	0	220	366	880	893
Seral Aspen IRA Only	0	223	929	1,384	713
Seral Aspen UUA Only	0	81	361	732	483
Seral Aspen IRA & UUA Overlap	0	493	2,021	3,385	2,993
Spruce/Fir IRA Only	0	211	754	1,434	916
Spruce/Fir UUA Only	0	29	109	226	141
Spruce/Fir IRA & UUA Overlap	0	206	657	1,267	864
Mixed Conifer IRA Only	0	0	0	0	0
Mixed Conifer UUA Only	0	1	0	0	0
Mixed Conifer IRA & UUA Overlap	0	7	1	11	1
Total	0	1,633	5,647	10,373	7,621

Table 49. Number of Goshawk nest areas (NAs) and post-fledgling areas (PFAs) being mechanically treated

	Number of PFAs Being Mechanically Treated	Number of NAs Being Mechanically Treated
Alternative 1	0	0
Alternative 2	0	0
Alternative 3	17	0
Alternative 4	17	17
Alternative 5	2	0

2.11 Alternatives Considered but Eliminated from Further Analysis and Record of the Evolution of the Proposed Action and Alternatives

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Notice of Intent provided suggestions for alternative methods for achieving the purpose and need. These alternatives may not have been carried forward for additional analysis because they were outside the scope of the purpose and need, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. The following alternatives were considered, but not carried forward for additional analysis in this draft environmental impact statement for reasons summarized below. This section also serves as the record to show the evolution of the proposed action and alternatives from the NOI, the development of the proposed action, the development of the alternatives, and through the writing of this draft environmental impact statement.

2.11.1 No Mechanical Thinning Treatments within Inventoried Roadless Areas, draft Unroaded-Undeveloped Areas

The Forest considered an alternative to exclude all mechanical thinning treatments within IRAs and UUAs. However, this alternative was not carried forward for additional analysis because by excluding mechanical thinning treatments within these areas, fire personnel would not be able to safely and effectively use prescribed fire to restore aspen ecosystems, move aspen towards desired conditions, and meet the purpose and need of this project while minimizing impacts to private property, old growth areas, Northern goshawk home ranges, and important aquatic resources. The current fuel-loads in these areas are not conducive to the safe utilization of prescription fire only.

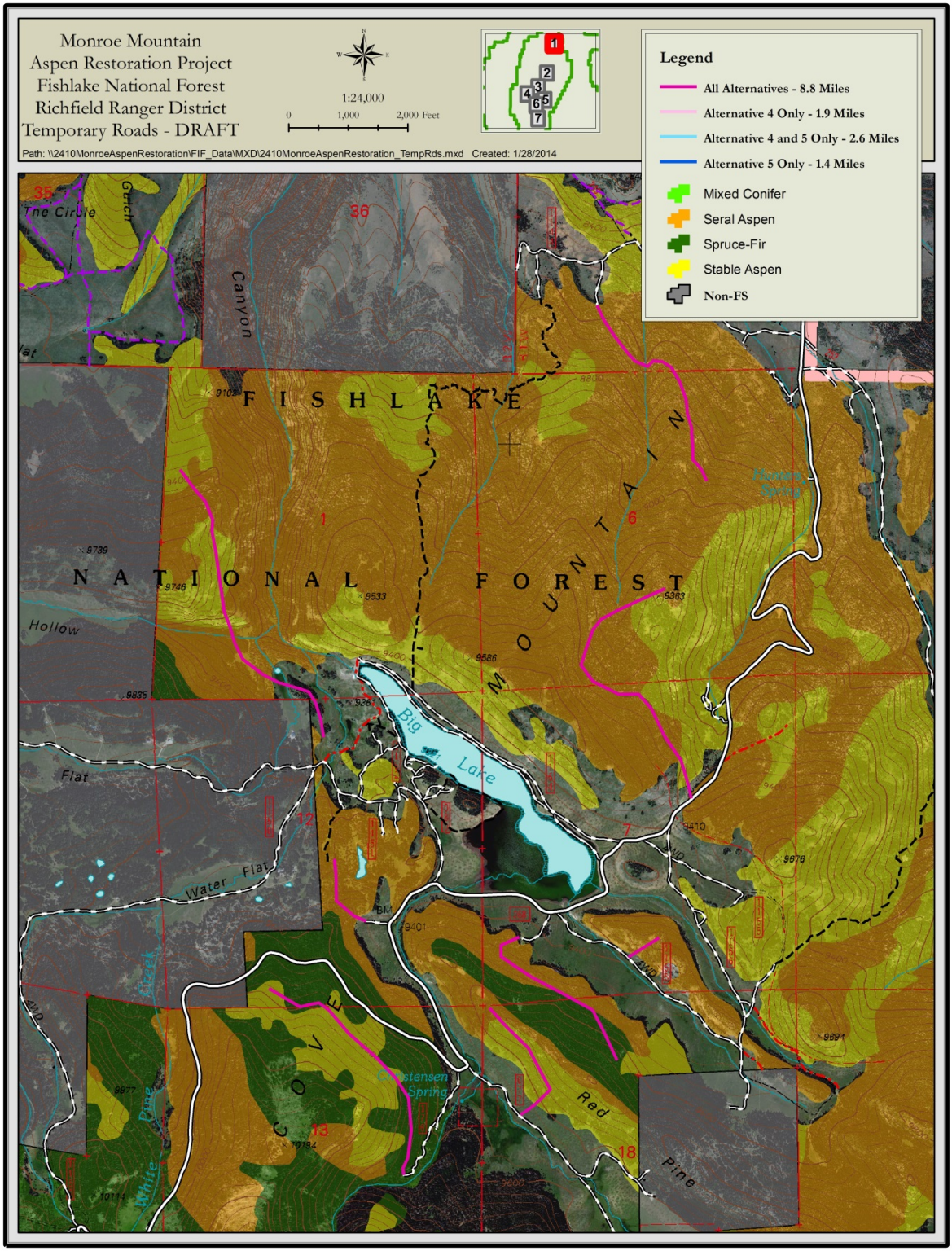


Figure 36. Area 1 temporary roads

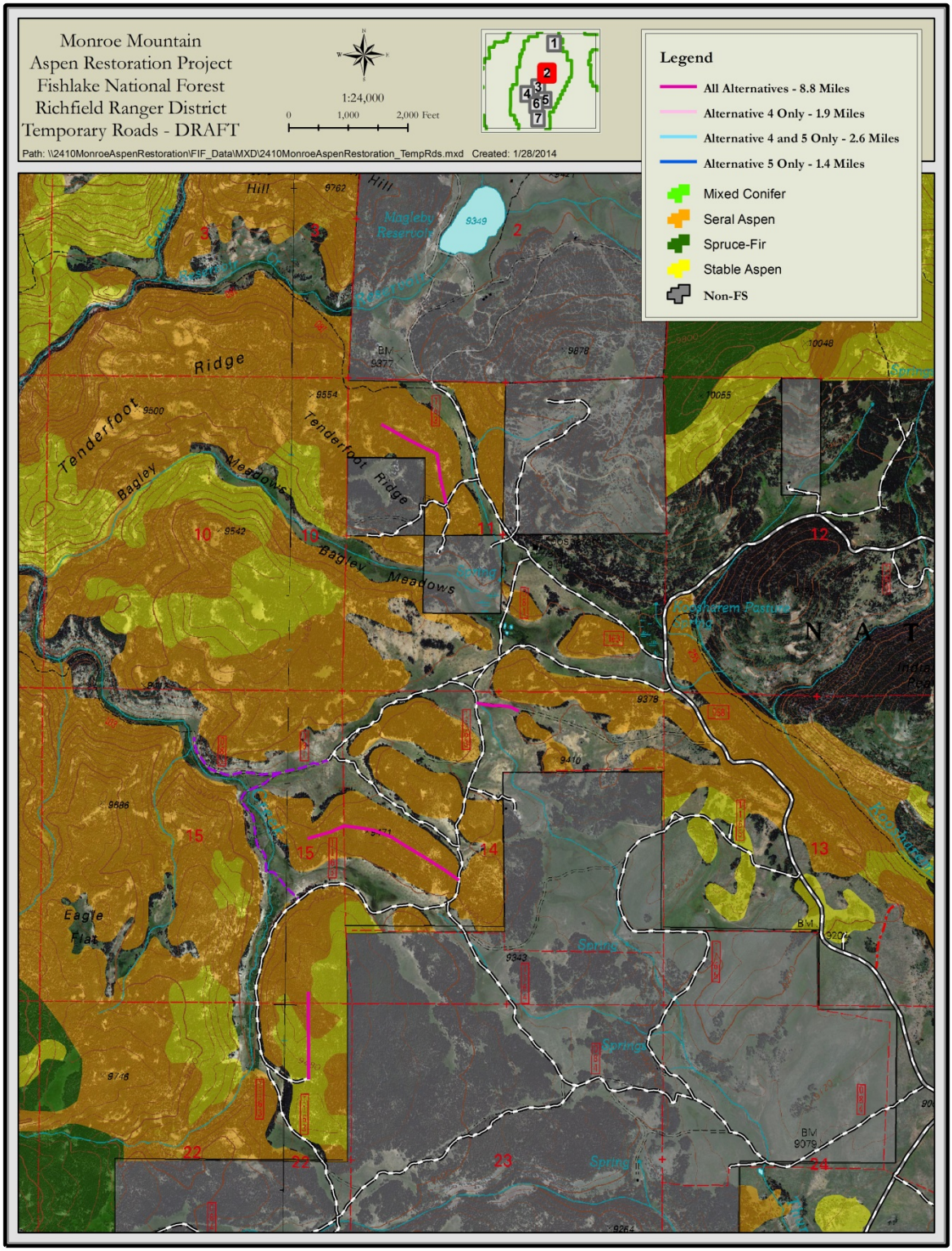


Figure 37. Area 2 temporary roads

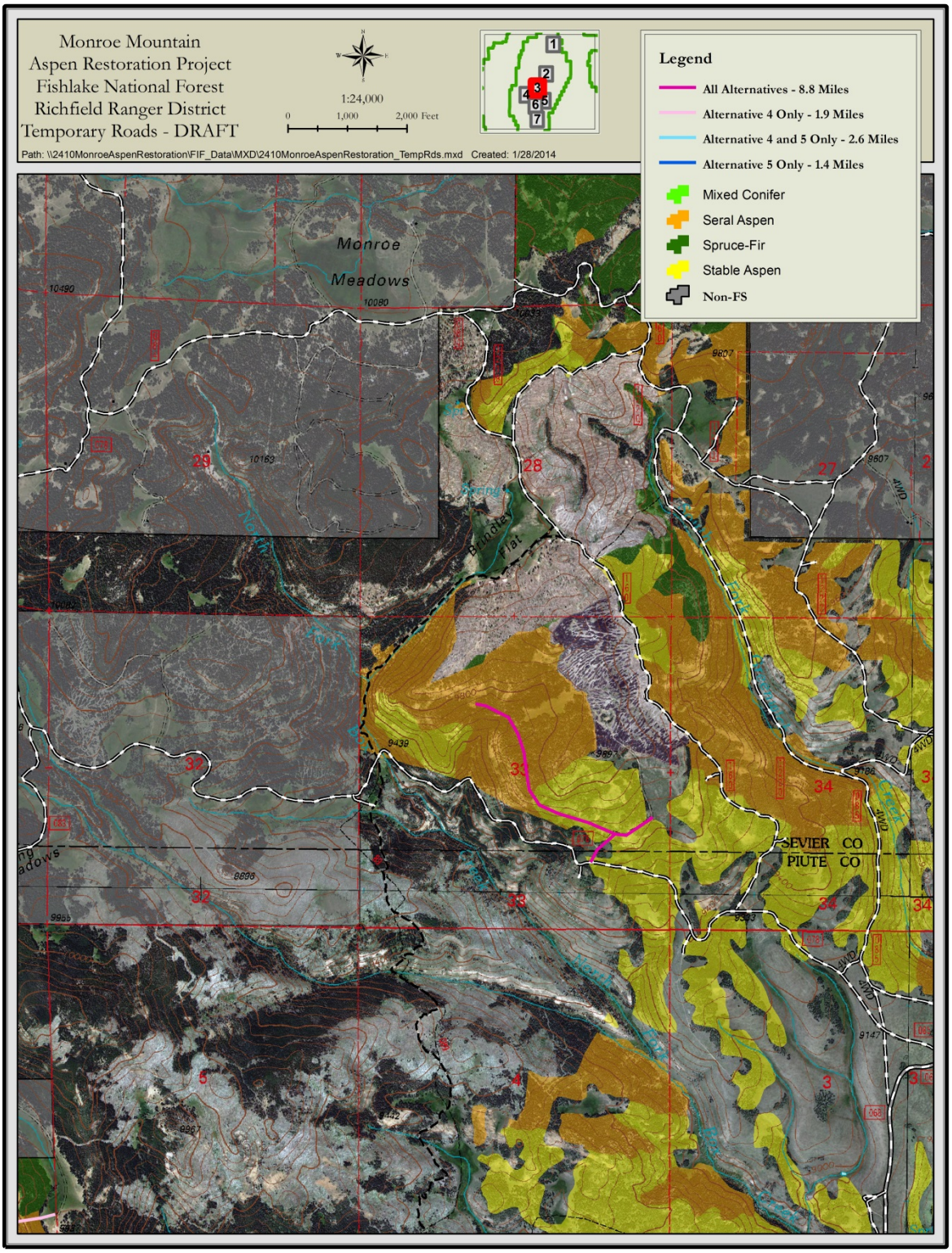


Figure 38. Area 3 temporary roads

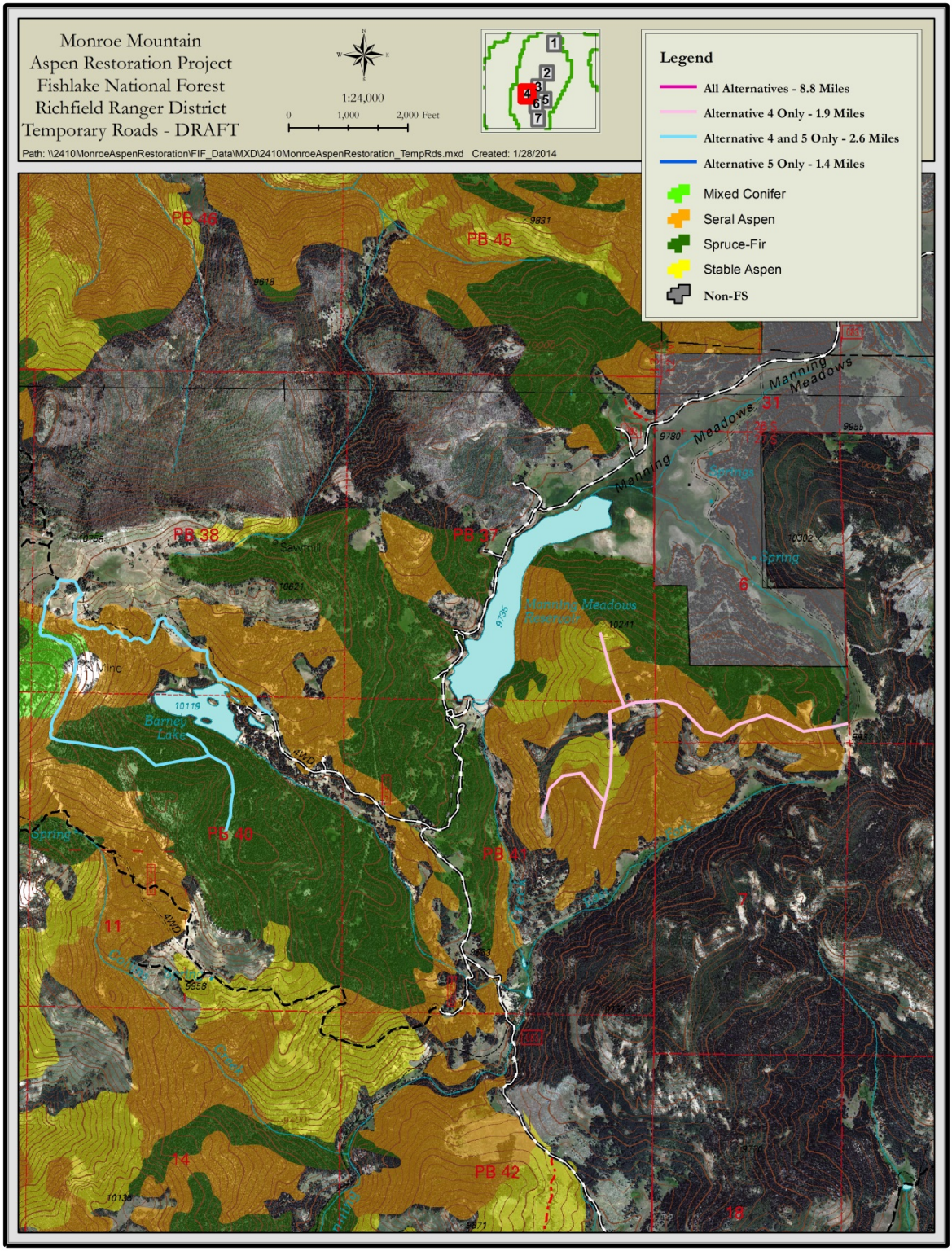


Figure 39. Area 4 temporary roads

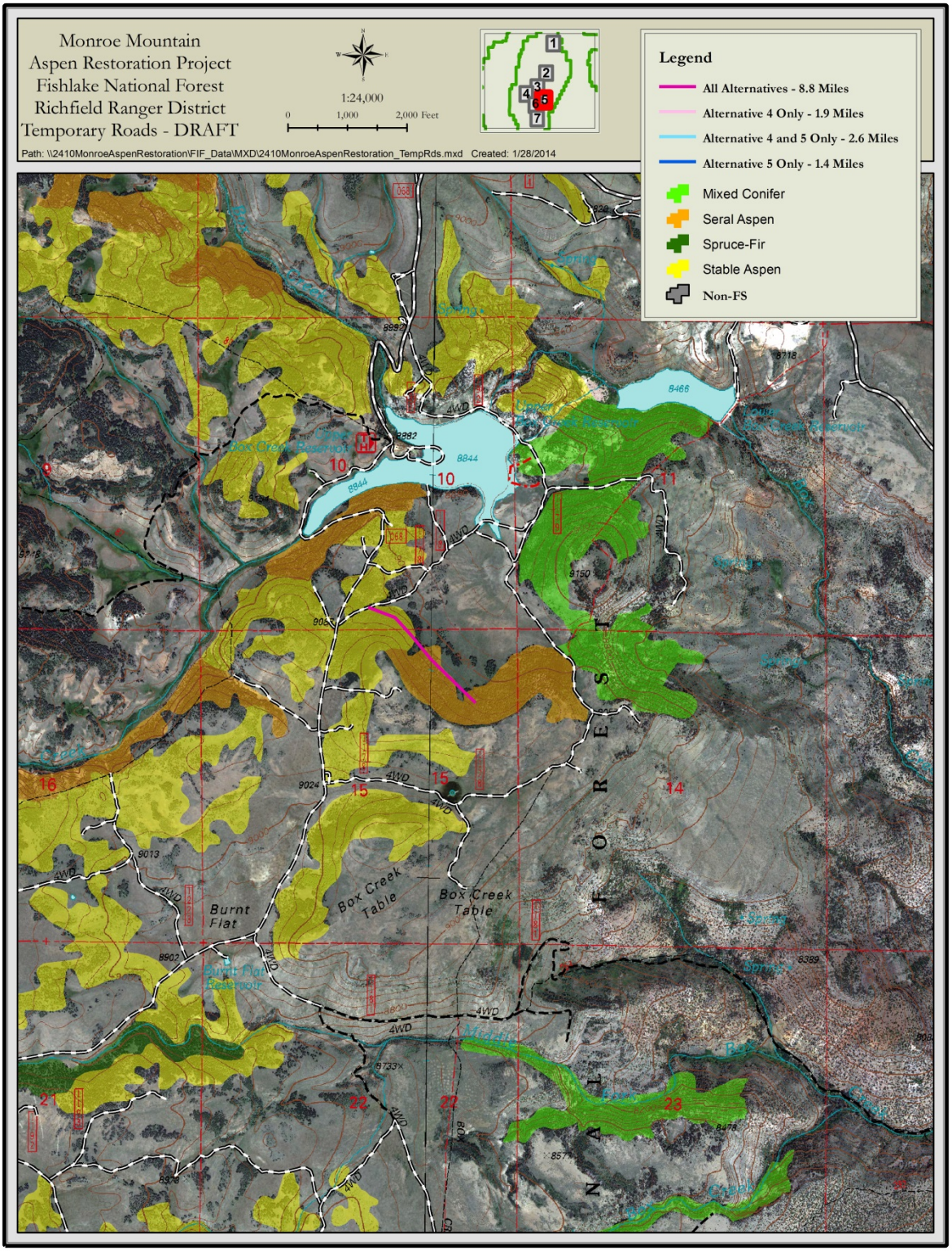


Figure 40. Area 5 temporary roads

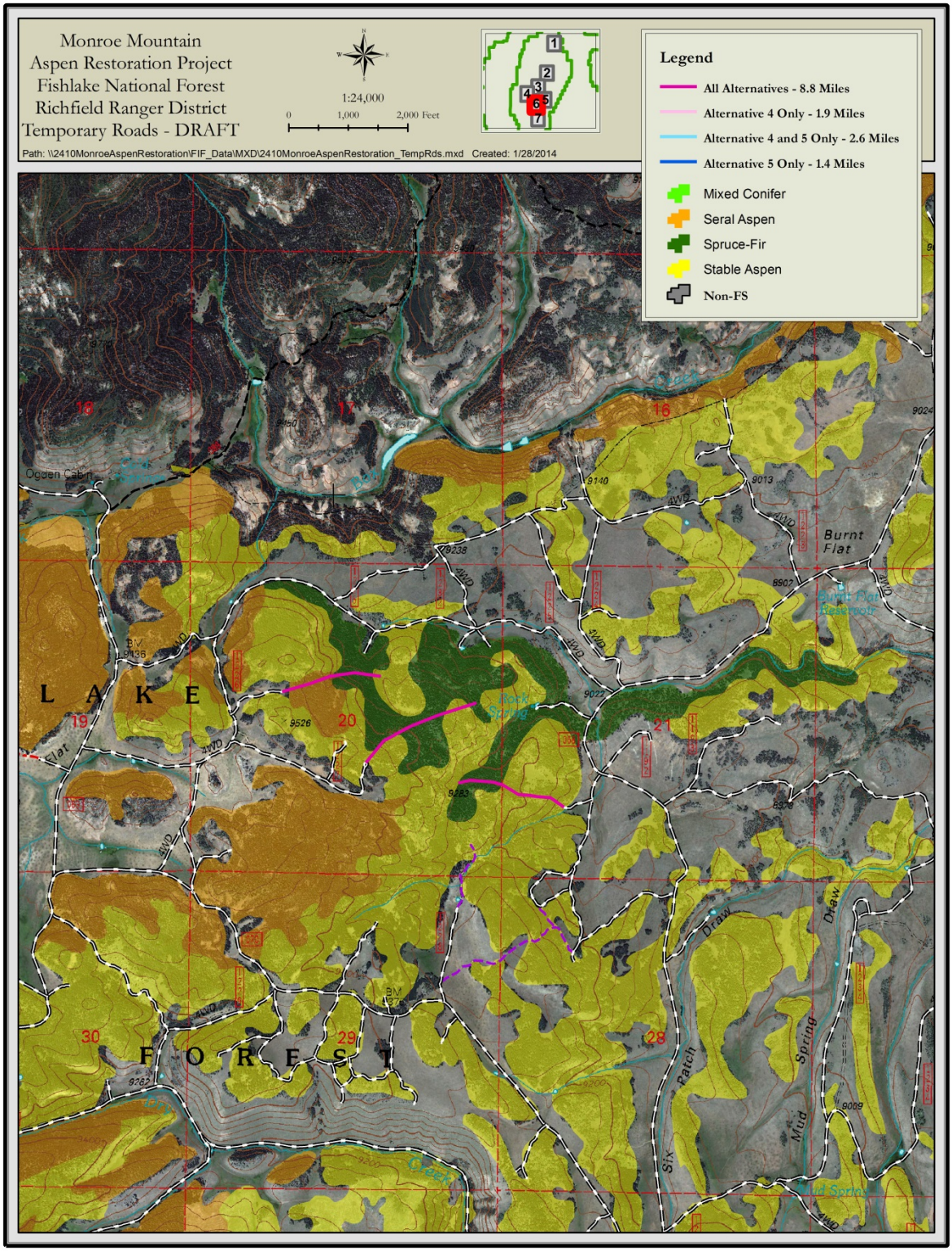


Figure 41. Area 6 temporary roads

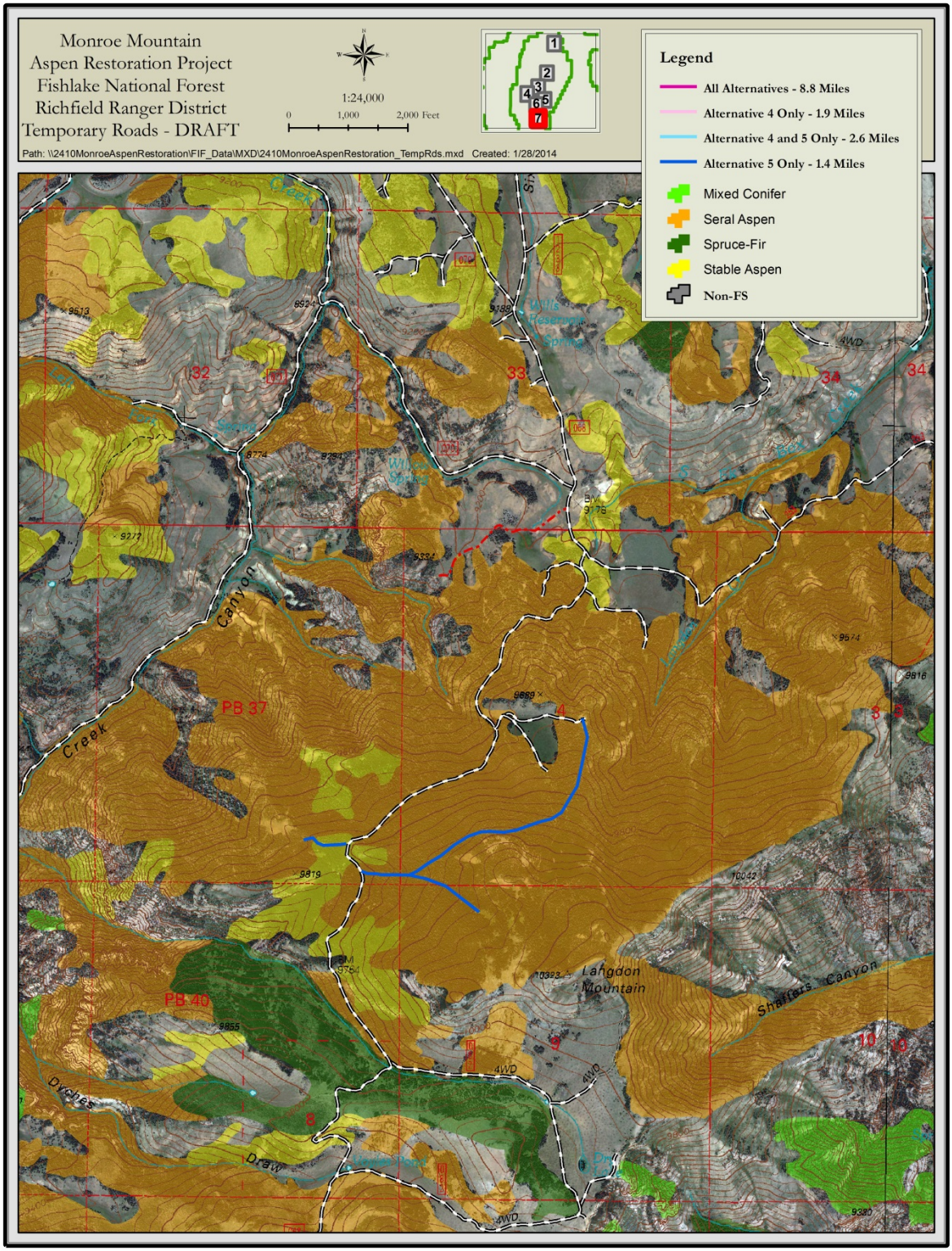


Figure 42. Area 7 temporary roads

2.11.2 Clearcut Seral and Stable Aspen Stands

The Forest considered an alternative to clearcut seral and stable aspen stands and any mixed conifer that may be in those stands. Although this alternative would likely result in the maximum response of aspen suckering and regrowth it was not carried forward for additional analysis due to the following:

1. Visual concerns (related to wilderness attributes and roadless area characteristics); and,
2. The existing multi-height aspen would be lost resulting in a longer timeframe to accomplish the desired condition of having multi-height aspen.
3. Old growth concerns.

2.11.3 Remove conifer first. If the remaining aspen have a stand density index greater than 140, then thin the remaining aspen to a stand density index of 140.

For treatments in seral and stable aspen stands, the Forest considered a proposal to remove the conifer from an aspen stand first. If the remaining aspen had a stand density index greater than 140, then the remaining aspen would be thinned to a stand density index of 140. This alternative would likely stimulate aspen suckering due to the disturbance from removing conifer and perhaps some aspen. However, this alternative was not carried forward for additional analysis due to the following:

1. It would be difficult to implement as marking and treating these stands would require a high level of expertise that is not available on the scale needed to implement the project; and,
2. Implementation of this alternative would be more costly compared to just removing conifers.

2.11.4 Temporary Fencing of all Treated Areas to Exclude Ungulate Browsing on Aspen Shoots

The Forest considered an alternative to install temporary fence around all the treatment areas to exclude browsing of aspen shoots by both wild and domestic livestock. However, this alternative was not carried forward for additional analysis due to the following:

1. The extent of the project area and the associated expense to fence (approximately 4 dollars per foot for materials and construction) (maintenance cost for 4 to 6years would be additional); and,
2. Fencing all treatment areas does not address overbrowsing as one of the underlying causes for aspen decline on Monroe Mountain.

2.11.5 Sequencing – Begin mechanical and prescribed fire treatments on the north end of Monroe Mountain and work in a southerly direction.

The Forest considered an alternative to begin mechanical and prescribed fire treatments on the north end of Monroe Mountain and work in a southerly direction. Wildlife studies on Monroe Mountain indicate the highest wildlife (elk and deer) use on Monroe Mountain occurs in the central portion followed by the northerly portion with the least use occurring in the southerly portion. Beginning treatments in the south where wildlife use is less, the District would be able to monitor treatments, learn, and adjust prior to initiating treatments in the north and central portions where wildlife use is higher. After considering the distribution of wildlife on Monroe Mountain, the alternative of beginning treatments in the north and working in a southerly direction was not carried forward for additional analysis (Figure 22).

2.11.6 Jack-strawing within all mechanical treatment areas

The District considered an alternative to leave additional material than what is required by the Land and Resource Management Plan in all the mechanical treatment areas to assist with jack-strawing (leaving material on the ground to help impede ungulates from moving into newly treated areas). However, this alternative was not carried forward for additional analysis due to:

1. If extra material for jack-strawing was left on the ground it would be more difficult for fire personnel to safely and effectively implement prescribed fire while minimizing impacts to private property, Northern goshawks, Bonneville cutthroat trout, and Boreal toads;
2. After the Oldroyd fire in 2000, fire crews purposely jack-strawed material in areas that burned. However, this jack-strawing was not effective as ungulates were still able to access burned areas and browse new aspen shoots;
3. Jack-strawing would be an additional cost to implementing the mechanical treatments; and,
4. Material being left for jack-strawing may attract bark beetles, thus increasing the risk of infestation to otherwise healthy trees.

Although the District did not consider jack-strawing to occur within all mechanical treatment areas, jack-strawing on a small scale, in site-specific areas to help impede ungulate access is still warranted, and could occur.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative by the issues outlined in chapter 1 and 2. It also presents the scientific and analytical basis for the comparison of alternatives presented here. The detailed analyses presented in this document are only for those resources that were identified as issues in chapter 1 and 2. All other resource analyses can be found in the specific specialists resource reports that are hereby incorporated by reference (see section 3.7). The referenced specialist reports are available for viewing on the Fishlake National Forest's website: www.fs.usda.gov/projects/fishlake/landmanagement/projects.

3.1 Issue 1 – Impacts to wilderness attributes and roadless area characteristics resulting from mechanical treatments within inventoried roadless areas and draft unroaded-undeveloped areas may result in these areas not being eligible for wilderness designation

This discussion is extrapolated directly from the Inventoried Roadless Areas and Draft Unroaded-Undeveloped Areas Specialist Report (Christensen 2014a).

3.1.1 Affected Environment

Inventoried Roadless Areas (IRAs) represent some of the largest and most extensive tracts of undeveloped land; having pristine, sensitive, and roadless characteristics (USFS 1976). Theoretically, to be classified as an IRA, areas must not contain constructed roads and generally are at least 5,000 acres. A roadless area is also defined as an area that meets the minimum criteria for wilderness. The Monroe Mountain Aspen Ecosystems Restoration Project includes five IRAs that may be affected. These include Signal Peak, Little Creek, Marysvale Peak, Tibadore, and Langdon. These five IRAs cover a total 86,366 acres, which is 49 percent of the project area for the EIS. Within these IRAs, there are many examples of modern human control, manipulation, and civilization in the form of structures, roads (including constructed roads), and other evidence of occupation. The experience of solitude and primitive unconfined recreation is hard to find due to motorized roads and trails, private land developments, dams, waterlines, ditches, relatively skinny strips of IRA, mining, range improvements, and timber harvest. There are beautiful landscape features and views of the surrounding valleys. Only the south portion of the Signal Peak IRA seems to hold a reasonable opportunity for manageability as wilderness due to its size and roadless characteristics (see Figure 43).

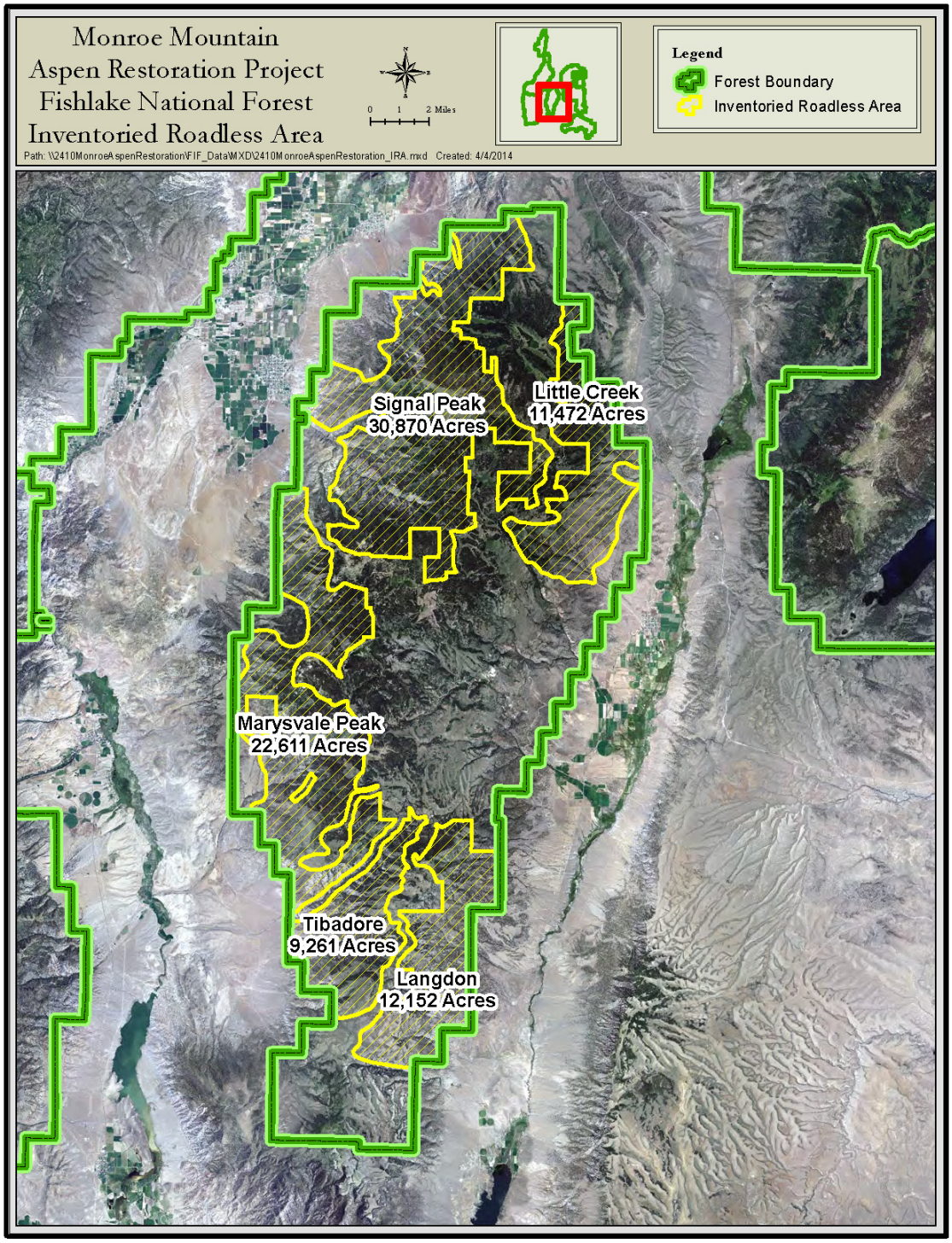


Figure 43. Existing Inventoried Roadless Areas (IRAs) and acreages on Monroe Mountain

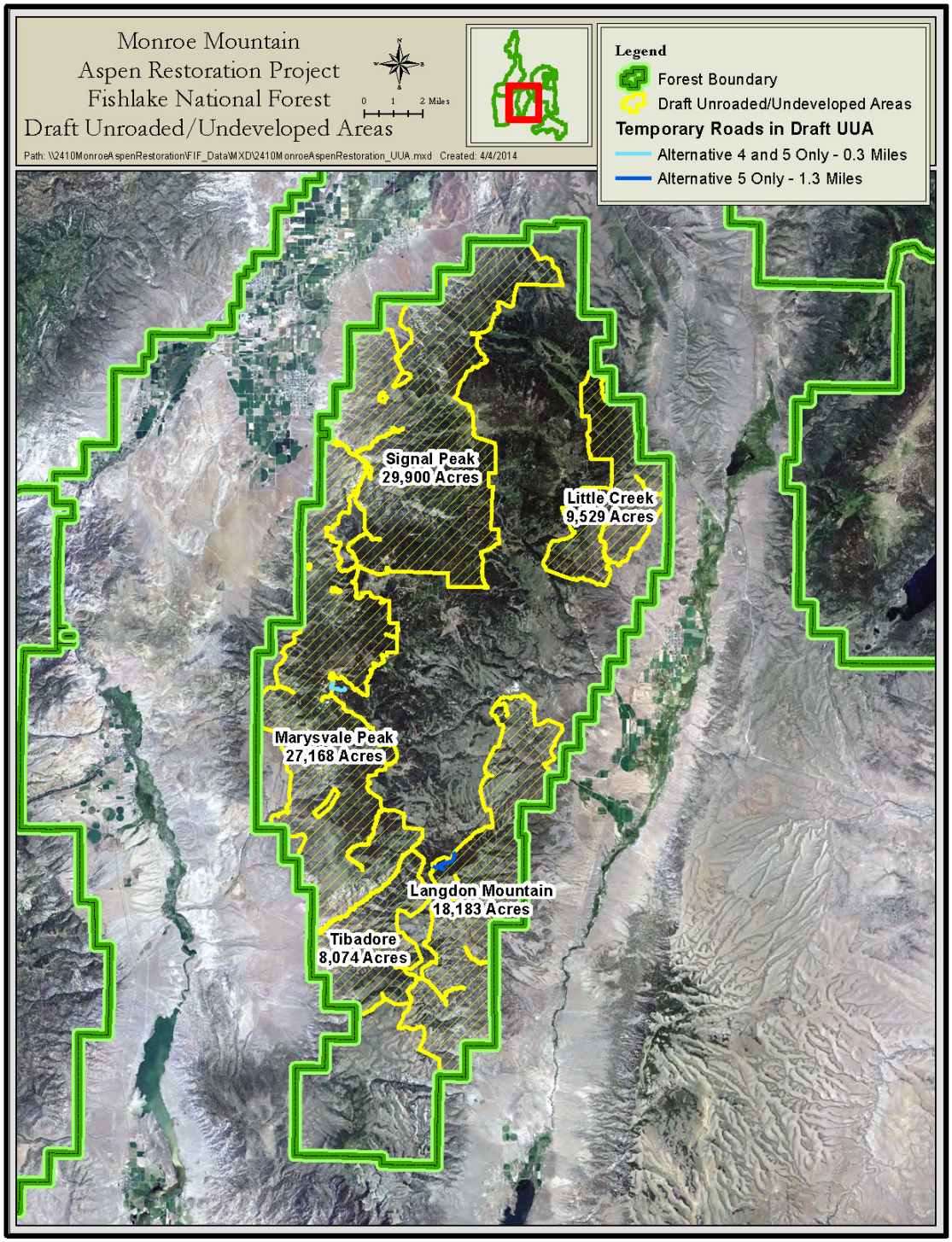


Figure 44. Existing draft Unroaded-Undeveloped Areas (UUAs) and acreages on Monroe Mountain

Within the Monroe Mountain Aspen Ecosystems Restoration Project area there are also five draft Unroaded-Undeveloped Areas (USFS 2004b; UUAs) of the same names and general locations as the five IRAs. These areas represent the latest draft inventory data for areas with potential wilderness qualities or attributes. The term "undeveloped area" refers to a geographic area usually of at least 5,000 acres, without developed and maintained roads, and substantially natural. There is no policy, law, or directive guiding the management of identified draft unroaded-undeveloped areas that lie outside of IRAs or wilderness areas. These five draft UUAs cover a total of 92,854 acres, which is 53 percent of the project area for the EIS. Within these draft UUAs there are many examples of modern human control, manipulation, and civilization in the form of structures, roads, and other evidence of occupation. The experience of solitude and primitive unconfined recreation is hard to find due to motorized roads and trails, private land developments, dams, waterlines, ditches, relatively skinny strips of draft UUA, mining, range improvements, and power lines. There are beautiful landscape features and views of the surrounding valleys. Only the south portion of the Signal Peak draft UUA seems to hold a reasonable opportunity for manageability as wilderness due to its size and roadless characteristics (see Figure 44).

Figure 44 on the following page displays the existing Monroe Mountain draft UUAs and their associated acreages.

Table 50 through Table 57 describe the existing conditions of the IRAs and draft UUAs on Monroe Mountain. Table 58 through Table 61 outline the wilderness quality or attributes and the roadless characteristics for each IRA and draft UUA.

Table 50. General descriptions of existing Inventoried Roadless Areas (IRAs) on Monroe Mountain (USFS 1983).

	Signal Peak IRA	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Total Acres	30,870	11,472	22,611	9,261	12,152
% Project Area	18%	7%	13%	5%	7%
Location	Northwest	Northeast	Middle West	Southwest	Southeast
Area Description	Very irregular in shape with six less than 2 mile wide strips and a larger south central area of 7 by 5 miles	Very irregular in shape with the widest point being 3 miles wide and 10 miles long	Very irregular in shape with the widest point being 3 miles wide and 14 miles long	Irregular in shape with the widest point being 3.5 miles wide and 7 miles long	Very irregular in shape with the widest point being 3 miles wide and 8 miles long
Adjacent Lands to the West	Private, BLM, National Forest	Private, National Forest	Private, BLM, National Forest	BLM, State, National Forest	National Forest
Adjacent Lands to the East	Private, National Forest	Private, BLM, National Forest	Private, National Forest	National Forest	Private, State, BLM

Table 51. General descriptions of existing draft Unroaded-Undeveloped Areas (UUAs) on Monroe Mountain

	Signal Peak UUA	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Total Acres	29,900	9,529	27,168	8,074	18,183
% Project Area	17%	5%	15%	5%	10%
Location	Northwest	Northeast	Middle West	Southwest	Southeast
Area Description	Very irregular in shape with a long less than 3 mile wide area and a larger south central area of 6 by 5 miles	Very irregular in shape with the widest point being 2 miles wide and 7 miles long	Very irregular in shape with the widest point being 4 miles wide and 16 miles long	Irregular in shape with the widest point being 3 miles wide and 5 miles long	Very irregular in shape with the widest point being 3 miles wide and 13 miles long
Adjacent Lands to the West	Private, State, BLM, National Forest	Private, National Forest	Private, BLM, National Forest	BLM, State, National Forest	National Forest
Adjacent Lands to the East	Private, National Forest	Private, BLM, National Forest	Private, National Forest	National Forest	State, Private, BLM, National Forest

Table 52. Existing IRA system roads and trails

System Routes	**Signal Peak IRA**	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Level 2 Roads (Open to all vehicles, yet may be very rough)	**About 4 miles** #1209, #2700, #1211, #1148, #080, #288, #068 #1150, #2037	**About 4 miles** #2004, #1159, #1160, #166	**About 4.5 miles** #075, #1185, #1187, #1188, #1189, #1194, #1230, #182	**About 1.5 miles** #1782, #1196, #1197, #200	**About 1.5 miles** #1809, #1202
Level 1 Roads (Administrative use only)	**About 5.5 miles** #168, #170, #171, #172, #810	**About 0.5 mile** Little Creek			**About 2 miles** Dead Horse Rock Canyon
Trails Open to All Vehicles	**About 0.5 mile** #762, #984, #932	**About 0.5 mile** #911, #912, #909, #910	**About 2 miles** #915, #919, #920 #916, #917, #918 #922, #924, #992 #926, #925	**About 0.5 mile** #941	**About 0.0625 mile** #971

System Routes	Signal Peak IRA	Little Creek IRA	Marysvale Peak IRA	Tibadore IRA	Langdon IRA
60" Motorized Trails	**About 4.5 miles** #950, #956, #763 #763A, #955, #761, #762, #761A, #761B	**About 0.25 mile** #913	**About 0.5 mile** #812, #814, #923		**About 5 miles** #868, PST63
50" Motorized Trails	**About 2 miles** PST 66	**About 7.5 miles** #764, #767 #260, #807, #793, Paiute 01	**About 12 miles** PST65, #088, #088A, #088B, #088C, #088D, #194, #837, #840 #841, #842, #833 #834, #843, #835 #845, #898, #969		**About 2 miles** #250, #859, #856
Total Miles of System Roads and Trails	**16.5 miles**	**12.75 miles**	**19 miles**	**2 miles**	**10.5 miles**

Table 53. Existing IRA non-system roads

Non-System Roads	Signal Peak IRA	Little Creek IRA	Marysvale Peak IRA	Tibadore IRA	Langdon IRA
Closed roads that still have a constructed footprint on the ground	**About 3.5 miles** Norton Creek Bertelson Can. Nielson Can. Signal Peak	**About 3 miles** Kinney Spring Little Creek East Hunter Flat	**About 2.5 miles** Live Oak Bean Hill Manning Cr. Straight Can. Dry Canyon	**About 2 miles** Tuft Draw Buck Hollow Hell Hole	

Table 54. Existing draft UUA system roads and trails

System Routes	Signal Peak UUA	Little Creek UUA	Marysvale Peak UUA	Tibadore UUA	Langdon UUA
Level 2 Roads (Open to all vehicles, yet may be very rough)	**About 0.5 mile** #1209, #2700	**About 0.5 mile** #1159			**About 0.5 mile** #068X, #082B

System Routes	Signal Peak UUA	Little Creek UUA	Marysvale Peak UUA	Tibadore UUA	Langdon UUA
Level 1 Roads (Administrative use only)		**About 0.5 mile** Little Creek			
Trails Open to All Vehicles					
60" Motorized Trails	**About 1 mile** #763, #103, #761 #761A, #763A				**About 3 miles** PST63
50" Motorized Trails	**About 2 miles** PST 66	**About 4 miles** #260, #807, #793	**About 14 miles** PST65, #088, #088A, #088B, #088C, #088D, #815A, #815B, #194, #837, #840 #841, #842, #833 #834, #843, #835 #089, #898, #969		**About 9 miles** #250, #859, #853, #852, PST53, PST53A, PST33, #856
Total Miles of System Roads and Trails	**3.5 miles**	**5 miles**	**14 miles**		**12.5 miles**

Table 55. Existing draft UUA non-system roads

Non-System Roads	Signal Peak UUA	Little Creek UUA	Marysvale Peak UUA	Tibadore UUA	Langdon UUA
Closed roads that still have a constructed footprint on the ground	**About 4 miles** Red Butte Can. Thompson Cr. Winget Can. Bertelson Can. Order Dugway Nielson Can.	**About 3 miles** Kinney Spring Little Creek East Hunter Flat	**About 3 miles** Oak Flat Live Oak Dry Canyon Manning Cr. Straight Can. Bean Hill	**About 1 mile** Tuft Draw	

Table 56. Existing IRA human developments and structures

	Signal Peak IRA	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Range Improvements	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines, tanks and fences
Culinary Water Developments	Norton Creek Monroe Creek				
Irrigation Water Developments	Serviceberry Cr.	Koosharem Can.	Anderson Can. Flat Canyon		
Waterlines and Pipelines	Norton Creek Monroe Canyon	Koosharem Can.	Anderson Can. Flat Can.		
Dams	Annabella Res. Deep Lake Washburn Res.		Hunts Lake (Upper & Lower)		
Ditches	Deep Lake Annabella		Hunts Lake Manning Creek Concrete		
Timber Harvest	Monument Peak Annabella Cove Mtn. Monroe Peak Whooton Spr.	Doe Flat	Dry Creek Nielson Can. Collins Creek Big Flat Aspen	Langdon	Dry Lake Langdon
Erosion Control Terracing	Thompson Basin		Live Oak Hunts Lake Monroe Peak Anderson Can.		
Mining	Bertelson Can		Manning Creek Durkee Spr. Miners Ridge Windy Ridge	Tibadore Can.	
Fire	Annabella Flat		Marysvale Peak Blackbird Mine		
Prescribed Fire	Monument Peak	Kinney Spring	Little Table Bean Hill	Tuft Draw Buck Hollow Deer Spring Tibadore Pond	Rock Canyon Pine Canyon Jackie Canyon Schaffers

	Signal Peak IRA	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Other	Mud Lake Cabin Old Monrovian Park Rec Site	Blue Peak Brush saw work	Nielson Can. Sawmills & Piles Windy Ridge Cabins, Barn, etc. Manning Cr. Old Tunnel (100 feet)		

Table 57. Existing draft UUA human developments and structures

	Signal Peak UUA	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Range Improvements	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines and fences	Ponds, troughs, waterlines, tanks and fences
Culinary Water Developments	Red Butte Creek Norton Creek Monroe Canyon				
Irrigation Water Developments	Maple Canyon				
Waterlines and Pipelines	Maple Canyon Red Butte Creek Norton Creek Monroe Canyon 1st Left Hand Cr.				
Dams	Washburn Res.				
Ditches		Mill Creek to Little Creek	Manning Creek Concrete		
Timber Harvest			Sawmill Flat		

	Signal Peak UUA	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Erosion Control Terracing	Thompson Basin		Live Oak Hunts Lake Monroe Peak Anderson Can.		
Mining	Bertelson Can.		Manning Creek Miners Ridge Windy Ridge	Tibadore Can.	
Fire	Annabella Flat		Marysvale Peak Blackbird Mine		
Prescribed Fire	Thompson Basin Monument Peak	Kinney Spring			Rock Canyon Pine Canyon Jackie Canyon
Other	Mud Lake Cabin Old Monrovian Park Rec Site		Neilson Can. Sawmills & Piles Windy Ridge Cabins, Barn, etc. Manning Cr. Old Tunnel (100 feet)		

Table 58. Existing IRA Wilderness quality or attributes. The overall ratings are taken from the RAREII evaluation of roadless areas (USFS 1979).

Wilderness Attributes	Signal Peak IRA	Little Creek IRA	Marysvale Peak IRA	Tibadore IRA	Langdon IRA
Untrammeled - *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	Modern human activities include: Roads, trails dams, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, partial cabin, old Monrovian campground, erosion control terracing, mining, fire and prescribed fire.	Modern human activities include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire and prescribed fire.	Modern human activities include: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, cabins, erosion control terracing, fire and prescribed fire.	Modern human activities include: Roads, trails, waterlines, mining, fences, troughs, ponds, fire and prescribed fire.	Modern human activities include: Roads, trails, waterlines, fences, troughs, ponds, fire and prescribed fire.
Untrammeled Overall Rating	**Moderate**	**Low**	**Moderate**	**Moderate**	**Low**
Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.*	Modern effects on ecological systems include: Roads, trails dams, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, partial cabin, old Monrovian campground, erosion control terracing, fire and prescribed fire.	Modern effects on ecological systems include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, cabins, erosion control terracing, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, waterlines, mining, fences, troughs, ponds, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, waterlines, fences, troughs, ponds, fire, and prescribed fire.

Natural Overall Rating	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Low**
Undeveloped - *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation; it is essentially without permanent improvements or modern human occupation.*	Modern human presence or occupation include: Roads, trails dams, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, partial cabin, old Monrovian campground, erosion control terracing, fire, and prescribed fire.	Modern human presence or occupation include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire, and prescribed fire.	Modern human presence or occupation: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, erosion control terracing, cabins, fire, and prescribed fire.	Modern human presence or occupation: Roads, trails, waterlines, mining, fences, troughs, ponds, fire, and prescribed fire.	Modern human presence or occupation: Roads, trails, waterlines, fences, troughs, ponds, fire and prescribed fire.
Undeveloped Overall Rating	**Moderate**	**Moderate**	**High**	**High**	**Moderate**

Outstanding opportunities for solitude or a primitive and unconfined type of recreation - *This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude is very limited due to motorized roads and trails, adjacent private developments, dams, waterlines, timber harvest, range improve-ments, erosion control terracing, and an irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 5%), Semi-Primitive Motorized (about 5%), and Semi-Primitive Non-Motorized (about 90%). The southern portion contains a larger continuous land area that is Semi-Primitive Non-Motorized which could allow for solitude.	Solitude is very limited due to motorized roads and trails, adjacent private developments, waterlines, timber harvest, range improve-ments, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 40%), and Semi-Primitive Motorized (about 60%).	Solitude is very limited due to motorized roads and trails, adjacent private developments, dams, waterlines, mining, timber harvest, range improvements, cabins, erosion control terracing, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 10%), Semi-Primitive Motorized (about 40%), and Semi-Primitive Non-Motorized (about 50%).	Solitude is very limited due to motorized roads and trails, range improvements, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 50%), and Semi-Primitive Non-Motorized (about 50%).	Solitude is very limited due to motorized roads and trails, waterlines, range improvements, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 10%), and Semi-Primitive Motorized (about 90%).

Solitude Overall Rating	**Moderate**	**Low**	**Moderate**	**Low**	**Low**
Special Features *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	Relatively insignificant cultural resources are present. There are no potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.
Special Feature Overall Rating	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Low**
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	The IRA is 30,870 acres and very irregular in shape. Only the southern portion contains a larger continuous land area resulting in a configuration that is possibly manageable as wilderness. It has moderate ratings for untrammeled, natural, undeveloped, solitude, and special features.	The IRA is 11,472 acres and very irregular in shape and would be difficult to manage as wilderness. It has moderate ratings for natural, undeveloped, and special features plus a low ratings for untrammeled and solitude.	The IRA is 22,611 acres and very irregular in shape and would be difficult to manage as wilderness. It has a high rating for undeveloped and moderate ratings for untrammeled, natural, solitude, and special features.	The IRA is 9,261 acres and very irregular in shape and would be difficult to manage as wilderness. It has a high rating for undeveloped, moderate ratings for untrammeled, natural, and special features plus a low rating for solitude.	The IRA is 12,152 acres and very irregular in shape and would be difficult to manage as wilderness. It has low ratings for untrammeled, natural, solitude and for special features plus a moderate rating for undeveloped.
Manageability Overall Rating	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Low**

Table 59. Existing IRA roadless characteristics

Roadless Characteristic	Signal Peak IRA	Little Creek IRA	Marysvale Peak IRA	Tibadore IRA	Langdon IRA
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	Soils unsuitable for disturbance occur in the steep canyons. Municipal source protection zones occur in Red Butte, Norton, and Monroe Canyons.	Soils unsuitable for disturbance occur in the steep canyons. A municipal source protection zone occurs in Koosharem Canyon.	Soils unsuitable for disturbance occur in the steep canyons.	Soils unsuitable for disturbance occur in the steep canyons.	Soils unsuitable for disturbance occur in the steep canyons.
Sources of public drinking water *- Identify any public drinking water systems or sources within the project area.*	There are public drinking water systems and sources in Norton and Monroe Canyons. Municipal source protection zones are in Red Butte, Norton, and Monroe Canyons.	There are no developed drinking water systems. A municipal source protection zone is in Koosharem Canyon.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.

Roadless Characteristic	**Signal Peak IRA**	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	See Specialist Reports: - Arizona willow (*Salix arizonica*) - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat *(Corynorhinus townsendii)* - Spotted Bat *(Euderma maculatum)* - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	Sensitive species: Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk_- Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: - Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: Arizona willow - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: Arizona willow - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports

Roadless Characteristic	**Signal Peak IRA**	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 90% of the IRA is in the Semi-Primitive Non-Motorized ROS class, with about 5% of the IRA in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 60% of the IRA is in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 40% of the IRA is in the Semi-Primitive Non-Motorized ROS class, with about 50% of the IRA in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 50% of the IRA is in the Semi-Primitive Non-Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 90% of the IRA is in the Semi-Primitive Motorized ROS class.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.

Roadless Characteristic	**Signal Peak IRA**	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	The desired scenic integrity is 90% high with 10% moderate. The character is steeply rolling with canyons and rock outcrops. Vegetation is pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 50% high and 50% moderate. The character is steeply rolling with canyons and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 75% high and 25% moderate The character is steeply rolling with canyons and rock outcrops. Vegetation is pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 100% moderate. The character is steeply rolling with canyons and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 50% high and 50% moderate. The character is steeply rolling with canyons, rock cliffs, and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	Cultural resources are present; however, they are relatively insignificant lithic scatters.	Cultural resources exist; however, there are no major sites present.	Cultural resources exist; however, there are no major sites present.	There are no known significant archeological sites.	There are no known significant archeological sites.

Roadless Characteristic	**Signal Peak IRA**	**Little Creek IRA**	**Marysvale Peak IRA**	**Tibadore IRA**	**Langdon IRA**
Other locally unique characteristics *- Identify any locally unique characteristics.*	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various water bodies, wildlife, trails, meadows, and rock outcrops. Popular activities include hiking, horseback riding and hunting.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, and meadows. Popular activities include hunting and ATV riding.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various water bodies, wildlife, trails, meadows, and rock outcrops. Popular activities include hiking, horseback riding, hunting, and ATV riding.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, meadows, and rock outcrops. Popular activities include hunting.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, meadows, and rock outcrops. Popular activities include hunting and ATV riding.

Table 60. Existing draft UUA wilderness quality or attributes. The overall ratings are taken from the 2004 Fishlake National Forest draft Undeveloped Area Evaluation.

Wilderness Attributes	Signal Peak UUA	Little Creek UUA	Marysvale Peak UUA	Tibadore UUA	Langdon UUA
Untrammeled - *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	Modern human activities include: Roads, trails, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, partial cabin, old Monrovian campground, erosion control terracing, mining, fire, and prescribed fire.	Modern human activities include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire and prescribed fire.	Modern human activities include: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, erosion control terracing, cabins, fire and prescribed fire.	Modern human activities include: Roads, trails, waterlines, mining, fences, troughs, ponds, fire, and prescribed fire.	Modern human activities include: Roads, trails, waterlines, fences, troughs, ponds, fire and prescribed fire.
Untrammeled Overall Rating	**Medium**	**Medium**	**Medium**	**Medium**	**Low**
Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.*	Modern effects on ecological systems include: Roads, trails, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, partial cabin, old Monrovian campground, erosion control terracing, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, erosion control terracing, cabins, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, waterlines, mining, fences, troughs, ponds, fire, and prescribed fire.	Modern effects on ecological systems include: Roads, trails, waterlines, fences, troughs, ponds, fire, and prescribed fire.
Natural Overall Rating	**High**	**Medium**	**High**	**High**	**Medium**

Wilderness Attributes	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Undeveloped - *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation; it is essentially without permanent improvements or modern human occupation.*	Modern human presence or occupation include: Roads, trails, ditches, culinary and irrigation water developments, waterlines, fences, troughs, ponds, partial cabin, old Monrovian campground, erosion control terracing, fire, and prescribed fire.	Modern human presence or occupation include: Roads, trails, irrigation water development, waterlines, fences, troughs, ponds, timber harvest, fire and prescribed fire.	Modern human presence or occupation include: Roads, trails, dams, ditches, irrigation water developments, waterlines, fences, troughs, ponds, timber harvest, mining, erosion control terracing, cabins, fire and prescribed fire.	Modern human presence or occupation include: Roads, trails, waterlines, mining, fences, troughs, ponds, fire, and prescribed fire.	Modern human presence or occupation include: Roads, trails, waterlines, fences, troughs, ponds, fire and prescribed fire.
Undeveloped Overall Rating	**Medium**	**Low**	**Medium**	**Medium**	**Low**

Wilderness Attributes	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Outstanding opportunities for solitude or a primitive and unconfined type of recreation - *This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude is very limited due to motorized roads and trails, adjacent private developments, waterlines, range improvements, erosion control terracing, and an irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 6%), Semi-Primitive Motorized (about 4%), and Semi-Primitive Non-Motorized (about 90%). The southern portion contains a larger continuous land area that is Semi-Primitive Non-Motorized which could allow for solitude.	Solitude is very limited due to a few motorized roads and trails, adjacent private developments, range improve-ments, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 35%), and Semi-Primitive Motorized (about 65%).	Solitude is very limited due to motorized trails, adjacent private developments, mining, range improvements, erosion control terracing, cabins, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 10%), Semi-Primitive Motorized (about 45%), and Semi-Primitive Non-Motorized (about 45%).	Solitude is very limited due to mining, range improvements, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations are Roaded Natural (about 40%), and Semi-Primitive Non-Motorized (about 60%).	Solitude is very limited due to motorized roads and trails, waterlines, range improvements, and a very irregular shaped land area. The Recreation Opportunity Spectrum (ROS) designations of Roaded Natural (about 5%), and Semi-Primitive Motorized (about 95%).
Solitude Overall Rating	**Medium**	**Medium**	**Medium**	**Low**	**Low**

Wilderness Attributes	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Special Features *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	There are no special features identified, nor are there any potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.	Bonneville Cutthroat trout in Manning Creek. There are no potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.	There are no special features identified, nor are there any potential or existing research natural areas.
Special Feature Overall Rating	**Low**	**Low**	**Medium**	**Low**	**Low**
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	The UUA is 29,900 acres and very irregular in shape. Only the southern portion contains a larger continuous land area resulting in a configuration that is possibly manageable as wilderness. It has a high rating for natural; medium for untrammeled, undeveloped, and solitude; and low for special features.	The UUA is 9,529 acres and very irregular in shape and would be difficult to manage as wilderness. It has medium ratings for untrammeled, natural, and solitude; and low for undeveloped and special features.	The UUA is 27,168 acres and very irregular in shape and would be difficult to manage as wilderness. It has a high rating for natural; and medium ratings for untrammeled, undeveloped, solitude, and special features.	The UUA is 8,074 acres and very irregular in shape and would be difficult to manage as wilderness. It has a high rating for natural; moderate ratings for untrammeled, undeveloped; and low ratings for solitude and special features.	The UUA is 18,183 acres and very irregular in shape and would be very difficult to manage as wilderness. It has a medium rating for natural; and low ratings for untrammeled, undeveloped, solitude and special features.
Manageability Overall Rating	**Medium**	**Low**	**Medium**	**Medium**	**Low**

Table 61. Existing draft UUA roadless characteristics

Roadless Characteristic	Signal Peak UUA	Little Creek UUA	Marysvale Peak UUA	Tibadore UUA	Langdon UUA
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	Soils unsuitable for disturbance occur in the steep canyons. Municipal source protection zones occur in Red Butte, Norton, and Monroe Canyons.	Soils unsuitable for disturbance occur in the steep canyons. A municipal source protection zone occurs in Koosharem Canyon.	Soils unsuitable for disturbance occur in the steep canyons.	Soils unsuitable for disturbance occur in the steep canyons.	Soils unsuitable for disturbance occur in the steep canyons.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are public drinking water systems, sources, and source protection zones in Norton, Red Butte, and Monroe Canyons.	There are no developed drinking water systems. A municipal source protection zone is in Koosharem Canyon.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl	See Specialist Reports: - Arizona willow - Boreal Toad - Bonneville Cutthroat Trout - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl

Roadless Characteristic	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	Sensitive species: - Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: - Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: - Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports	Sensitive species: - Arizona willow - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports:	Sensitive species: - Arizona willow - Bonneville Cutthroat Trout - Boreal Toad - Northern Goshawk - Townsend's Big-eared Bat - Spotted Bat - Three-toed woodpecker - Flammulated Owl See Specialist Reports
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 90% of the UUA is in the Semi-Primitive Non-Motorized ROS class, with about 4% of the UUA in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 65% of the UUA is in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 45% of the UUA is in the Semi-Primitive Non-Motorized ROS class, with about 45% of the UUA in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 60% of the UUA is in the Semi-Primitive Motorized ROS class.	There are no opportunities for primitive recreation and there is none mapped as Primitive ROS. About 95% of the UUA is in the Semi-Primitive Motorized ROS class.

Roadless Characteristic	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	The desired scenic integrity is 95% high with 5% moderate. The character is steeply rolling with canyons and rock outcrops. Vegetation is pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 50% high and 50% moderate. The character is steeply rolling with canyons and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 65% high and 35% moderate The character is steeply rolling with canyons and rock outcrops. Vegetation is pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 100% moderate. The character is steeply rolling with canyons and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.	The desired scenic integrity is 40% high and 60% moderate. The character is steeply rolling with canyons, rock cliffs, and open areas. Vegetation is mostly pinion, juniper, mountain shrubs, and grass with aspen and conifer in the upper canyons and elevations.

Roadless Characteristic	**Signal Peak UUA**	**Little Creek UUA**	**Marysvale Peak UUA**	**Tibadore UUA**	**Langdon UUA**
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	Cultural resources are present; however, they are relatively insignificant lithic scatters.	Cultural resources exist; however, there are no major sites present.	Cultural resources exist; however, there are no major sites present.	There are no known significant archeological sites.	There are no known significant archeological sites.
Other locally unique characteristics - *Identify any locally unique characteristics.*	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various water bodies, wildlife, trails, meadows, and rock outcrops. Popular activities include hiking, horseback riding and hunting.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, and meadows. Popular activities include hunting and ATV riding.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various water bodies, wildlife, trails, meadows, and rock outcrops. Popular activities include hiking, horseback riding, hunting, and ATV riding.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, meadows, and rock outcrops. Popular activities include hunting.	There are no locally unique characteristics, but common to the area are many beautiful features that occur within and adjacent to the project area. Adjacent would include views of the surrounding valleys and mountain vistas. Within the project area, include various streams, wildlife, meadows, and rock outcrops. Popular activities include hunting, and ATV riding.

3.1.2 Alternatives

3.1.2.1 No Action Alternative (Alternative 1):

The No Action Alternative Represents the existing condition described in the previous pages and in the EIS. This alternative would maintain the status quo and conditions on the ground would not measurably change in respect to wilderness attributes and roadless characteristics. Aspen restoration would not take place except by wildfires and natural succession. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Generally all existing activities would continue. Recreation activities including hunting, fishing, hiking, driving, and off-road vehicle use on designated routes, would continue, and are relatively non-impacting. Cattle grazing, with maintenance of associated range improvements such as fences and water developments, would occur. Dam, water source, and waterline maintenance would continue. These activities are not anticipated to affect the existing wilderness quality or attributes and roadless characteristics.

The present qualities or attributes of wilderness; untrammeled, natural integrity, appearance, remoteness, solitude, special features, and manageability, as well as the characteristics of Inventoried Roadless Areas; soil, water, and air; sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive, non-motorized, and semi-primitive motorized classes of recreation opportunities; reference landscapes; landscape character and scenic integrity; traditional cultural properties and sacred sites; and other locally identified unique characteristics, would remain affected primarily by natural processes.

3.1.2.2 Alternatives 2 through 5

Alternatives 2 through 5 within IRAs would include mechanical and prescribed fire activities to meet the purpose and need of aspen restoration. Mechanical (2 options) treatments would occur in the four action alternatives as well as prescribed fire. No new access roads, temporary roads, or road maintenance is required within the IRAs. Firebreaks and control lines would be feathered to appear natural. Trees would be cut as close to the ground as possible. Access for mechanical treatments would be cross-country by tracked vehicles.

The IRA analysis in Table 62 and Table 63 shows the total acres of each IRA. Next is shown the proposed acres within each alternative being treated by mechanical and prescribed fire, plus the percentage of the IRA being treated by mechanical and by prescribed fire, as well as the total percent of the combined treated acres. Note that 60 percent or less is actually being burned across the landscape. Therefore, the result of 60 percent being treated is the number shown in the Prescribed Fire Mixed Burn Severities Acres (“60% Treated” column).

Table 62. Inventoried Roadless Area (IRA) analysis

		Alt. 1	Alternative 2					Alternative 3				
Inventoried Roadless Area (IRA)	Total IRA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60%Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated
Langdon	12,152	0	42	0%	490	4%	4%	223	2%	514	4%	6%
Little Creek	11,472	0	327	3%	1,569	14%	17%	1,422	12%	1,088	10%	22%
Marysvale Peak	22,611	0	217	1%	4,024	18%	19%	925	4%	4,008	18%	22%
Signal Peak	30,870	0	862	3%	8,095	26%	29%	2,439	8%	7,631	25%	33%
Tibadore	9,261	0	61	1%	1,201	13%	14%	122	1%	1,237	13%	15%
All IRAs Combined	83,366	0	1,509	2%	15,379	18%	20%	5,131	6%	14,478	17%	23%

Table 63. Inventoried Roadless Area (IRA) analysis (Continued)

		Alt. 1	Alternative 4					Alternative 5				
Inventoried Roadless Area (IRA)	Total IRA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated
Langdon	12,152	0	278	2%	514	4%	6%	317	3%	324	3%	6%
Little Creek	11,472	0	2,142	19%	737	6%	25%	1,228	11%	1,028	9%	20%

		Alt. 1	Alternative 4					Alternative 5				
Inventoried Roadless Area (IRA)	Total IRA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of IRA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of IRA Treated	All Treatments Combined Percent of IRA Being Treated
Marysvale Peak	22,611	0	1,637	7%	3,747	17%	24%	1,517	7%	3,356	15%	22%
Signal Peak	30,870	0	5,009	16%	6,396	21%	37%	3,478	11%	6,633	22%	33%
Tibadore	9,261	0	196	2%	1,237	13%	15%	317	3%	1,047	11%	14%
All IRAs Combined	83,366	0	9,262	11%	12,632	15%	26%	6,857	8%	12,388	14%	22%

Table 64. Inventoried Roadless Area (IRA) acreage of mechanical and slash burning, and prescribed fire in alternative 2 by vegetation type

Alternative 2 - Mechanical & Slash Burning		
IRA	**Vegetation**	**Acres**
Langdon	Seral Aspen	42
Langdon Total		**42**
Little Creek	Seral Aspen	173
	Spruce/fir	11
	Stable Aspen	143
Little Creek Total		**327**
Marysvale Peak	Seral Aspen	144
	Spruce/fir	48
	Stable Aspen	25
Marysvale Peak Total		**217**
Signal Peak	Mixed Conifer	1
	Seral Aspen	304
	Spruce/fir	359
	Stable Aspen	197
Signal Peak Total		**862**
Tibadore	Mixed Conifer	5
	Seral Aspen	53
	Stable Aspen	2
Tibadore Total		**61**

GRAND TOTAL		**1,509**
Alternative 2 - Prescribed Fire Mixed Burn Severities		
IRA	**Vegetation**	**Acres**
Langdon	Mixed Conifer	126
	Seral Aspen	352
	Spruce/fir	11
	Stable Aspen	1
Langdon Total		**490**
Little Creek	Seral Aspen	951
	Spruce/fir	22
	Stable Aspen	596
Little Creek Total		**1,569**
Marysvale Peak	Mixed Conifer	371
	Seral Aspen	2,096
	Spruce/fir	451
	Stable Aspen	1,106
Marysvale Peak Total		**4,024**
Signal Peak	Mixed Conifer	1,254
	Seral Aspen	2,671
	Spruce/fir	2,169
	Stable Aspen	2,001
Signal Peak Total		**8,095**
Tibadore	Mixed Conifer	198
	Seral Aspen	880
	Spruce/fir	63
	Stable Aspen	60
Tibadore Total		**1,201**
GRAND TOTAL		**15,379**

Table 65. Inventoried Roadless Area (IRA) acreage of mechanical and slash burning, and prescribed fire in alternative 3 by vegetation type

Alternative 3 - Mechanical & Slash Burning		
IRA	**Vegetation**	**Acres**
Langdon	Seral Aspen	223
Langdon Total		**223**
Little Creek	Seral Aspen	1,018
	Spruce/fir	46
	Stable Aspen	359
Little Creek Total		**1,422**
Marysvale Peak	Seral Aspen	692
	Spruce/fir	164
	Stable Aspen	69
Marysvale Peak Total		**925**
Signal Peak	Mixed Conifer	1
	Seral Aspen	913

	Spruce/fir	1,202
	Stable Aspen	323
Signal Peak Total		**2,439**
Tibadore	Seral Aspen	103
	Stable Aspen	18
Tibadore Total		**122**
GRAND TOTAL		**5,131**
Alternative 3 - Prescribed Fire Mixed Burn Severities		
IRA	**Vegetation**	**Acres**
Langdon	Mixed Conifer	126
	Seral Aspen	376
	Spruce/fir	11
	Stable Aspen	1
Langdon Total		**514**
Little Creek	Seral Aspen	573
	Spruce/fir	8
	Stable Aspen	507
Little Creek Total		**1,088**
Marysvale Peak	Mixed Conifer	371
	Seral Aspen	2,098
	Spruce/fir	428
	Stable Aspen	1,111
Marysvale Peak Total		**4,008**
Signal Peak	Mixed Conifer	1,254
	Seral Aspen	2,477
	Spruce/fir	1,888
	Stable Aspen	2,012
Signal Peak Total		**7,631**
Tibadore	Mixed Conifer	200
	Seral Aspen	912
	Spruce/fir	63
	Stable Aspen	62
Tibadore Total		**1,237**
GRAND TOTAL		**14,478**

Table 66. Inventoried Roadless Area (IRA) acreage of mechanical and slash burning, and prescribed fire in alternative 4 by vegetation type

Alternative 4 - Mechanical & Slash Burning		
IRA	**Vegetation**	**Acres**
Langdon	Seral Aspen	278
Langdon Total		**278**
Little Creek	Seral Aspen	1,448
	Spruce/fir	62
	Stable Aspen	632

Little Creek Total		**2,142**
Marysvale Peak	Seral Aspen	1,086
	Spruce/fir	425
	Stable Aspen	125
Marysvale Peak Total		**1,637**
Signal Peak	Mixed Conifer	11
	Seral Aspen	1,779
	Spruce/fir	2,213
	Stable Aspen	1,006
Signal Peak Total		**5,009**
Tibadore	Seral Aspen	177
	Stable Aspen	18
Tibadore Total		**196**
GRAND TOTAL		**9,262**
Alternative 4 – Prescribed Fire Mixed Burn Severities		
IRA	**Vegetation**	**Acres**
Langdon	Mixed Conifer	126
	Seral Aspen	376
	Spruce/fir	11
	Stable Aspen	1
Langdon Total		**514**
Little Creek	Seral Aspen	380
	Spruce/fir	8
	Stable Aspen	349
Little Creek Total		**737**
Marysvale Peak	Mixed Conifer	371
	Seral Aspen	1,978
	Spruce/fir	314
	Stable Aspen	1,084
Marysvale Peak Total		**3,747**
Signal Peak	Mixed Conifer	1,248
	Seral Aspen	2,122
	Spruce/fir	1,391
	Stable Aspen	1,635
Signal Peak Total		**6,396**
Tibadore	Mixed Conifer	200
	Seral Aspen	912
	Spruce/fir	63
	Stable Aspen	62
Tibadore Total		**1,237**
GRAND TOTAL		**12,632**

Table 67. Inventoried Roadless Area (IRA) acreage of mechanical and prescribed fire in alternative 5 by vegetation type

Alternative 5 - Mechanical & Slash Burning		
IRA	**Vegetation**	**Acres**
Langdon	Stable Aspen	2
	Seral Aspen	315
Langdon Total		**317**
Little Creek	Seral Aspen	809
	Spruce/fir	35
	Stable Aspen	384
Little Creek Total		**1,228**
Marysvale Peak	Seral Aspen	847
	Spruce/fir	340
	Stable Aspen	331
Marysvale Peak Total		**1,517**
Signal Peak	Mixed Conifer	1
	Seral Aspen	1,444
	Spruce/fir	1,405
	Stable Aspen	628
Signal Peak Total		**3,478**
Tibadore	Seral Aspen	290
	Stable Aspen	27
Tibadore Total		**317**
GRAND TOTAL		**6,857**
Alternative 5 - Prescribed Fire Mixed Burn Severities		
IRA	**Vegetation**	**Acres**
Langdon	Mixed Conifer	126
	Seral Aspen	187
	Spruce/fir	11
Langdon Total		**324**
Little Creek	Seral Aspen	569
	Spruce/fir	8
	Stable Aspen	451
Little Creek Total		**1,028**
Marysvale Peak	Mixed Conifer	372
	Seral Aspen	1,736
	Spruce/fir	320
	Stable Aspen	928
Marysvale Peak Total		**3,356**
Signal Peak	Mixed Conifer	1,255
	Seral Aspen	1,999
	Spruce/fir	1,579
	Stable Aspen	1,800
Signal Peak Total		**6,633**

Tibadore	Mixed Conifer	200
	Seral Aspen	738
	Spruce/fir	63
	Stable Aspen	46
Tibadore Total		**1,047**
GRAND TOTAL		**12,388**

3.1.3 Inventoried Roadless Area Wilderness Quality or Attributes and Potential Effects by Alternative

Table 68. Langdon IRA - Effects to Wilderness Quality or Attributes for all Alternatives

Langdon IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	42 acres (0%) of mechanical and slash burning and 490 acres (4%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased	223 acres (2%) of mechanical and slash burning and 514 acres (4%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased	278 acres (2%) of mechanical and slash burning and 514 acres (4%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased	317 acres (3%) of mechanical and slash burning and 324 acres (3%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased

Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes. Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes. Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes. Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes. Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation *– This quality monitors conditions that affect the opportunities for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*					

Special Features - *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.
Manageability (as Wilderness) *- A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.

Table 69. Langdon Inventoried Roadless Area - Effects to roadless characteristics for all alternatives.

Langdon IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.

Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.

Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.

Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	Project activities would avoid significant cultural/heritage resources; therefore, no direct, indirect, or cumulative effects because of implementing the action alternatives are expected to occur. No concerns were raised by local tribes. See Heritage Resources Report	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.

Other locally unique characteristics *- Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.

Table 70. Little Creek Inventoried Roadless Area (IRA) - Effects to wilderness quality or attributes for all alternatives

Little Creek IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* *Undeveloped - This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance	327 acres (3%) of mechanical and slash burning and 1,569 acres (14%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles	1,422 acres (12%) of mechanical and slash burning and 1,088 acres (10%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles	2,142 acres (19%) of mechanical and slash burning and 737 acres (6%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles	1,228 acres (11%) of mechanical and slash burning and 1,028 acres (9%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles

or occupation. *Natural - This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.*	would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features - *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.

Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.

Table 71. Little Creek Inventoried Roadless Area (IRA) - Effect to roadless characteristics for all alternatives

Little Creek IRA	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation *- Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.

Table 72. Marysvale Peak Inventoried Roadless Area (IR) - Effects to wilderness quality or attributes for all alternatives

Marysvale Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* ***Natural -*** *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	217 acres (1%) of mechanical and slash burning and 4,024 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	925 acres (4%) of mechanical and slash burning and 4,008 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	1,637 acres (7%) of mechanical and slash burning and 3,747 acres (17%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	1,517 acres (7%) of mechanical and slash burning and 3,356 acres (15%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features - *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.
Manageability (as Wilderness) *- A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 73. Marysvale Peak Inventoried Roadless Area - Effect to roadless characteristics for all alternatives

Marysvale Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.

Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.

Reference landscapes for research study or interpretation *- Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.

Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.

Table 74. Signal Peak Inventoried Roadless Area (IRA) - Effects to wilderness quality or attributes for all alternatives

Signal Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	0 acres of mechanical and prescribed fire would take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue.	862 acres (3%) of mechanical and slash burning and 8,095 acres (26%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	2,439 acres (8%) of mechanical and slash burning and 7,631 acres (25%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	5,009 acres (16%) of mechanical and slash burning and 6,396 acres (21%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	3,478 acres (11%) of mechanical and slash burning and 6,633 acres (22%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.

Signal Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Natural *- This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.*	No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features *- (Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.

Signal Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 75. Signal Peak Inventoried Roadless Area - Effects to roadless characteristics for all alternatives

Signal Peak IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	Municipal watersheds occur within the project area. No change would take place.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.

Table 76. Tibadore Inventoried Roadless Area (IRA) - Effects to wilderness quality or attributes for all alternatives

Tibadore IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	0 acres of mechanical and prescribed fire would take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and	61 acres (1%) of mechanical and slash burning and 1,201 acres (13%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time,	122 acres (1%) of mechanical and slash burning and 1,237 acres (13%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time,	196 acres (2%) of mechanical and slash burning and 1,237 acres (13%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time,	317 acres (3%) of mechanical and slash burning and 1,046 acres (11%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time,

Tibadore IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.

Tibadore IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Special Features *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.	No significant special features would be directly or indirectly affected because there are not any in the IRA.
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 77. Tibadore Inventoried Roadless Area - Effects to roadless characteristics for all alternatives

Tibadore IRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the IRA.

Action alternatives 2 through 5 within draft UUAs would include mechanical (2 options) and prescribed fire activities to meet the purpose and need of aspen restoration. Mechanical treatments would occur in the four action alternatives as well as prescribed fire. Approximately 0.3 miles of temporary road would be constructed in alternative 4, and 1.3 miles of temporary road would be constructed in alternative 5 in the draft UUAs to access mechanical treatments. Temporary roads would be rehabilitated upon project completion. Firebreaks and control lines would be feathered to appear natural. Trees would be cut as close to the ground as possible. Access for mechanical treatments would be cross-country by tracked vehicles within draft UUAs, with the exception of temporary roads in alternatives 4 and 5.

Draft UUA Analysis Table 78 and Table 79 shows the total acres of each draft UUA. Next is shown the proposed acres within each alternative being treated by mechanical and prescribed fire, plus the percentage of the draft UUA being treated by mechanical and by prescribed fire as well as the total percent of the combined treated acres. Note that 60 percent or less actually being burned across the landscape. Therefore, the result of 60 percent being treated is the number shown in the Prescribed Fire Mixed Burn Severities Acres (“60% Treated” column).

Table 78. Draft Unroaded-Undeveloped Area (UUA) analysis

		Alt. 1	Alternative 2					Alternative 3				
Draft Unroaded/Undeveloped Area (UUA)	Total Draft UUA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA Treated	All Treatments Combined Percent of UUA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA Treated	All Treatments Combined Percent of UUA Being Treated
Langdon	18,183	0	79	0%	987	5%	5%	268	1%	1,033	6%	7%
Little Creek	9,529	0	127	1%	1,220	13%	14%	685	7%	894	9%	16%
Marysvale Peak	27,168	0	220	1%	4,977	18%	19%	1,016	4%	4,958	18%	22%
Signal Peak	29,900	0	583	2%	6,318	21%	23%	1,536	5%	6,273	21%	26%
Tibadore	8,074	0	42	1%	1,119	14%	15%	56	1%	1,143	14%	15%
All IRAs Combined	92,854	0	1,051	1%	14,620	16%	17%	3,561	4%	14,301	15%	19%

Table 79. Draft Unroaded-Undeveloped Area (UUA) analysis (continued)

		Alt. 1	Alternative 4					Alternative 5				
Draft Unroaded/Undeveloped Area (UUA)	Total Draft UUA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA	All Treatments Combined Percent of UUA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA	All Treatments Combined Percent of UUA Being Treated
Langdon	18,183	0	363	2%	1,033	6%	8%	513	3%	725	4%	7%
Little Creek	9,529	0	1,033	11%	685	7%	18%	669	7%	894	9%	16%
Marysvale Peak	27,168	0	1,918	7%	4,623	17%	24%	1,621	6%	4,251	16%	22%
Signal Peak	29,900	0	3,283	11%	5,504	18%	29%	2,426	8%	5,318	18%	26%
Tibadore	8,074	0	56	1%	1,143	14%	15%	285	4%	972	12%	16%

		Alt. 1	Alternative 4					Alternative 5				
Draft Unroaded/Undeveloped Area (UUA)	Total Draft UUA Acres	Acres Being Treated	Mechanical & Slash Burning Acres Being Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA	All Treatments Combined Percent of UUA Being Treated	Mechanical & Slash Burning Acres Treated	Mechanical & Slash Burning Percent of UUA Being Treated	Prescribed Fire Mixed Burn Severities Acres (60% Treated)	Prescribed Fire Mixed Burn Severities Percent of UUA	All Treatments Combined Percent of UUA Being Treated
All IRAs Combined	92,854	0	6,654	7%	12,989	14%	21%	5,514	6%	12,161	13%	19%

Table 80. Draft Unroaded-Undeveloped Area (UUA) acreage of mechanical and slash burning, and prescribed fire in alternative 2 by vegetation type

Alternative 2 - Mechanical & Slash Burning		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Mixed Conifer	2
	Seral Aspen	77
Langdon Mountain Total		**79**
Little Creek	Seral Aspen	70
	Stable Aspen	57
Little Creek Total		**127**
Marysvale Peak	Seral Aspen	144
	Spruce/fir	53
	Stable Aspen	23
Marysvale Peak Total		**220**
Signal Peak	Mixed Conifer	1
	Seral Aspen	246
	Spruce/fir	181
	Stable Aspen	154
Signal Peak Total		**583**
Tibadore	Mixed Conifer	5
	Seral Aspen	37
Tibadore Total		**42**
GRAND TOTAL		**1,051**
Alternative 2 - Prescribed Fire Mixed Burn Severities		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Mixed Conifer	381
	Seral Aspen	547

	Spruce/fir	23
	Stable Aspen	36
Langdon Mountain Total		**987**
Little Creek	Seral Aspen	771
	Spruce/fir	2
	Stable Aspen	447
Little Creek Total		**1,220**
Marysvale Peak	Mixed Conifer	433
	Seral Aspen	2,747
	Spruce/fir	573
	Stable Aspen	1,224
Marysvale Peak Total		**4,977**
Signal Peak	Mixed Conifer	1,273
	Seral Aspen	2,571
	Spruce/fir	913
	Stable Aspen	1,561
Signal Peak Total		**6,318**
Tibadore	Mixed Conifer	220
	Seral Aspen	826
	Spruce/fir	23
	Stable Aspen	49
Tibadore Total		**1,118**
GRAND TOTAL		**14,620**

Table 81. Draft Unroaded-Undeveloped Area (UUA) acreage of mechanical and slash burning, and prescribed fire in alternative 3 by vegetation type

Alternative 3 - Mechanical & Slash Burning		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Seral Aspen	268
Langdon Mountain Total		**268**
Little Creek	Seral Aspen	554
	Spruce/fir	2
	Stable Aspen	128
Little Creek Total		**685**
Marysvale Peak	Seral Aspen	749
	Spruce/fir	187
	Stable Aspen	79
Marysvale Peak Total		**1,016**
Signal Peak	Mixed Conifer	1
	Seral Aspen	760
	Spruce/fir	576
	Stable Aspen	199
Signal Peak Total		**1,536**
Tibadore	Seral Aspen	51
	Stable Aspen	6

Tibadore Total		**56**
GRAND TOTAL		**3,561**
Alternative 3 - Prescribed Fire Mixed Burn Severities		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Mixed Conifer	382
	Seral Aspen	592
	Spruce/fir	23
	Stable Aspen	36
Langdon Mountain Total		**1,033**
Little Creek	Seral Aspen	489
	Spruce/fir	1
	Stable Aspen	404
Little Creek Total		**894**
Marysvale Peak	Mixed Conifer	433
	Seral Aspen	2,748
	Spruce/fir	549
	Stable Aspen	1,228
Marysvale Peak Total		**4,958**
Signal Peak	Mixed Conifer	1,273
	Seral Aspen	2,523
	Spruce/fir	846
	Stable Aspen	1,631
Signal Peak Total		**6,273**
Tibadore	Mixed Conifer	222
	Seral Aspen	849
	Spruce/fir	23
	Stable Aspen	49
Tibadore Total		**1,143**
GRAND TOTAL		**14,301**

Table 82. Draft Unroaded-Undeveloped Area (UUA) acreage of mechanical and slash burning and Prescribed fire in alternative 4 by vegetation type

Alternative 4 - Mechanical & Slash Burning		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Seral Aspen	363
Langdon Mountain Total		**363**
Little Creek	Seral Aspen	781
	Spruce/fir	2
	Stable Aspen	250
Little Creek Total		**1,033**
Marysvale Peak	Seral Aspen	1,278
	Spruce/fir	507
	Stable Aspen	134
Marysvale Peak Total		**1,918**
Signal Peak	Mixed Conifer	11

	Seral Aspen	1,644
	Spruce/fir	984
	Stable Aspen	643
Signal Peak Total		**3,283**
Tibadore	Seral Aspen	51
	Stable Aspen	6
Tibadore Total		**56**
GRAND TOTAL		**6,654**

Alternative 4 - Prescribed Fire Mixed Burn Severities		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Mixed Conifer	382
	Seral Aspen	592
	Spruce/fir	23
	Stable Aspen	36
Langdon Mountain Total		**1,033**
Little Creek	Seral Aspen	353
	Spruce/fir	1
	Stable Aspen	331
Little Creek Total		**685**
Marysvale Peak	Mixed Conifer	432
	Seral Aspen	2,589
	Spruce/fir	400
	Stable Aspen	1,202
Marysvale Peak Total		**4,623**
Signal Peak	Mixed Conifer	1,267
	Seral Aspen	2,178
	Spruce/fir	663
	Stable Aspen	1,396
Signal Peak Total		**5,504**
Tibadore	Mixed Conifer	223
	Seral Aspen	849
	Spruce/fir	23
	Stable Aspen	49
Tibadore Total		**1,144**
GRAND TOTAL		**12,989**

Table 83 Draft Unroaded-Undeveloped Area (UUA) acreage of mechanical and slash burning, and prescribed fire in alternative 5 by vegetation type.

Alternative 5 - Mechanical & Slash Burning		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Seral Aspen	474
	Stable Aspen	39
Langdon Mountain Total		**513**
Little Creek	Seral Aspen	539
	Spruce/fir	2

	Stable Aspen	128
Little Creek Total		**669**
Marysvale Peak	Seral Aspen	933
	Spruce/fir	407
	Stable Aspen	281
Marysvale Peak Total		**1,621**
Signal Peak	Mixed Conifer	1
	Seral Aspen	1,252
	Spruce/fir	596
	Stable Aspen	577
Signal Peak Total		**2,426**
Tibadore	Seral Aspen	279
	Stable Aspen	7
Tibadore Total		**285**
GRAND TOTAL		**5,514**
Alternative 5 - Prescribed Fire Mixed Burn Severities		
Draft UUA	**Vegetation**	**Acres**
Langdon Mountain	Mixed Conifer	382
	Seral Aspen	308
	Spruce/fir	23
	Stable Aspen	13
Langdon Mountain Total		**725**
Little Creek	Seral Aspen	489
	Spruce/fir	1
	Stable Aspen	404
Little Creek Total		**894**
Marysvale Peak	Mixed Conifer	433
	Seral Aspen	2,336
	Spruce/fir	406
	Stable Aspen	1,076
Marysvale Peak Total		**4,251**
Signal Peak	Mixed Conifer	1,273
	Seral Aspen	1,979
	Spruce/fir	702
	Stable Aspen	1,364
Signal Peak Total		**5,318**
Tibadore	Mixed Conifer	222
	Seral Aspen	682
	Spruce/fir	23
	Stable Aspen	45
Tibadore Total		**972**
GRAND TOTAL		**12,161**

3.1.4 Draft Unroaded/Undeveloped Area Wilderness Characteristics and Potential Effects by Alternative

Table 84. Langdon draft Unroaded-Undeveloped Area - effects to wilderness quality or attributes for all alternatives

Langdon UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* ***Natural -*** *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	79 acres (0%) of mechanical and slash burning and 987 acres (5%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due To the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes.	168 acres (1%) of mechanical and slash burning and 1,033 acres (6%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have little effect on these wilderness attributes.	363 acres (2%) of mechanical and slash burning and 1,033 acres (6%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have little effect these wilderness attributes.	513 acres (3%) of mechanical and slash burning and 725 acres (4%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time; typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have little effect these wilderness attributes.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation – *This quality monitors conditions that affect the opportunities for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features *- (Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little effect for 2 to 5 years.

Table 85. Langdon draft Unroaded-Undeveloped Area (UUA) - Effects to roadless characteristics for all alternatives

Langdon UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.

Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.	The landscape is steeply rolling with canyons, rock cliffs, and open areas. As evidenced through the developments surrounding and within the project area there is little to no unique reference landscape potential.

Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	Project activities would avoid significant cultural/heritage resources; therefore, no direct, indirect, or cumulative effects because of implementing the action alternatives are expected to occur. No concerns were raised by local tribes. See Heritage Resources Report	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.

Table 86. Little Creek draft Unroaded-Undeveloped Area (UUA) - Effects to wilderness quality or attributes for all alternatives

Little Creek UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* ***Natural -*** *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	127 acres (1%) of mechanical and slash burning and 1,220 acres (13%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	685 acres (7%) of mechanical and slash burning and 894 acres (9%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	1,033 acres (11%) of mechanical and slash burning and 685 acres (7%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	669 acres (7%) of mechanical and slash burning and 894 acres (9%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features *- (Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be a little affect for 2 to 5 years.

Table 87. Little Creek draft Unroaded-Undeveloped Area (UUA) - Effects to roadless characteristics for all alternatives

Little Creek UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.
Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.

Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.
Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.

Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.
Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.

Table 88. Marysvale Peak draft Unroaded-Undeveloped Area - Effects to wilderness quality or attributes for all alternatives

Marysvale Peak UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.* ***Natural -*** *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.*	0 acres of mechanical and prescribed fire will take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	220 acres (1%) of mechanical and slash burning and 4,977 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	1,016 acres (4%) of mechanical and slash burning and 1,958 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	1,918 acres (7%) of mechanical and slash burning and 4,623 acres (17%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.	1,621 acres (6%) of mechanical and slash burning and 4,251 acres (16%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments.
Undeveloped - *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*		Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation *- This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features *- (Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.

Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 89. Marysvale Peak draft Unroaded-Undeveloped Area - Effects to roadless characteristics for all alternatives

Marysvale Peak UUA	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in two to five years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.

Table 90. Signal Peak draft Unroaded-Undeveloped Area (UUA) - Effects to wilderness quality or attributes for all alternatives

Signal Peak UUA	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	0 acres of mechanical and prescribed fire would take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and	583 acres (2%) of mechanical and slash burning and 6,318 acres (21%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time,	1,536 acres (5%) of mechanical and slash burning and 6,273 acres (21%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to	3,283 acres (11%) of mechanical and slash burning and 5,504 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to	2,426 acres (8%) of mechanical and slash burning and 5,318 acres (18%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically three to

Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	canopy closures in conifers would continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	typically three to five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	five years for vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation - *This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.

Special Features *- (Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.
Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 91. Signal Peak draft Unroaded-Undeveloped Area (UUA) - Effects to roadless characteristics for all alternatives

Signal Peak UUA	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	Municipal watersheds occur within the project area. No change would take place.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.	Municipal watersheds do occur within the project area. Buffers would be in place to protect public drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in 2 to 5 years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in 2 to 5 years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in 2 to 5 years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in 2 to 5 years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.	The landscape is steeply rolling with canyons and rock outcrops. As evidenced through the developments surrounding and within the project area the unique reference landscape potential is possible, yet not likely.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.

Table 92. Tibadore draft Unroaded-Undeveloped Area (UUA) - Effects to wilderness quality or attributes for all alternatives

Tibadore UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Untrammeled *This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems; it is essentially unhindered and free from modern human control or manipulation.*	0 acres of mechanical and prescribed fire would take place. Fuel loadings would continue to increase with a greater likelihood of large uncharacteristic fire and damage to private land. Conifer encroachment in aspen would continue and canopy closures in conifers would	42 acres (1%) of mechanical and slash burning and 1,119 acres (14%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically 3 to5 years for	56 acres (1%) of mechanical and slash burning and 1,143 acres (14%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically 3 to 5 years for vegetation to	56 acres (1%) of mechanical and slash burning and 1,143 acres (14%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically 3 to 5 years for vegetation to	285 acres (4%) of mechanical and slash burning and 972 acres (12%) of prescribed fire with mixed burn severities. Stumps would remain in the mechanically treated areas and fire would be noticeable after implementation and would fade over time, typically 3 to 5 years for vegetation to

Natural - *This quality monitors both intended and unintended effects of modern people on ecological systems; they are substantially free from the effects of modern civilization.* ***Undeveloped -*** *This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation.*	continue to increase. Recreation activities, range administration, dam, water source, and waterline maintenance would continue. No action would not trend toward the desired condition, yet this would still have little effect on these wilderness attributes.	vegetation to regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.	regenerate. Firebreaks and control lines would be feathered to appear natural. Tracked vehicles would be used to accomplish mechanical treatments. Due to the relatively small percentage of the area being treated, increased regeneration and the methods being used; the proposed actions would have a minor short-term effect on these wilderness attributes.
Outstanding opportunities for solitude or a primitive and unconfined type of recreation - *This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation; including the values of inspiration and physical and mental challenge.*	Solitude would not be affected and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.	Solitude would only be affected during the implementation of the project and the Recreation Opportunity Spectrum (ROS) designations would not change.
Special Features *(Ecological, Geologic, Scientific, Educational, Scenic or Historical Values)*	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.	No significant special features would be directly or indirectly affected because there are not any in the draft UUA.

Manageability (as Wilderness) - *A measure of the ability to manage an area to meet the size criteria (5,000 + acres), the resulting configuration of the potential wilderness, and the interaction of the other elements above.*	There would not be any change to the boundary, shape, size, location, or access.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.	The proposed actions of mechanical treatment and prescribed fire would not change the boundary, shape, size, location, or access. The above elements would only be affected for 2 to 5 years.

Table 93. Tibadore draft Unroaded-Undeveloped Area (UUA) - Effects to roadless characteristics for all alternatives

Tibadore UUA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil, water and Air resources - *Identify any unique or critical watershed or airshed resource and the habitats that depend on them.*	No impacts to threatened, endangered, sensitive, or MIS plant resources and animal species. See specialist reports.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.	Mechanical treatments would disturb soils and remove vegetation while prescribed fire would impart a charred appearance on the land. See aquatic, wildlife, and botany specialist reports. Actions will be consistent with the Clean Air Act.
Sources of public drinking water - *Identify any public drinking water systems or sources within the project area.*	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.	There are no developed drinking water systems.

Diversity of plant and animal communities - *Discuss the diversity of plant and animal communities. Identify any unique plant and animal communities within the area.*	No change.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on the landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.	The mechanical and prescribed burn treatments would create areas of early seral plant species that would increase plant size, age, and species diversity thereby improving animal diversity as well. Refer to the wildlife, aquatics, and botany specialist reports to see effects to plant and animal communities on landscape scale.
Habitat for TES and species dependent on large undisturbed areas of land - *Identify any TES or sensitive species within the Roadless area.*	No change.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.	Implementation of the mechanical and prescribed burn portions of the proposed action would be completed in a mosaic burn pattern creating a patchwork of burned and unburned areas. These areas would contain early seral plant species improving plant size, age, and species diversity important to maintaining a properly functioning ecosystem. See specialist reports.

Primitive and semi-primitive classes of recreation - *Describe current recreation opportunities for primitive and semi-primitive classes of recreation within the Roadless area.*	No effect on semi-primitive classes of recreation.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.	Mechanical treatments and prescribed burning would temporarily detract from semi-primitive classes of recreation. Subsequent vegetation regeneration would eliminate this in two to five years.
Reference landscapes for research study or interpretation - *Describe the landscape that is present. Describe any unique reference landscapes that exist within the Roadless area.*	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.	The landscape is steeply rolling with canyons and open areas. As evidenced through the developments surrounding and within the project area there is little unique reference landscape potential.
Landscape character and integrity - *Describe the current scenic quality and character of the area.*	Scenic values would not be changed.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.	The areas treated through mechanical and prescribed burning would temporarily detract from scenic values of the area. Vegetation regeneration and growth would eliminate these effects in 2 to 5 years.

Traditional cultural properties and sacred sites - *Identify generically any significant cultural resources within the Roadless area.*	No change.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.	The mitigation measure of avoiding cultural resources would be employed during project implementation, which would prevent adverse effects to heritage resources eligible to the National Register of Historic Places, as described in the Heritage Resources Report. No concerns were raised by local tribes.
Other locally unique characteristics - *Identify any locally unique characteristics.*	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.	No locally unique characteristics would be directly or indirectly affected because there are not any in the draft UUA.

3.1.5 Cumulative Effects for All Alternatives

Past, present and reasonable foreseeable actions on the Monroe Mountain were reviewed to determine the cumulative effects to IRAs and draft UUAs. (Refer to Table 52 through Table 57.) Impacts to IRAs and draft UUAs from their geographic location, human activities, and from forest management activities that exist on the ground contribute to the current moderate to low ratings for wilderness qualities or attributes and roadless characteristics. Reasonably foreseeable actions would not lower the wilderness attributes and roadless characteristics.

3.1.6 Desired Condition

The desired condition for IRAs and draft UUAs is to “make practicable their preservation and use in an unimpaired condition” (Intermountain Region Planning Desk Guide; USFS 2004a). The action alternatives 2 through 5 would temporarily affect the wilderness qualities or attributes and roadless characteristics. Over time, they would stay the same or even improve as aspen ecosystems are improved.

3.1.7 Conclusions

The five IRAs located in the project area presently average low to moderate ratings for the six wilderness qualities or attributes. The southern portion of the Signal Peak IRA is the best area that seems to hold the potential for manageability as a wilderness area. Alternatives 2 through 5 would leave stumps mostly flush with the ground and a burned appearance. No roads would be constructed, no clear cuts, control lines would be feathered and reclaimed, sensitive areas would be avoided, and timing restrictions imposed, as proposed. The proposed actions would only temporarily reduce the qualities or attributes and characteristics until the vegetation grows and improves over a period of about 2 to 5 years. Therefore, alternatives 2 through 5 would take place without permanently lowering the wilderness qualities or attributes and roadless characteristics; therefore, the existing wilderness eligibility would not change.

Effects to the draft UUAs would be the same as for the IRAs with the exception of temporary roads in alternatives 4 and 5 being constructed. These roads would be reclaimed after use and would only temporarily reduce the wilderness qualities, or attributes and roadless characteristics; therefore, the existing wilderness eligibility would not change.

Table 94. Mechanical treatment acres in Inventoried Roadless Areas (IRAs) and draft Unroaded-Undeveloped Areas (UUAs) by alternative

	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total IRA Only Acres	0	582	2,086	3,719	2,107
Total Draft UUA Only Acres	0	125	516	1,111	763
Total Overlap IRA and Draft UUA Acres	0	926	3,045	5,543	4,751
Total Combined IRA and Draft UUA Acres	**0**	**1,633**	**5,647**	**10,373**	**7,621**

The implementation of best management practices such as no new road construction in IRA and little road construction in draft UUA, reclaiming control lines, reclaiming the temporary roads in draft UUA, and cutting stumps mostly flush with the ground would manage the IRAs and draft UUAs in a way that would not permanently lower and may over time enhance the wilderness attributes and roadless characteristics from their present condition.

3.1.8 Compliance with the LRMP and Other Regulatory Direction

The Fishlake National Forest Land and Resource Management Plan (USFS 1986) does not provide desired conditions, goals, or standards and guidelines to specifically address or maintain roadless character.

As described in chapter 1 of the EIS, the desired conditions and the purpose and need for this project are consistent with the Forest's goals, the objectives found in chapter IV of the LRMP, and the Utah Fire Amendment (USFS 2001). The District has also compared the action alternatives with the general direction and the standards and guidelines listed in the LRMP to determine compliance, and found that the action alternatives are compliant with the LRMP. This review, along with supporting rationale is found in the project record.

The District did a 2001 Roadless Area Conservation Rule (USFS 2014c; RACR) consistency review to determine compliance. The District determined this project complies with §294.13(b)(1)(i), (ii), and (2) of the 2001 Roadless Rule. The review and supporting rationale in found in the project record. The Intermountain Region also concurred that this project complies with the 2001 RACR.

3.2 Issue 2 – Prescribed fire activities may impact adjacent private property

This discussion is extrapolated directly from the Fire Ecology/Fire/Fuels Specialist Report (Chappell et al. 2014).

3.2.1 Agency Level Direction

Forest Service Manual 5100 (page 9) includes direction on Forest Service use of prescribed fire to meet land and resource management goals and objectives. The objectives of fire management on lands managed by the Forest Service are:

1. Forest Service fire management activities shall always put human life as the single, overriding priority.
2. Forest Service fire management activities should result in safe, cost-effective fire management programs that protect, maintain, and enhance National Forest System lands, adjacent lands, and lands protected by the Forest Service under cooperative agreement.

New: 5103.1 - Risk Management and Risk Reduction

1. Firefighter and public safety is the first priority in every fire management activity. The wildland fire management environment is complex and possesses inherent hazards that can---even with reasonable mitigation---result in harm. In recognition of this fact, we are committed to the aggressive management of risk.

5103.2 - Ecological

1. Identify and use fire ecology to frame land and resource management objectives.
2. Use Fire Management programs and activities to implement LRMP objectives.
3. Incorporate public health and environmental quality considerations into fire management programs and activities.
4. Manage the land to make it more resilient to disturbance, in accordance with management objectives.

Again, new: Forest Service Manual 5140 (page 8) includes direction on USFS use of prescribed fire to meet land and resource management goals and objectives. 5140.2 - Objectives

1. Understand the role of fire on the landscape in order to integrate fire, as a critical natural process, into land and resource management plans, and develop achievable and sustainable LRMP objectives that provide for landscape that are resilient to fire related disturbances and climate change.
2. In cooperation with partners, strategically plan and implement on a landscape scale, risk-informed, and cost-effective hazardous fuel modification and vegetation management treatments (wildland fire (wildfire and prescribed), mechanical manipulation, biological, and chemical) to attain management objectives identified in Land and Resource Management Plans, to protect, sustain, and enhance resources and, where appropriate, emulate the ecological role of natural fire.

5142 - PRESCRIBED FIRE

5142.3 - Policy

1. When appropriate, use prescribed fire in a safe, carefully planned, and cost-effective manner to achieve desired conditions and attain management objectives identified in Land and Resource Management Plans (FSM 1920).
2. The NWCG Interagency Prescribed Fire Planning and Implementation Procedures Guide - PMS 484, is Forest Service policy (incorporated by reference at: http://www.nwcg.gov/pms/RxFire/rxfireguide.pdf) (FSM 5142, Page 8).

3.2.2 Methodology for Analysis

The method of analysis is primarily fire behavior modeling to predict the behavior of a fire in the project area for the vegetation conditions that would exist under the no action alternative and range of proposed action alternatives. Fire behavior model inputs were obtained from a combination of historical weather records and the weather prescription used during implementation of the Box Creek broadcast prescribed fire in late spring of 2012. Forest Vegetation Simulator outputs from stand exam data were used to inform fuel model and canopy characteristics choices.

The landscapes were developed utilizing Landfire 2010 vegetation cover. Fuel models were identified by a small group of fire specialists, then reviewed and approved by a fire-modelling expert at the Missoula Fire Lab. These fuel models are based on the current and expected post-

treatment vegetation types. A side-by-side comparison of the modeling results shows how the alternatives would alter fire behavior. Below is a list of outputs that were evaluated.

- Flame length
- Spotting distance
- Crown/surface fire activity

For more information on how the fire models work, please see appendix FM in the Fire Ecology/Fire/Fuels Specialist Report (Chappell et al. 2014).

These models were developed to predict wildfire behavior for fire behavior analysts, often working on specific landscapes. We are pushing the models' capabilities in attempting to determine post-treatment fire effects (Ager et al. 2011).

Since it can be difficult to demonstrate differences among alternatives using just a single fire behavior indicator, such as flame length or spotting, an index combining the flame length, spotting distance and crown/surface fire activity outputs was created. This index displays combined fire behavior differences among the no action and action alternatives proposed in this project.

The issue of fire affecting private lands necessitated a focus on fire behavior in and adjacent to the mechanical treatments beside the private lands, both after the mechanical treatments occur and once the project is completed. A distance filter from private land boundaries was applied to differentiate among the four action alternatives when compared to the no action alternative.

Specific burn parameters will be addressed at the burn plan level for project implementation. Each burn unit will have site-specific burn prescriptions developed to implement both the pile burning and the prescribed burning once the mechanical and pile burning is completed. These parameters include items such as fuel model, fuel loading and moisture, weather, organization and equipment needed, a communication plan, and a safety and medical plan to meet objectives (U.S. Department of the Interior et al. 2014). Each burn plan requires line officer approval to implement.

3.2.3 Environmental Indicators

The environmental indicators listed below were selected by a sub-group of fire, fuels, and modeling specialists. These indicators were determined to be the critical indicators that are relevant for decision-making:

- Firefighter and public safety
- Flame length
- Spotting distance
- Crown/surface fire activity

Firefighter and public safety are assessed through changes in fuels, and therefore fire behavior is shown in the fire modeling. Existing condition is modeled and then examined in the context of alternatives 1 through 5.

Flame lengths are one of the indicators of safety (Table 95):

Table 95. Fire suppression interpretations of lame length compared to safety (Andrews and Rothermel 1982).

Flame Length (Feet)	Interpretation
<4	Fire can generally be attacked at the head or flanks by persons using hand tools.
4-8	Fires are too intense for direct attack on the head by persons using hand tools. Handline should hold the fire.
8-11	Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
>11	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

A fire behavior characteristics chart illustrates a primary characteristic of fire behavior: spread rate (Figure 45). The figure represents the character of a fire, which can range from a fast or slow spreading fire with low flame lengths, to a fast or slow spreading fire with high flame lengths. It helps communicate and interpret modeled or observed fire behavior. 'Perhaps the single most valid characteristic of a fire's general behavior and direct impact on above ground vegetation is 'fire intensity." Fireline intensity (Btu[30] per foot per second) is the amount of heat released per second by a foot-wide slice of the flaming combustion zone (Alexander 1982). This value has been directly related to flame length, an observable characteristic of fire behavior. Fireline intensity is indicative of the heat that would be experienced by a person working near the fire. Flame length and fireline intensity can be interpreted in terms of suppression capabilities as shown in Figure 45 (Andrews and Rothermel, 1982).

The curved lines on the fire behavior chart define the areas of interpretations shown in Table 95. The interpretations range from fires being easily controlled by hand crews, to fire on which equipment can be effective, to fires on which control effort at the head will be ineffective.

The surface fire characteristics chart includes curves for several flame length values as related to rate of spread and heat per unit area (Figure 45) with symbols for fire suppression interpretations ranging from fires that can be attacked by firefighters with hand tools to fires for which control efforts are ineffective (Andrews et al. 2011).

[30] British thermal unit – The amount of energy needed to coor or hear one pound of water by one degree Fahrenheit.

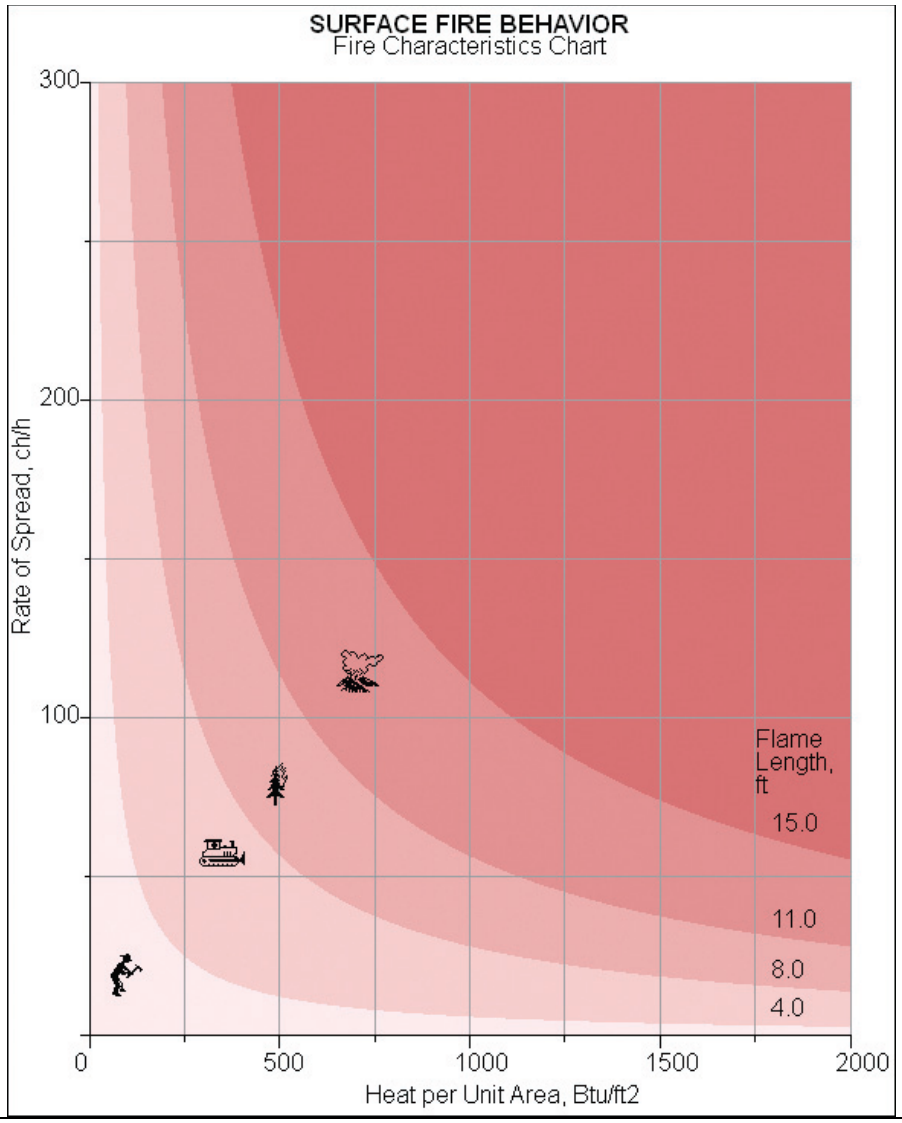


Figure 45. A fire behavior characteristics chart illustrates two primary characteristics of fire behavior - spread rate and intensity. Figures on the chart are an indication of fire suppression effectiveness related to flame length (Andrews et al. 2011).

Indicators listed above are primarily short-term indicators to address Issue 2; prescribed fire may affect private property.

The long-term indicator chosen to show the health of aspen ecosystem is Properly Functioning Condition (PFC), utilizing the Region 4 process shown in Appendix PFC of the Fire Ecology/Fire/Fuels Specialist Report (Chappell et al. 2014).

Properly Functioning Condition: Ecosystems at any temporal or spatial scale are in a properly functioning condition when they are dynamic and resilient to perturbations to structure, composition, and processes of their biological or physical components. The assessment utilized here was completed initially in 1998, as part of the then developed 'Prescribed Natural Fire Plan'(USFS 1998), updated in 2000 in the Fishlake National LRMP Amendment (USFS 2000).

Indicators are fire return interval and acres disturbed by ecosystem cover type.

3.2.4 Affected Environment

Monroe Mountain is currently vegetated with fire adapted and fire dependent species across much of its area. As one scans the landscape, it is evident that the vegetation evolved with fire as the aspen/conifer patterns show below (Figure 46). It is also apparent that fires have not functioned within their historic cycles for more than a century as evidenced by the large number of historic aspen stands now overtopped by old conifers across the ecosystems. Low severity surface fires and stand replacing fires occurred at regular intervals historically, more than 250 years ago (Chappell et al. 1997; Heyerdahl et al. 2011).

The fire occurrence database for the Monroe Mountain area shown in Table 96 and Figure 47 below is summarized from 1951 to 2013. Fire occurrence is displayed beginning at the top left chart. During the 62-year time span, 272 known ignitions occurred and burned 8,807 total acres of land. There is a range from 0 to 15 fires per year. The acreage per year was widely divergent, from none to over 2000. There were so few acres burned during many years from 1951 to 1977 that acreage did not register on this chart (acreage shown in blue hatch marks).

Only 2 years have had fires that burned more than 2,000 acres in over 60 years. Marysvale Peak, Annabella and Blackbird Mine fires burned in 2006, and the Box Creek Fire burned in 2012. More than 80 percent of the ignitions burned less than 0.25 acre each, as displayed in the lower left box as size class A. Only 4 ignitions burned more than 1,000 acres each, again in the lower left box as size class F. The lower central box displays that more than 80 percent of the ignitions in the last 62 years have been lit by lightning. Humans have ignited 17 percent of the reported fires and just over 10 percent were caused by debris burning. This is higher than the Fishlake Forest wide average at 6.6 percent.

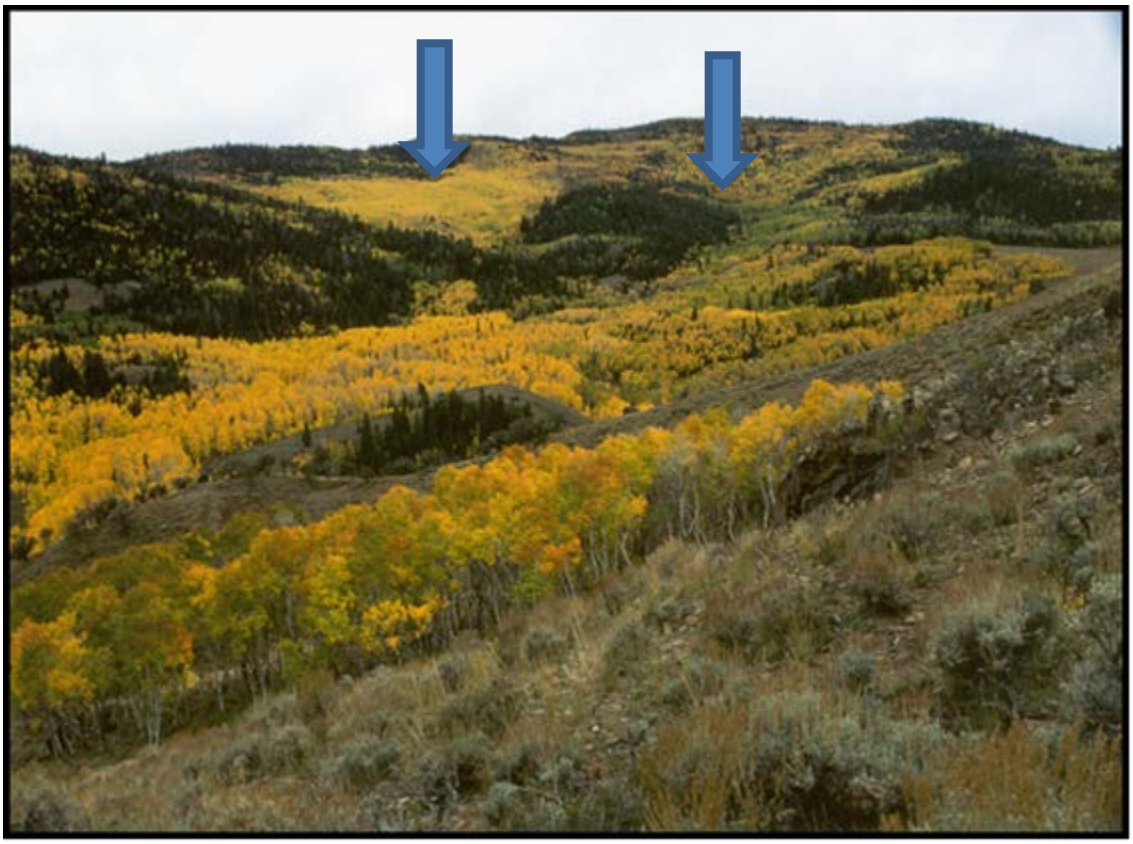


Figure 46. In this landscape view of Langdon Mountain, there is evidence of two historic fires, leaving two different stands of aspen of different ages and succession intervals. The large aspen stand on the left occurred from a fire in the 1990s and the stand to the right is an older fire that occurred in the 1840s and is being replaced by conifer. However, if one were to look under the aspen canopy of the 1890s fire, subalpine fir trees are there and have not exceeded the aspen canopy yet.

Table 96. Fire size class and cause class rating categories for wildland fire

Size Class	Fire Size (acres)	Cause Class	Ignition Type
A	0 - 0.25	**1**	Lightning
B	0.25 - 10	**2**	Equipment
C	10 - 99	**3**	Smoking
D	100 - 299	**4**	Campfire
E	300 - 999	**5**	Debris Burning
F	1,000 - 4,999	**6**	Railroad
G	5,000 +	**7**	Arson
		8	Children

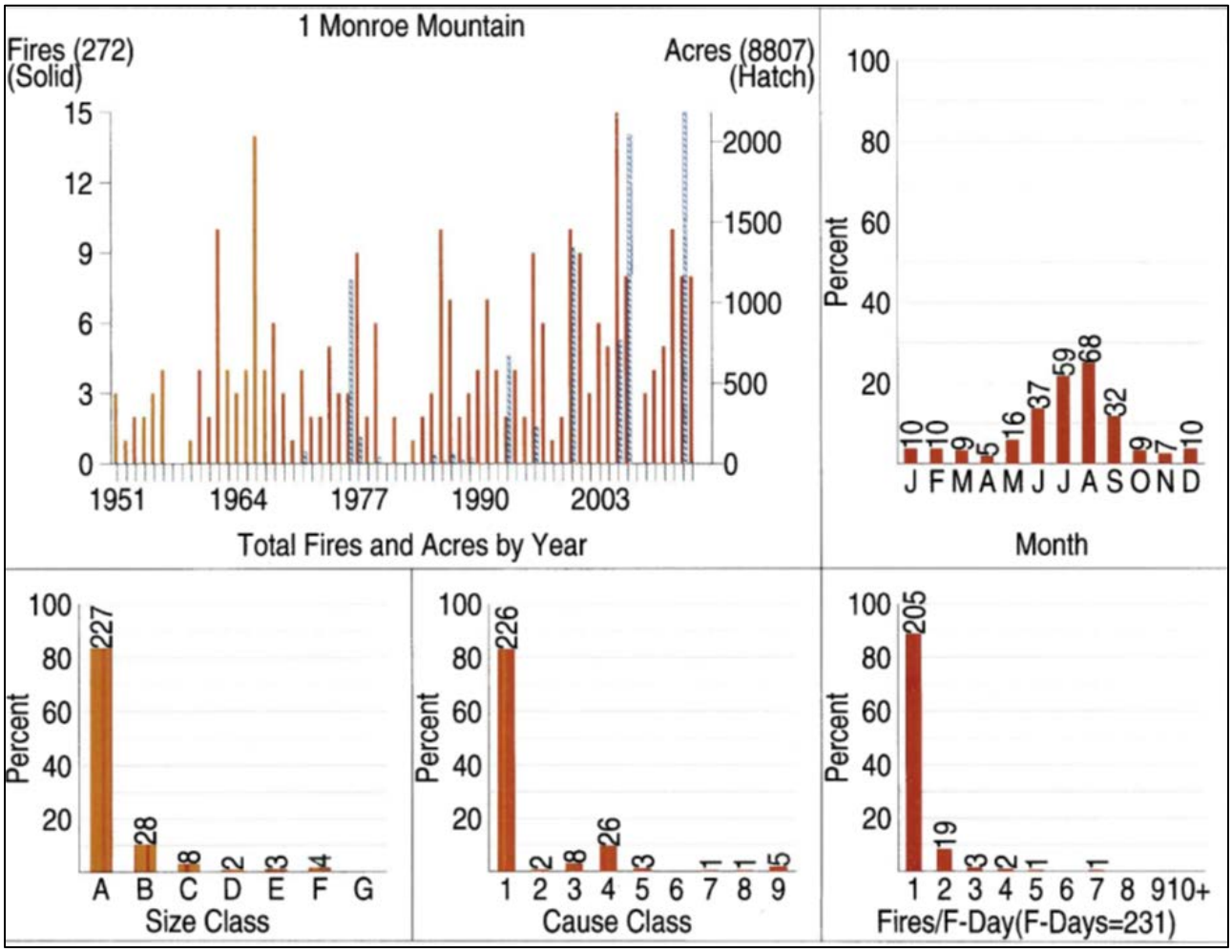


Figure 47. The occurrence on Monroe Mountain for 1951 through 2013, cumulative effects area.

Largely due to a reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and overbrowsing, most of the aspen ecosystems on Monroe Mountain presently do not meet the desired conditions described further in the document. Most of the aspen stands on Monroe Mountain do not have multi-height stems and adequate recruitment to perpetuate the communities. Big sagebrush in several areas is a major component, and fire regimes have not been adequate to perpetuate aspen in areas that are now seral to conifer. Sustainability of these diverse fire-adapted aspen ecosystems will largely depend on the successful reintroduction of appropriate disturbance processes, and reduction in overbrowsing of aspen. Currently, it is difficult for managers to allow fire to play a natural role in the ecosystem due to high stand densities, abundant fuel loading, the forest's proximity to private property, and public and firefighter safety. The desire is for fire to be adequate to perpetuate and sustain aspen stands, an average of approximately every 20 to 60 years (Table 5).

3.2.4.1 Existing Condition

Mixed Conifer

Mixed conifer types occur across the Monroe Mountain project area at the higher elevations primarily on north facing slopes. These stands consist mainly of older age class Engelmann spruce or Douglas fir trees intermixed with aspen, white fir, subalpine fir, and mountain shrub. Fire return intervals in this type are typically in the 10 to 80 year range (USFS 1998). In those areas where Douglas fir and white fir are the dominant conifers, fire return intervals are estimated at 10 to 50 years. Where spruce and subalpine fir occurs, return intervals are believed to be 50 to 80 years (Jackson et al. 1998). In areas where spruce occurs without an aspen component, fire return intervals have been documented in the 50 to 300 year range (Bradley et al. 1992). There are few pure spruce stands within the analysis area. These areas have fairly high fuel loading in the 25 to 60 tons per acre range; (Fishlake 2010 Data Collection) leading the stands to a higher intensity, stand replacing fire regime condition. Many of these mixed Douglas fir and spruce stands in the project area are falling victim to insect and disease attacks, increasing the concentration of dead woody material and contributing to increased fire risk. Fuel loadings during historical times were probably no more than one-fourth to one-third of present day loadings, or 12 to 18 tons per acre (Dieterich 1983).

Aspen

The aspen within the Monroe Mountain project area historically dominated the higher elevations. Many of the areas that were once pure aspen stands have declined due to the effects of fire exclusion and browsing. Aspen is being overtaken by subalpine fir and Engelmann spruce throughout much of the analysis area. Many of these stands occur on the steep slopes. Fire return intervals in this fuel type have been estimated at 20 to 60 years (USFS 1998). These areas would have typically been categorized in a low to mixed severity fire regime depending on the amount of conifer present in the understory. Historically, typical fuel loads for these stand conditions were 3 to 10 tons per acre. Today, however, they are more likely to burn under a high severity regime due to the higher presence of conifer in both the understory and overstory. Today, fuel loading under these conditions range from 3 to 50 tons per acre (Fishlake 2010 Data Collection).

Current Fire Behavior and Safety

During the recent uncharacteristic wildfires, fire behavior was more extreme and faster moving than historically. Flame lengths of 50 feet to greater than 100 feet are common in the mixed conifer fuel types. The typical flame lengths in these fuel types make it extremely difficult for initial attack suppression resources to safely and successfully extinguish fire as shown in Figure 48 and Figure 49. It is common for wildfires in central Utah to grow to greater than 1,000 acres in a single day.

The bottom line is that initial attack, utilizing available engine and hand crews, is likely unsuccessful on hot, dry, windy, days in the heavy, continuous fuel. This makes working conditions unsafe for firefighters and often, the nearby public.

Most of the vegetation (fuels) across the Monroe Mountain project area has experienced fire exclusion for over 150 years, resulting in an atypically high fuel load. Had fires continued to burn as they did historically, a mosaic of fuel loads would be present. Now, the continuous fuel loading increases the risk of a fire easily spreading once it ignites, adding to the wildfire hazard and risk over a larger area.

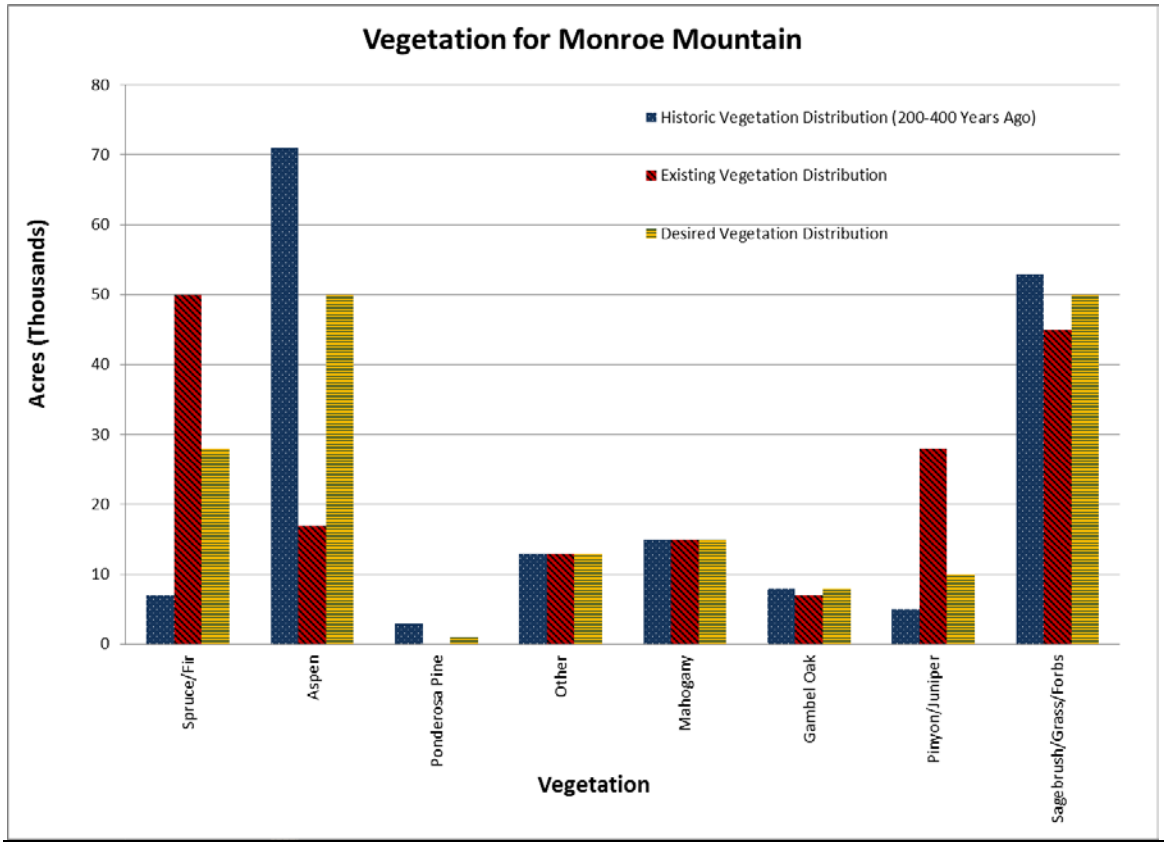


Figure 48. Historic vegetation compared with existing vegetation and desired vegetation (Prescribed Natural Fire Plan 2000)

The 2007 Central Utah Regional Wildfire Protection Plan identified the Monroe Mountain Area (includes area from Monroe to Glenwood) as a regional priority project. The selection of these areas was based on the need for fuels reductions. The communities at risk in that project area are Monroe, Annabella, Monroe Meadows, Manning Meadows, the Koosharem Reservoir area, Long Flat, and Burrville. These are all state-identified communities at risk and reducing risk is a priority under the Healthy Forest Restoration Act (HFRA). There has been strong community interest in fuels reduction and creating defensible space. Sevier County has included the structures on Monroe Mountain as part of the completed Monroe Mountain/Cove Mountain Community Wildfire Protection Plan and begun some private land and structures defensible space work. This includes removal of surface fuels, limbing, and pruning trees and brush, and increasing canopy spacing between trees.

Community wildfire protection plans may also document possible practices in the event of wildfire including fire preparedness, evacuation procedures, and opportunities for fire education, mitigation, and prevention.

Topography and Weather

Fuels, weather, and topography describe the fire environment. They work together to define fire behavior. The fuels element of the fire environment is the only element of the fire behavior triangle, which can be modified. Appropriate fuels modifications reduce potential fire behavior by changing the distribution, continuity, size, and shape of fuels, and fuel loading.

Topographic characteristics that influence fire behavior include slope, aspect, elevation, shape of the land, and the influence of topography on wind. Narrow canyons, box canyons, saddles, chimneys, and chutes all increase fire control problems when compared to other land formations. Topography and topographic shapes can influence wind patterns, convection patterns, and the susceptibility of vegetation outside of the fire to radiant heat from the fire. For example narrow canyons produce a chimney effect for the convection column, preheating fuels located within the "chimney", narrow canyons can also allow for radiant heat to be transferred from one side (or aspect) of the canyon to the other, thus drying them out and making them easier to ignite.

Slope increases fire behavior by more easily allowing a fire to preheat fuels upslope of the fire and enabling spotting from rolling and aerial firebrands. Flame length and rate of spread increase with an increase in slope. Slopes within the Monroe Mountain project area are moderately steep, and range from less than 20 percent on uplands, 30 to 60 percent on east side of the range and 40 to 80 percent on the west side of the range.

Aspect is the direction a slope faces and, within the Monroe Mountain project area, all aspects are represented. South and southwest aspects typically experience the more severe fire behavior due to the duration of sun exposure and pre-dominant wind directions in this part of the country. Vegetation located on south or southwest aspects typically contain lighter and flashier fuels when compared to other aspects in the same or similar locations. Heavier fuel loads tend to be on the north aspects. Predominant winds within the project area are generally southwest, with local winds based on the topography.

Elevation affects fire behavior in several different ways including the amount of precipitation received, snow melt dates, fuel types and loadings, vegetation curing dates, the overall length of the fire season, and cooler temperatures in higher elevation resulting in shorter individual burn periods.

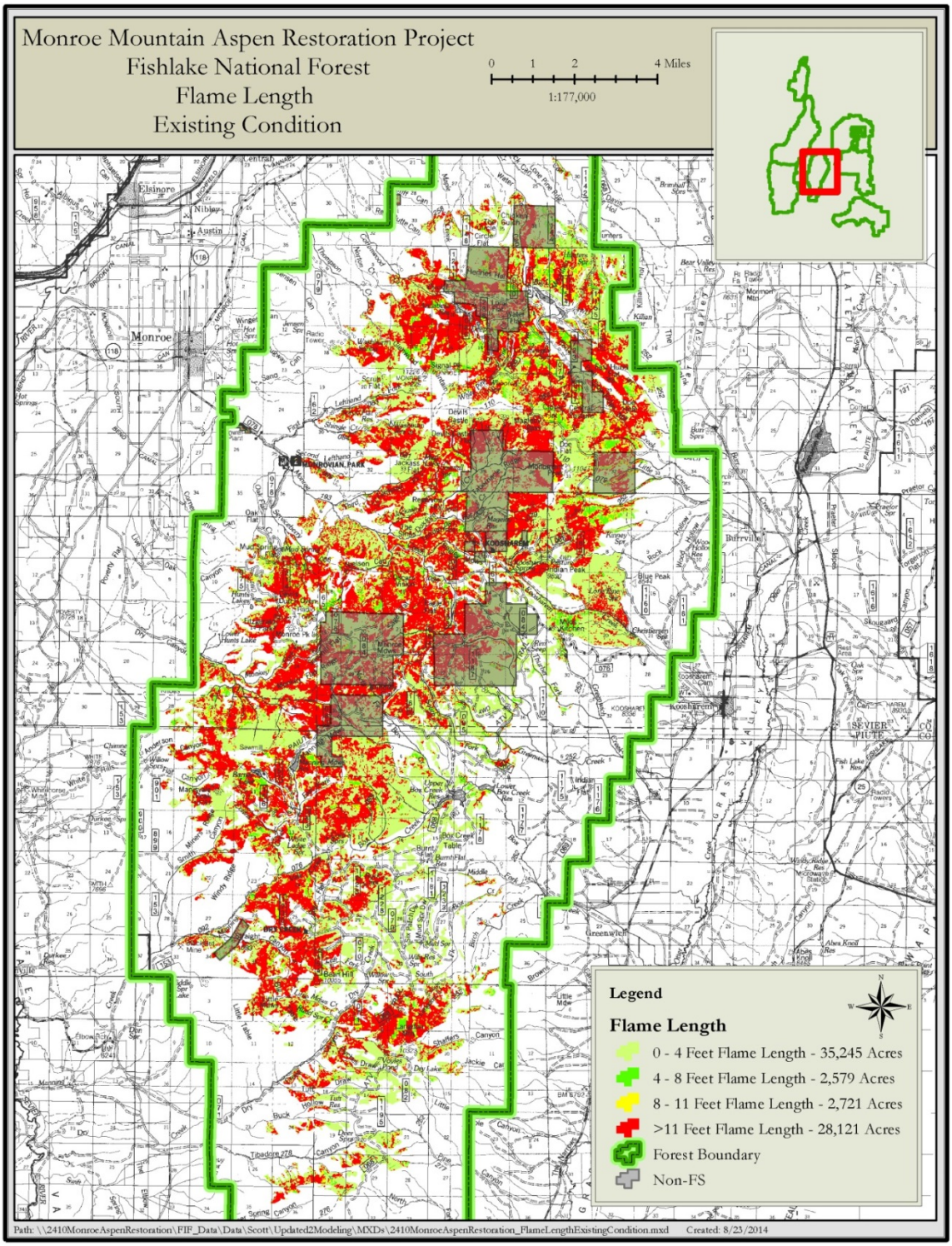


Figure 49. Existing conditions and flame length on Monroe Mountain

Summers are typically hot and dry with daytime temperature averaging approximately 85 degrees Fahrenheit with single or low double-digit relative humidity and poor overnight relative humidity recovery. The monsoonal pattern typically begins to set up in July, but is neither

reliable nor predictable. Lightning caused fires occur primarily in July and August associated with the monsoonal pattern typical of the high desert. Often these thunderstorms produce dry lightning and strong winds with little to no moisture.

3.2.4.2 Desired Condition

The desired condition as outlined in this document is specific to Monroe Mountain and was developed by the District; it is consistent with the Forest's Land and Resource Management Plan (LRMP; USFS 1986). The desired condition for fire and fuels is outlined in its entirety in chapter 1 of this document. It is summarized here.

The desired condition is to have persistent aspen communities, with multi-height stems and adequate recruitment to perpetuate aspen communities, including site-appropriate, biodiverse understories. Big sagebrush, if present would be a minor component of the aspen community. Fire regimes would be adequate to perpetuate aspen, particularly in areas seral to conifer (approximately every 20 to 60 years (Fishlake National Forest Prescribed Natural Fire Plan 1998; Table 5). Table 2 describes the current and desired aspen stand structure for areas currently classified as seral aspen, spruce/fir, and mixed conifer.

Aspen sprouts are defined as aspen less than 6 feet in height, aspen saplings are defined as aspen 6 to 12 feet in height, and aspen recruits are defined as aspen greater than 12 feet in height. For seral aspen stands, the disparity between the existing and desired condition is great. The existing condition describes 592 sprouts per acre compared to 10,000 to 20,000 sprouts per acre as described in the desired condition. Similarly, the existing condition describes 119 saplings per acre while the desired condition describes approximately 1,000 to 2,000 saplings per acre. Lastly, the existing condition describes 276 recruits per acre, while the desired condition is 400 to 600 recruits per acre (Table 2). Similar results occur for aspen in the spruce/fir and mixed conifer dominated stands (Table 2). Accomplishing these 10,000 to 20,000, 1,000 to 2,000, and 400 to 600 sprouts, saplings, and recruits per acre would result in achieving the desired conditions described above of having persistent aspen communities with multi height stems and adequate recruitment to perpetuate aspen communities, including site-appropriate, biodiverse understories.

The existing vegetation distribution (Figure 6) shows approximately 20 percent of Monroe Mountain is dominated by spruce/fir, mixed conifer, and seral aspen while approximately 10 percent is dominated by stable aspen. As shown in Figure 7, the desire is to have more areas dominated by stable aspen and fewer areas dominated by spruce/fir, mixed conifer, and seral aspen.

3.2.5 Environmental Consequences

Throughout this section, changes directly attributable to the action alternatives, such as thinning or prescribed fire, and direct effects are described. These include changes to canopy bulk density, canopy base height, consumption of surface fuel, etc. Changes to the potential behavior and effects of wildfires that result from the direct effects are considered indirect effects.

3.2.5.1 Alternative 1 - No Action

Direct Effects

Under alternative 1, there would be no changes to current management. The treatment area would not move towards desired conditions in the mixed conifer/aspen ecosystems nor restore disturbance-based ecosystems. This alternative would not reduce the wildfire risk to human lives nor would it result in safe, cost-effective fire management that would protect, maintain, and enhance National Forest System lands, or adjacent lands as required by FSM 5100.

This alternative would not meet the purpose and need. Under this alternative, wildfire, when it occurs, could be detrimental to the ecosystems. It could burn public lands as well as adjacent private lands. Wildfire in untreated areas is usually more costly and less efficient to manage than either prescribed fire or wildfire that is managed in areas that have had restoration treatments.

It is likely that large, unmitigated wildfires would continue to occur as this area has had repeated lightning ignitions in the recent past and that lightning pattern is expected to continue. The area has a higher potential for human-caused ignitions as shown by historic data for Monroe Mountain and Fishlake National Forest.

Indirect Effects

Effects resulting from alternative 1 are indirect because there would be no management actions. The effects of implementing alternative 1 are discussed in the following order. In the short-term (less than 20 years), effects of alternative 1 would include an increased risk of undesirable fire behavior and effects. Wildfire behavior would threaten lives, resources, and infrastructure. This alternative would not move the area toward desired condition.

In the long-term (greater than 20 years) wildfires would likely continue at inopportune times and places while aspen continue to lose function as conifer continue to grow into those stands due to lack of disturbance. The fire return interval would continue to increase in these disturbance-based ecosystems. In addition to allowing surface fuels to buildup, this alternative would allow ladder fuels to grow up in areas on the edges of denser forested areas, and woody species continue to expand into aspen.

With no treatments or disturbance, it would be expected that the aspen would continue to decline. If wildfire burns though aspen, the larger stands could likely respond with prolific sprouting, as most of the larger recruits are top killed. Recent trends show that browsing pressure would probably prevent the sprouts from reaching maturity so, without some sort of protection or change to ungulate browsing, stands would be weakened as the roots use up carbohydrates trying to keep suckering. Stands that are already declining may be killed, or pushed closer to dying from ungulate browsing, particularly when combined with uncharacteristic fire effects at the wrong time of year. If they did respond by sprouting (likely), browsing of those sprouts would further weaken the stands, and some would disappear (Amacher 2001 and Kay 1993).

Cumulative Effects

Spatially, cumulative effects of projects were evaluated within the project area. The prevailing southwesterly winds typically drive fires to the northeast across Monroe Mountain, so fires igniting on the southwest side of the mountain have more potential to burn into the project area than fires further away or in other directions.

Cumulative effects include the effects of wildfire and vegetation management activities (mechanical treatments and prescribed fire) on fire behavior and fire effects. The period considered is about 20 years into the past and 10 years in the future at which time the majority of the actions proposed will have been completed.

Past Vegetation Management Projects

Past vegetation treatments and wildfires near, adjacent to, and within the project area have contributed to shaping the existing vegetation conditions for the treatment area with prescribed fire and/or mechanical treatments (Table 97, Table 98, and Table 99).

Table 97. Past, present, and reasonably foreseeable Brushsaw, Dixie Harrow, and Harvest treatments

Past, Present and Reasonably Foreseeable Future Actions on Monroe Mountain			
Name	**Type of Action**	**Year**	**Acres**
Blue Peak	Brushsaw	2003	766
Dukee Fuels	Brushsaw	2004	617
Thompson Basin	Brushsaw	2007	579
Total for last 20 years		**1994-2013**	**1962**
Box Creek	Dixie Harrow	1995	29
Burnt Flat	Dixie Harrow	1995	96
Six Patch	Dixie Harrow	1995	440
Six Patch/Rock Springs	Dixie Harrow	1995	109
Squaw Springs	Dixie Harrow	1995	440
Bell Rock	Dixie Harrow	1996	138
Bagley North	Dixie Harrow	1997	47
Little Table	Dixie Harrow	1997	126
Thurber Fork	Dixie Harrow	1998	570
Burnt Flat	Dixie Harrow	1998	316
Forshea Mountain	Dixie Harrow	1999	65
085 Road	Dixie Harrow	2000	22
Big Flat	Dixie Harrow	2003	133
Blue Peak	Dixie Harrow	2003	766
Box Creek	Dixie Harrow	2003	104

Indian Flat	Dixie Harrow	2003	14
Koosharem	Dixie Harrow	2003	76
Six Patch	Dixie Harrow	2003	265
Dry Creek	Dixie Harrow	2004	93
Durkee Springs	Dixie Harrow	2004	466
Hells Hole	Dixie Harrow	2004	132
Indian Flat	Dixie Harrow	2004	89
Rueben Burn	Dixie Harrow	2004	155
Willis Spring	Dixie Harrow	2005	176
Brindley Flat	Dixie Harrow	2006	40
Indian Peak	Dixie Harrow	2006	95
Box Creek Retreat 1	Dixie Harrow	2008	156
Thurber Fork Retreat 1	Dixie Harrow	2009	461
Twin Peaks	Dixie Harrow	2012	578
Totals for last 20 years		**1994-2013**	**6,197**
Indian Ranch	Harvest	1969	47
Langdon Mountain	Harvest	1969	17
Monroe Peak	Harvest	1980	14
Pole Canyon	Harvest	1982	19
Big Flat Aspen 4,5 &6	Harvest	1983	4
Lone Pine	Harvest	1984	78
Lower Langdon	Harvest	1984	82
South Monument Asp.	Harvest	1987	17
Clover Flat	Harvest	1989	186
Wooten Spring	Harvest	1989	103
Langdon	Harvest	1991	151
Doe Flat	Harvest	1992	28
Dry Lake	Harvest	1993	46
Cove Mtn. Salvage 1	Harvest	1993	9
Buck Hollow	Harvest	1994	24
Cove Mtn. Salvage II	Harvest	1996	29
White Ledge	Harvest	1997	36
Forshea	Harvest	1998	111
Research Unit	Harvest	1998	12
State Section 16	Harvest	1998	147
White Ledge B	Harvest	1998	71
Monument Peak Salvage.	Harvest	1998	60

Dry Creek –State	Harvest	1999	151
Mill #8 Salvage	Harvest	1999	10
Monument Peak Salvage II	Harvest	1999	131
Mill #9 Salvage	Harvest	2000	52
Mill Creek	Harvest	2000	274
White Pine	Harvest	2000	49
Annabella	Harvest	2001	234
Mill #11	Harvest	2001	68
White Pine 2	Harvest	2002	61
Mill #10	Harvest	2003	162
Mill #11a	Harvest	2003	68
Mill 12	Harvest	2004	62
Annabella Aspen II	Harvest	2005	104
Annabella Aspen 3	Harvest	2005	22
North Clover	Harvest	2011	191
Box Creek Phase 1	Harvest	2012	386
Box Creek Phase 2	Harvest	2013	284
Cove Mountain	Harvest	2014	1,774
Monument Peak	Harvest	2014	400
Harvest since 1969		**1969-2013**	**5774**
Harvest last 20 years		**1995-2014**	**4949**

Table 98. Past, present and reasonably foreseeable prescribed fires

Prescribed Fire Name	**Year**	**Acres**
Kingston Trough	1980	255
Bean Hill	1986	123
Deer Spring	1988	195
Tibadore Pond	1988	669
Deer Spring	1989	41
Buck Hollow	1989	18
Tuft Draw	1989	622
Forshea	1993	1,313
Tibadore Pond	1988	669
Kinney Spring	1996	794
Greenwich Creek	1996	83
Box Creek	1997	509
Little Table	1997	485
Shaffers	1997	334
Jackie Canyon	1997	267

Ruebens	2005	948
Thompson Basin	2008	163
Thompson Basin	2009	180
Box Creek	2012	650
Twin Peaks	2014	5,169
Monument Peak	2015	3,120
Box Creek	2015	2,658
Total for 34 years	**1980-2013**	**19265**
Total for 20 years	**1994-2013**	**4,847**
Total in upcoming years	**2014-2015**	**10,947**

Table 99. Past wildfires

Wildfire Name	Year	Acres
Hell Hole	1975	896
Monroe Mtn.	1979	8
Monroe Mtn.	1979	67
Kingston Trough	1980	255
Burnt Flat	1983	359
Bean Hill	1986	123
Deer Spring	1988	195
Tibadore Pond	1988	669
Deer Spring	1989	41
Buck Hollow	1989	18
Tuft Draw	1989	622
Tibadore Pond	1989	387
Killian Spring	1990	407
Forshea	1993	1,313
Monroe Canyon	1996	196
Thompson Basin	1996	103
Flat	1997	5,505
Oldroyd	2000	1,329
Bald Knoll	2003	68
Marysvale Peak	2005	759
Annabella	2006	573
Blackbird Mine	2006	1,463
Box Creek	2012	1,520
Total for 20 years	**1994-2013**	**11,516**
Total for 39 years	**1975-2013**	**16,876**

The combined effects of the projects listed in Table 98 are limited to 4,847 acres treated with prescribed fire in the last 20 years. Wildfires had a slightly larger impact at 11,516 acres burned in the last 20 years (Table 99). An average of 432 acres per year burned over the 39 years of known fires. Very few wildfires were managed for multiple objectives beyond suppression due to the conditions while they were burning. Sixty percent of the last 20 years of burning treatments have occurred as wildfires.

Unavoidable Adverse Effects, Irreversible and Irretrievable Commitment of Resources

Without treatment, there would be expected more and larger fires of higher severity than occurred historically, or than are sustainable on the landscape. There is broad consensus that such fires will continue to burn in this area if no action is taken, though the specific extent and location of the negative effects could not be known until an incident occurs.

First order effects would include (but are not limited to): chemical and physical changes to soil; high levels of mortality across the burned area (assuming approximately 30 percent high severity); consumption and/or killing the seed banks; consumption of organic material in soil, including flora and fauna; and conversion of forested habitat to non-forested habitat through loss of the spruce/fir component.

Second order fire effects would include (but are not limited to) erosion, flooding, debris flows, destroyed infrastructure, changes in visitation to the forest and the economies of local businesses that depend on visitors, and degradation of water resources for wildlife and humans. Loss or damage to the Bonneville cutthroat watershed and boreal toad habitat would be more likely under this scenario.

With no treatments or disturbance, the aspen ecosystems would be expected to continue to decline rather than be sustained as functioning ecosystems. It is likely that more and possibly larger wildfires would occur, increasing the likelihood of private lands burning, private property damage and possible large areas of high severity fire impacts. The possibility of human injury or death also rises during these unusual wildfires.

Some of these effects would last just a few days or weeks (infrastructure would be rebuilt), some would take years to recover, some changes would be permanent. For instance, it is likely that where fires occur, continued overbrowsing on the post-fire sprouts would also occur, likely killing the aspen roots, resulting in loss of aspen ecosystems across the project area. Another example is that topsoil is critical to healthy surface vegetation and would take centuries to recover though, with climate change, it is unknown exactly what the ecological trajectory would be. The loss of old growth and old trees would require decades to centuries to recover.

3.2.5.2 Alternatives 2 through 5

Direct and Indirect Effects Common to All Proposed Prescribed Fire Treatments in All Action Alternatives

Fire is a natural process that the aspen/mixed conifer and aspen/spruce/fir ecosystems evolved with, as did many other vegetative systems on Monroe Mountain. Fires will continue to occur. Prescribed fires and fires managed for multiple objectives are likely to produce beneficial post-fire effects in the fire-adapted ecosystems. Most fire effects cannot be created by a treatment other than fire. These effects include nutrient cycling, seed scarification (by both heat and smoke) promoting a vegetative mosaic of seedlings, suckers, shrubs, forbs and grasses, regulating available fuel loads, changes in soil moisture, etc. The many benefits of mechanical treatments coupled with prescribed fire include a controlled reduction in surface and canopy fuels which is especially needed in the project area near private lands. The effects of the action alternatives differ primarily in the magnitude of the treatments, which are disclosed in Table 43.

The risk of large, unmitigated wildfire would be reduced through all the action alternatives, although some treatments would better create safer work places for fire fighters and prescribed fire managers to work as the project progresses. The treatments assessed would not fireproof the project area; instead, they would reduce the amount of fuels near private lands, leading to reduced fire behavior. Reduced fire behavior (flame lengths below 4 feet, reduced spotting and less crown fire initiation) creates a safer place for wildland firefighters and prescribed fire crews to work in both the short and long term.

Stable aspen stands are known to slow and/or stop a fire on the Forest during many fire seasons. On the adjacent Beaver District, there are more than 100,000 acres of mixed conifer and aspen ecosystems. A variety of treatments causing dominant aspen units occurred in this area including the Grindstone Flat clearcut and exclosure study in 1934, the Betenson Mill wildfire in 1958, and the Betenson Flat spruce harvest in 1972. These treatments gave rise to vigorous young stands of aspen.

All of these treatments were in the path of the Pole Creek wildfire that burned through the area in 1996 and scorched about 10,400 acres. The Pole Creek fire burned around these aspen stands that were about 20, 40, and 60 years old respectively. All were effective firebreaks during the 1996 wildfire. This is a landscape-scale example showing that young aspen stands can be effective firebreaks for at least 60 years, once established and recruitment has occurred (Campbell et al. 2004).

Options 1 and 2 Compared

Options 1 and 2 are not shown separately on maps and charts developed from this fire modeling as the models are too general to differentiate between them. The proposed option 1 and option 2 treatments differ in a number of ways that affect fire behavior.

Flame Lengths

Flame lengths outputs from the models used are not different enough to be useful in decision-making.

Spotting

Spotting would be extremely limited in option 1 in seral and stable aspen stands as only aspen are left, which rarely spot. Mixed conifer and spruce/fir under option 1 post-treatment would have a lower average stand height. This lower stand height would reduce spotting distance compared to option 2. Option 2 would not reduce spotting distance, as the stand height would remain the same.

Crown Fire

Opening the overstory up through cutting the stands to a 90 basal area, as in option 1, would have an impact on crown fire initiation. Small clumps of trees may still be able to torch, and a running crown fire would be unsustainable in a crown which had been partially cut out. This lowers the threat of crown fire affecting private lands and lowers the risk to firefighters working there. There are more trees per acre greater than 8 inch DBH in option 2 in IRA/draft UUA areas. This means that more continuous aerial fuel is available to carry a crown fire through it, if a crown fire hits it, than the discontinuous crown fuels created in option 1.

Option 2: Thinning a stand from below reduces primarily surface and some ladder fuels. The majority of the crown fuels, both conifer and aspen, remain as if untreated. When a crown fire moves into the thinned from below stands, it is possible that it could sustain itself across those stands and into the next, resulting in a fire crossing onto private lands. Until the prescribed burning is completed (in up to 10 years), crown fires could cross from forestlands to private lands. Once the prescribed fires were completed, the private lands would be at a lower risk.

On stable aspen sites, it is unusual to have enough ladder fuel to cause much torching and crown fires are unlikely due to aspen's typical high fuel moisture. In fact, aspen is often used as a safety zone by firefighters as the typical vegetation has higher fuel moisture than surrounding vegetation communities. Aspen communities are also often used as firebreaks when burning surrounding vegetation (Hood and Miller, eds. 2007). Autumn leaf fall can carry a surface fire and frequent fires can maintain a grass-forb community, with aspen suckers confined to the shrub layer. Fire behavior is often so low that aerial ignition is recommended in the sparse fuels of an aspen forest to create enough preheating to move a fire across the fuels (Brown and Simmerman 1986).

Treatment Length

The effective lengths of the impacts from fuels treatment on fire behavior are different as well. Option 1, once fully treated, should last without maintenance for more than 20 years as the stands have been opened up and will take years to reach the pre-treatment density. Option 2, once fully treated, will begin to accumulate new fuels immediately from the untouched overstory, contributing to a shorter time between treatments.

Option 1 fuels treatment effects would last without maintenance up to 20 years, based conservatively on the Beaver District Pole Canyon fire effects. Crown fire initiation is a function of basal area, crown base height, and trees per acre. Indirect effects include a longer estimated retreatment time when compared with option 2.

Option 2 will likely need to be retreated in 10 years, leading to twice the treatment cost over the length of the project and into the future. Indirectly, the estimated retreatment time on option 2 would be at least double that of option 1, then it would likely need to be thinned again to keep it open enough to use as a shaded fuel break.

Immediately following treatments, surface flame lengths would be similar as leftover fuels in both treatments would be piled and burned. Over time, it is likely that option 2 will recruit dead and down fuels faster due to the denser overstory, standing trees dying and falling and dead branch wood. Option 1 is likely to result in lower overall fire behavior than option 2.

It is important to note that fire modeling was not capable of showing any differences between option 1 and option 2. The differences described above are based on the fire and fuels staff's professional knowledge of fire behavior.

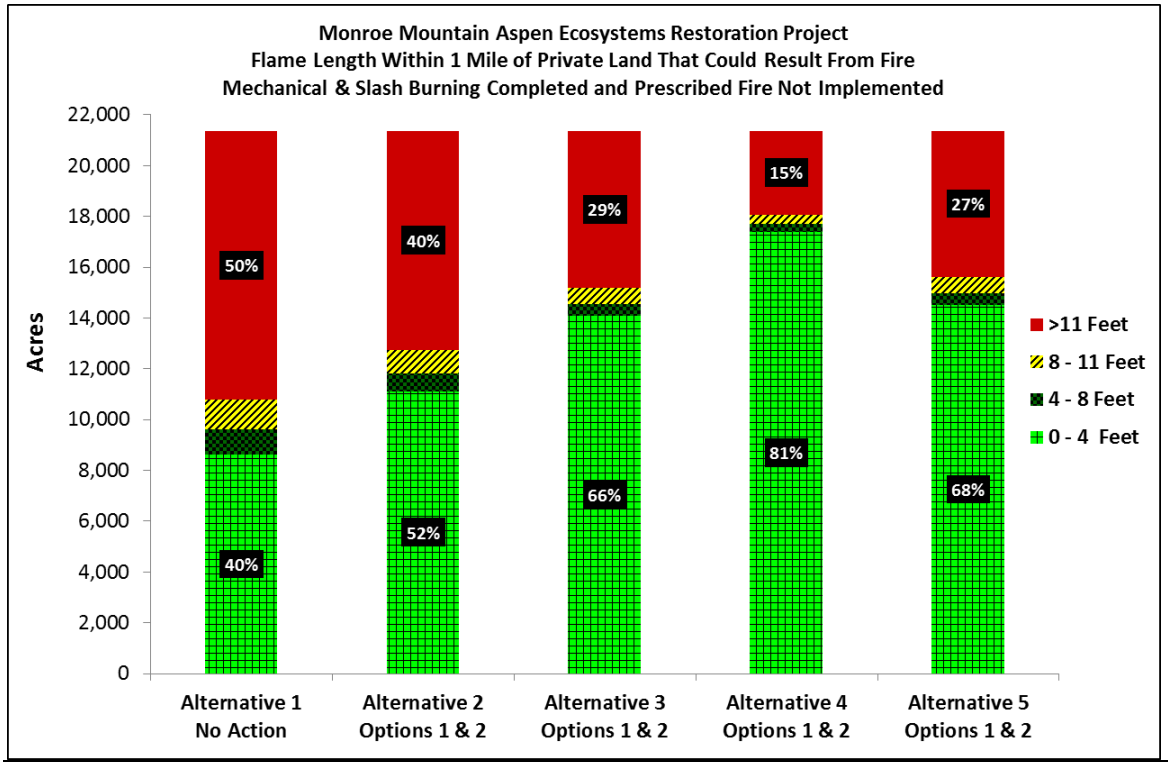


Figure 50. Flame length. Options 1 and 2 proposed treatment areas within 1 mile of private land. Mechanical and slash burning completed and prescribed fire not implemented.

Flame Lengths

Flame length fire modeling results are shown after the mechanical treatments are done and piles are burned for each alternative proposed.

Figure 50 shows the flame length differences among the no action and action alternatives for options 1 and 2 within 1 mile of private land.

Under no action, 60 percent of the acreage can produce flame lengths of more than four feet. Remember that flame lengths greater than 4 feet are unsafe to have firefighter's direct attack safely. Any of the action alternatives increase the number of acres that are considered safe to initially attack.

Compared to the no action alternative, which has 60 percent of the flame lengths above 4 feet, alternative 2 has 48 percent of the acreage exhibiting flame lengths above four feet, which is less than the 60 percent. Within the IRAs/draft UUAs, the majority of the acreage exhibiting flame lengths of more than 4 feet occurs 300 feet or more from private property. These narrow fuel buffer changes will have a direct effect on whether or not the subsequent prescribed fires are completed. Where slopes are steep and fuel mitigation is narrow, it is unlikely that prescribed fires will be lit in a timely manner to conclude the project in 10 years. Ignition windows are limited by current weather and fuel dryness, expected fire behavior and expected weather. There may be few days a year that a prescribed fire can be lit and conducted with success with the proposed fuel changes as ignition/holding barriers. The adjoining wildland fuels are likely to burn much more actively.

Alternative 3 shows 34 percent of the acreage exhibiting flame lengths above four feet. Within the IRAs/draft UUAs, the majority of the acreage exhibiting flame lengths of more than 4 feet occurs 0.5 mile or more from private property.

Alternative 4 shows 19 percent of the acreage exhibiting flame lengths above 4 feet. Within the IRAs/draft UUAs, the majority of the acreage exhibiting flame lengths of more than 4 feet occurs 1.3 miles or more from private property.

Alternative 5 shows 32 percent of the acreage exhibiting flame lengths above 4 feet. Within the IRAs/draft UUAs, the majority of the acreage exhibiting flame lengths of more than 4 feet occurs 1.3 miles or more from private property.

Summary: At this interim stage of the project, alternative 4 best reduces flame lengths compared to the no action alternative. This results in the most acres exhibiting flame lengths less than 4 feet, which creates a safer situation to ignite prescribed fires to complete the proposed actions with lower risk to private lands (Issue 2). This also minimizes potential fire impacts to private lands better than the other alternatives.

The no action alternative leaves 53 percent of the area with flame lengths above 4 feet. After all treatments are completed, all action alternatives are an improvement over the no action alternative (Figure 51). In terms of flame lengths, alternatives 2 and 5 are similar post-treatment, leaving 10 percent and 9 percent respectively above 4-foot flame lengths. Alternative 3 causes 95 percent of the area to exhibit flame lengths below 4 feet. Alternative 4 performs best, causing 98 percent of treated area to exhibit flame lengths below 4 feet.

Spotting

Figure 52 shows the spotting distance differences between the no action and action alternatives.

Under the no action alternative, 59 percent of the acreage can produce spots. All of the action alternatives decrease the number of acres that can produce spots. Alternative 2 reduces overall spotting acres from 59 percent to 47 percent; alternative 3 reduces overall spotting to 34 percent compared to 59 percent (no action). Alternative 4 reduces overall spotting to 18 percent compared to 59 percent (no action). Alternative 5 reduces overall spotting to 32 percent compared to 59 percent (no action).

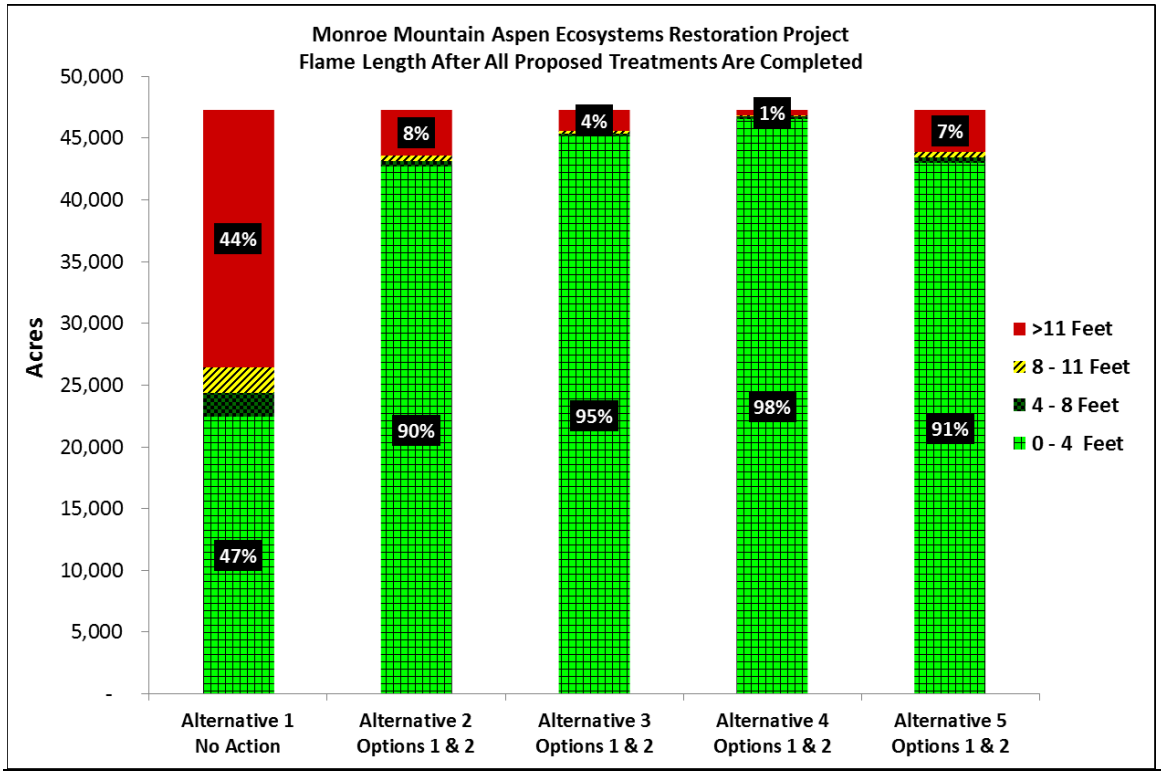


Figure 51. Flame length after all proposed treatments are completed.

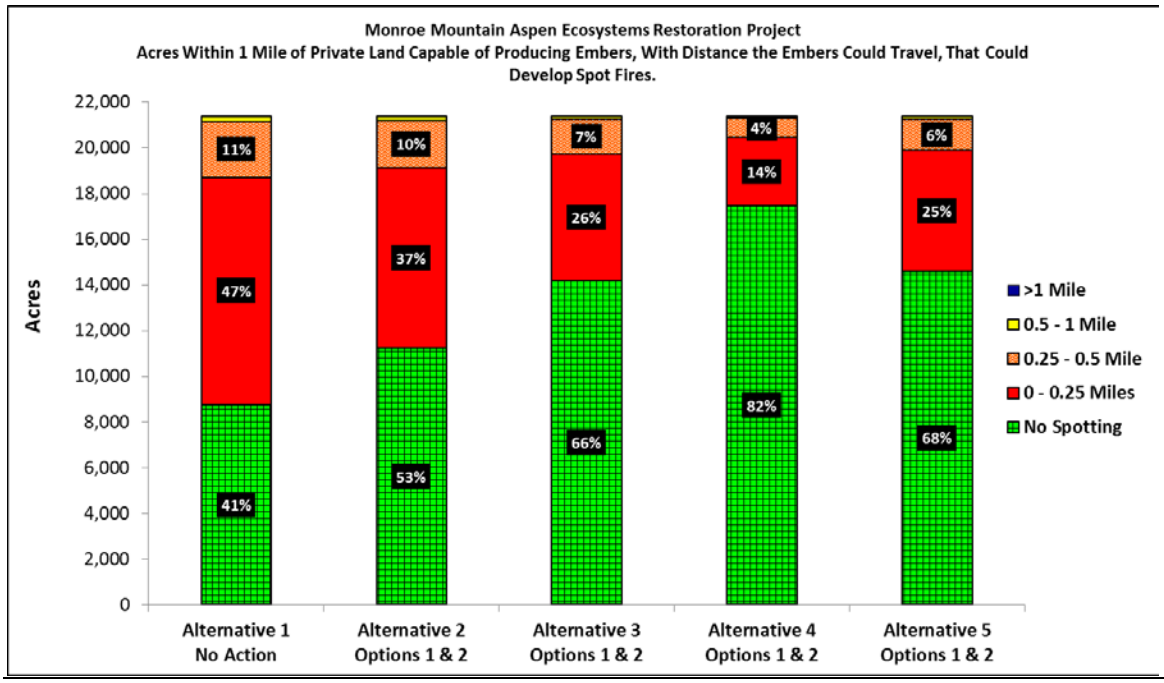


Figure 52. Spotting distance. Options 1 and 2 proposed treatment areas within 1 mile of private land. Mechanical and slash burning completed and prescribed fire not implemented.

Alternative 2 reduces 0.0 mile to 0.25 mile spotting from 47 percent to 37 percent compared to no action. Alternative 3 reduces 0.0 mile to 0.25 mile spotting from 47 percent to 26 percent compared to no action. Alternative 5 reduces 0.0 mile to 0.25 mile spotting from 47 percent to 14 percent compared to no action. Alternative 5 reduces 0.0 mile to 0.25 mile spotting from 47 percent to 25 percent compared to no action.

Alternative 2 reduces 0.25 mile to 0.5 mile spotting from 11 percent to 10 percent compared to no action. Alternative 3 reduces 0.25 mile to 0.5 mile spotting from 11 percent to 7 percent compared to no action. Alternative 4 reduces 0.25 mile to 0.5 mile spotting from 11 percent to 4 percent compared to no action. Alternative 5 reduces 0.25 mile to 0.5 mile spotting from 11 percent to 6 percent compared to no action.

A similar pattern in reduction of acreage, which can create spots, follows for further spotting distances. Alternative 4 is likely to produce the fewest acres that can produce embers that can cause spot fires, minimizing impact to private land the best.

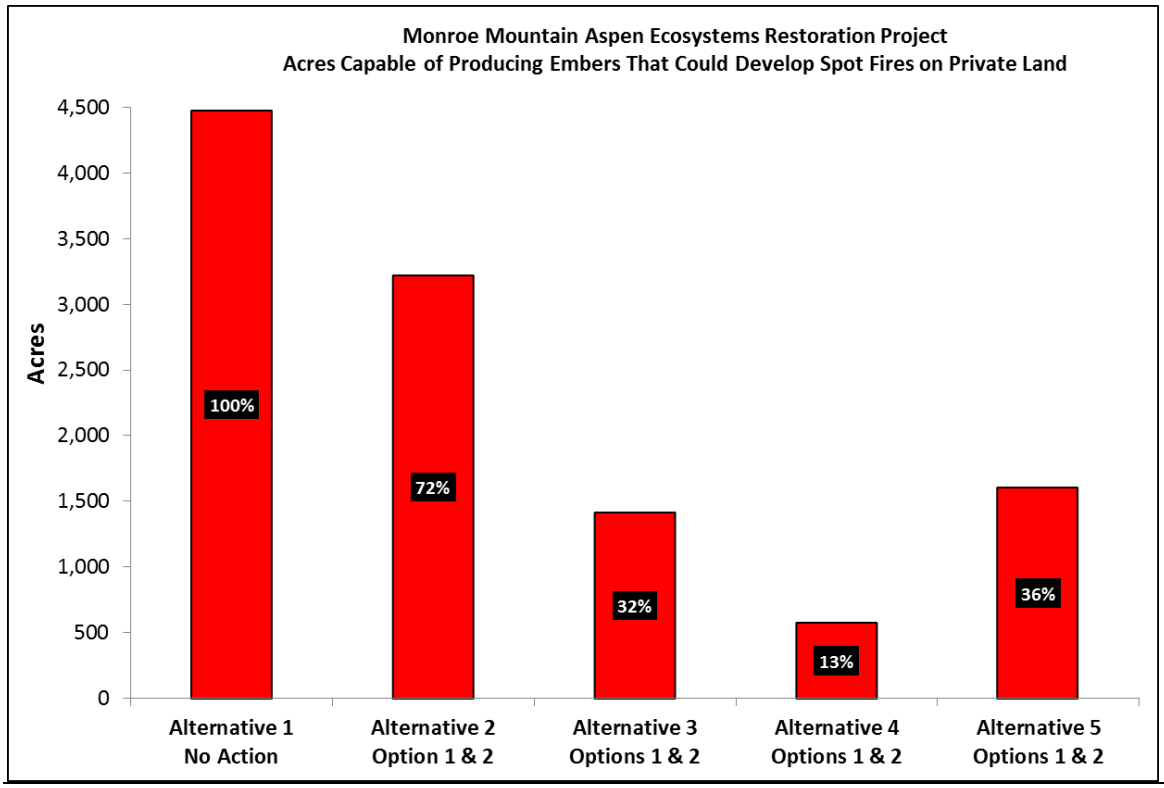


Figure 53. Spotting capable of producing embers that could develop spot fires on private land. Mechanical and slash burning completed and prescribed fire not implemented.

Figure 53 directly addresses Issue 2 – Prescribed fire activities may affect adjacent private property. It demonstrates that without action, 4,500 acres can produce embers that could cause spot fires on private land. That is, 100 percent of the spotting produced during a fire can reach private lands. Alternative 2 reduces that to 3,300 acres (72 percent); alternative 3 reduces it to 1,400 acres (33 percent). Alternative 5 reduces is to 1,500 (36 percent), similar in outcome to Alternative 3. Alternative 4 does the best job of reducing spotting that may reach private lands from fire, reducing the acreage to 500 (13 percent).

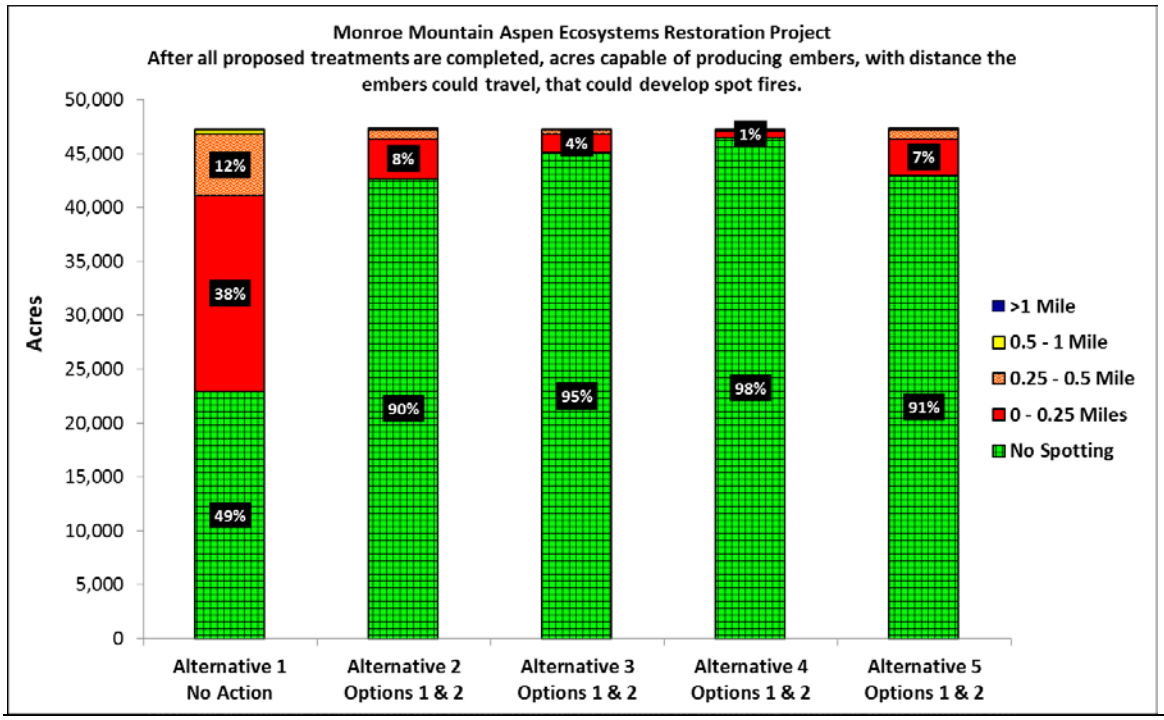


Figure 54. After all proposed treatments are completed, acres capable of producing embers, with the distance the embers could travel that could start spot fires.

Figure 54 shows that with no action, no spotting occurs from 49 percent of the area. Thirty eight percent of the area can produce embers up to 0.25 mile, 12 percent can produce embers 0.25 mile to 0.5 mile, and 1 percent can produce embers, which can travel up to 1 mile. All action alternatives greatly lessen the total spotting. Alternative 2 exhibits no spotting over 90 percent of the area, 8 percent can produce embers up to 0.25 mile, and 2 percent produces embers, which can travel up to 1 mile. Alternative 3 exhibits no spotting over 95 percent of the area, 4 percent can produce embers up to 0.25 mile and 1 percent produces embers, which can travel up to 1 mile. Alternative 4 exhibits no spotting over 98 percent of the area, 1 percent can produce embers up to 0.25 mile and 1 percent produces embers, which can travel up to 1 mile. Alternative 5 exhibits no spotting over 91 percent of the area, 7 percent can produce embers up to 0.25 mile and 2 percent produces embers, which can travel up to 1 mile. Alternative 4 produces the best results for addressing Issue 2 with over 45,000 acres unlikely to produce any spots once all proposed treatments are completed.

Crown Fire

Crown fire and surface fire both reach private lands at high rates under the no action alternative.

This is of interest as crown fire is indefensible utilizing ground firefighters. Surface fire may be defensible depending on the fire intensity and flame length. More surface fire equates to a higher defensibility in keeping fire off private lands.

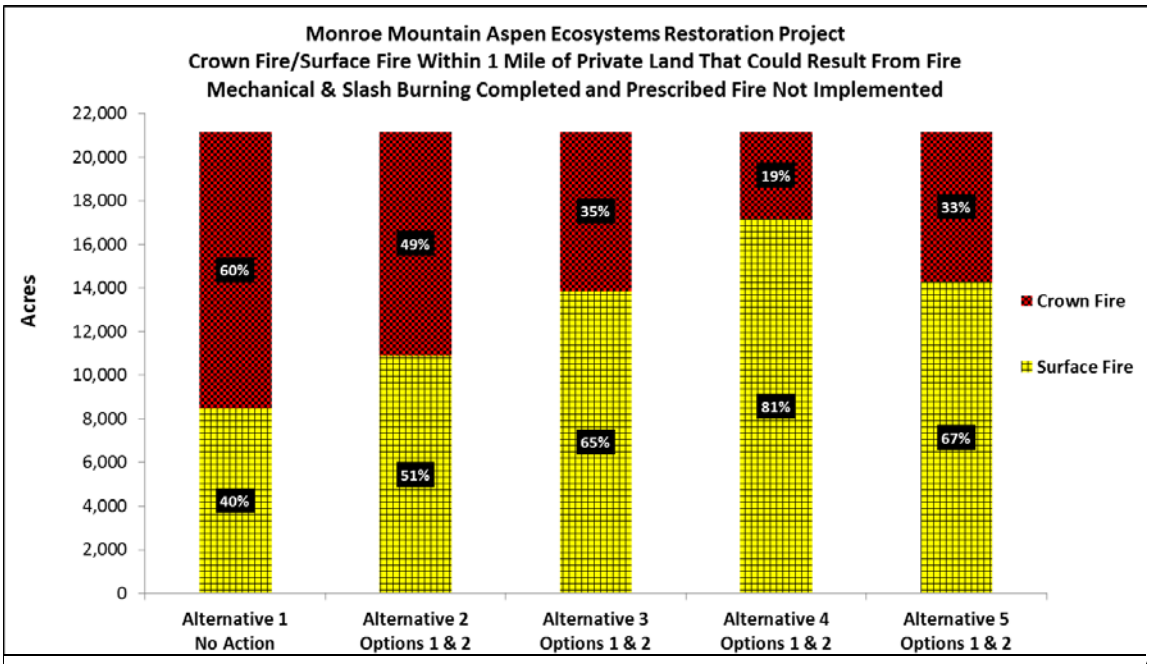


Figure 55. Crown fire/surface fire within 1 mile of private land that could result from prescribed fire. Mechanical and slash burning completed and prescribed fire not implemented.

Figure 55 shows the no action produces 60 percent crown fire and 40 percent surface fire. Each action alternative lowers the amount of crown fire. Alternative 2 shows 49 percent crown fire versus 60 percent crown fire under no action. Alternatives 3 and 5 show 35 percent and 33 percent respectively versus 60 percent crown fire under no action. Alternative 4 produces the best outcome with 19 percent crown fire versus 60 percent crown fire under the no action alternative and this is before the prescribe fire has been completed.

Figure 56 shows the no action alternative exhibits 53 percent crown fire. All action alternatives result in less crown fire than the no action alternative. Alternative 2 shows 10 percent crown fire versus 53 percent crown fire under no action. Alternatives 3 and 5 show 5 percent and 9 percent, respectively, versus 53 percent crown fire under no action. Alternative 4 produces the best outcome with 2 percent crown fire versus 53 percent crown fire under the no action alternative after all proposed treatments are completed.

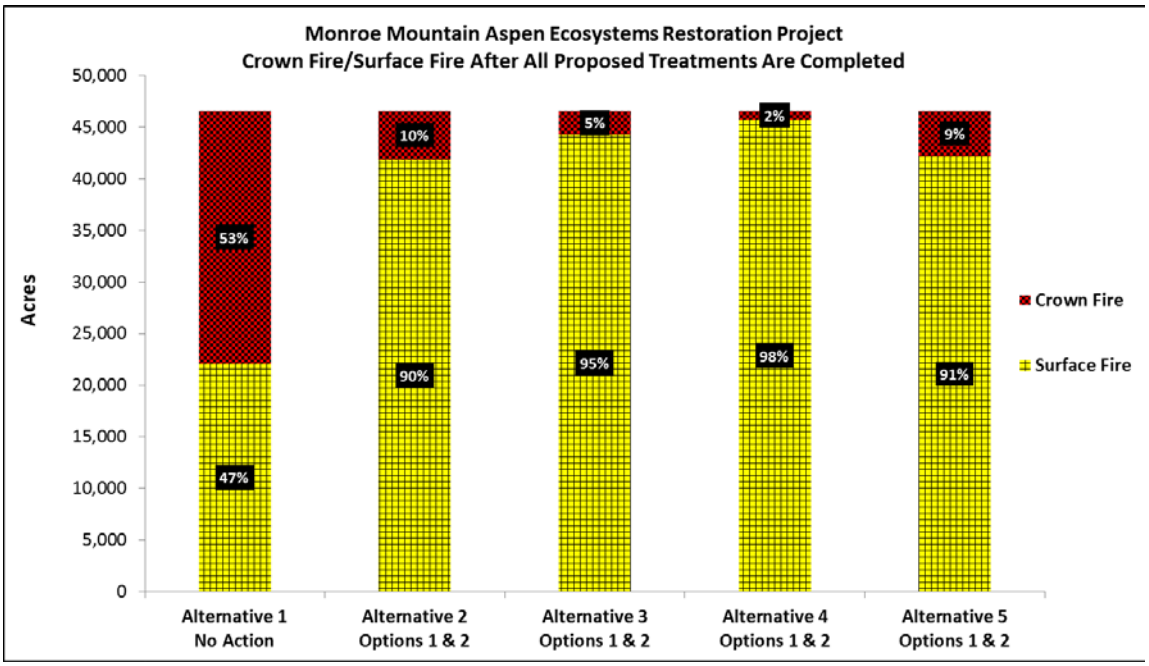


Figure 56. Crown fire/surface fire after all proposed treatments are completed.

Fire Activity Index

A Fire Activity Index was developed, combining flame length, spotting, and crown fire parameters summarized from the fire modeling to show an overall difference among alternatives. These data are summarized in Figure 57 and Figure 58. Alternative 4 best lowers the overall Fire Activity Index within a mile of private land at 81 percent low compared to 40 percent low under no action as in single indicators previously described. Alternative 4 also shows a lower amount of high fire activity at 15 percent compared to 50 percent under no action. Alternative 2 shows the following fire activity: 52 percent low, 8 percent moderate and 41 percent high, compared to no action with 40 percent low, 9 percent moderate, and 50 percent high. Alternative 3 shows the following fire activity: 66 percent low, 5 percent moderate and 29 percent high, compared to no action with 40 percent low, 9 percent moderate, and 50 percent high. Alternative 4 shows the following fire activity: 81 percent low, 4 percent moderate, and 15 percent high, compared to no action with 40 percent low, 9 percent moderate, and 50 percent high. Alternative 5 shows the following fire activity: 68 percent low, 5 percent moderate, and 27 percent high, compared to no action with 40 percent low, 9 percent moderate, and 50 percent high.

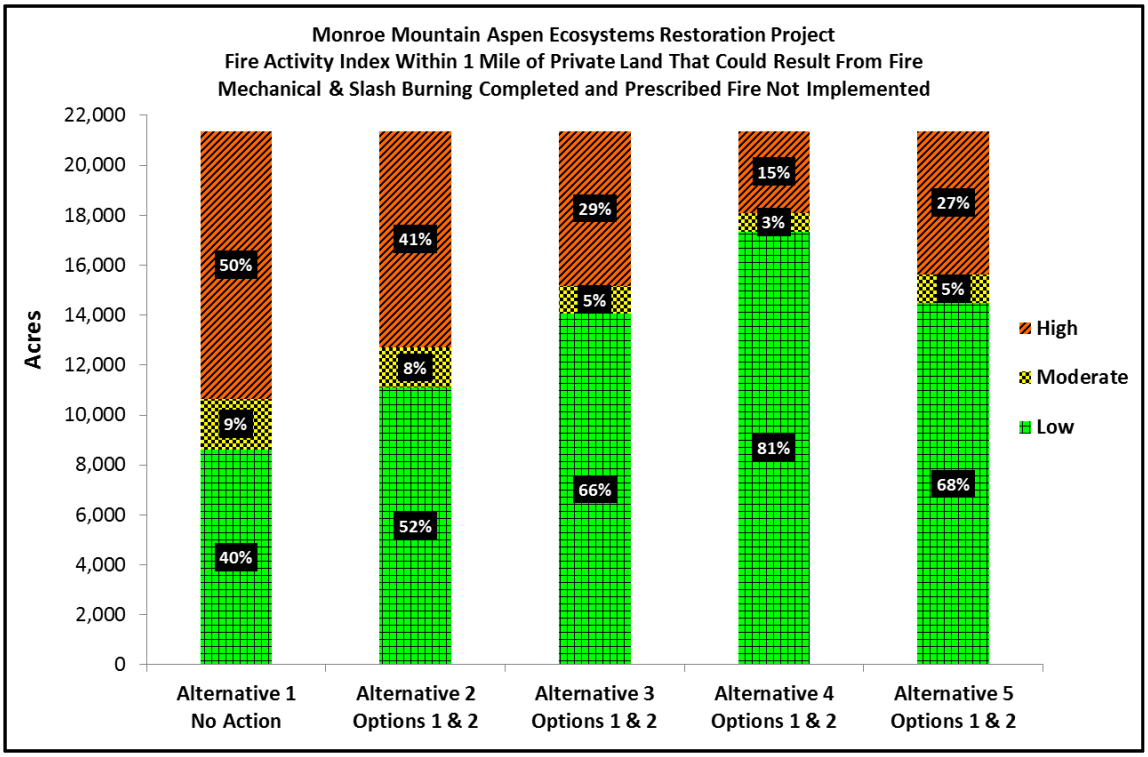


Figure 57. Fire Activity Index within 1 mile of private land that could result from prescribed fire. Mechanical and slash burning completed and prescribed fire not implemented.

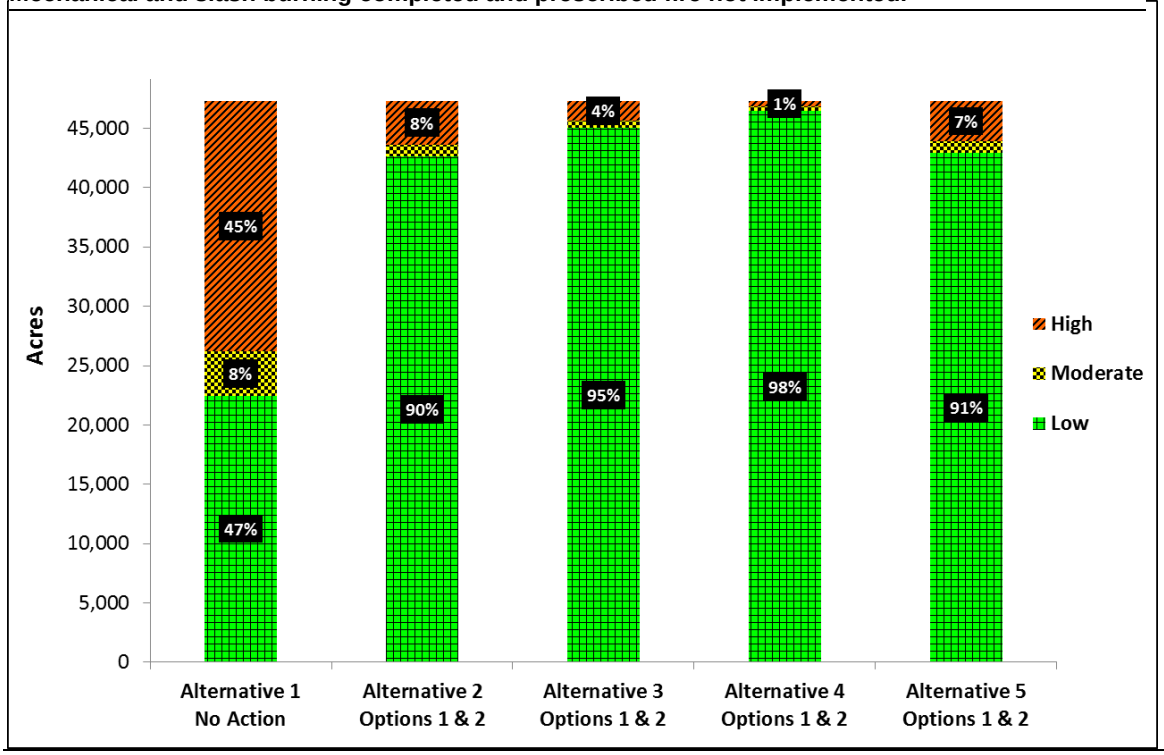


Figure 58. Fire Activity Index within 1 mile of private land that could result from prescribed fire. Mechanical and slash burning completed and prescribed fire not implemented.

Once all treatments are completed, alternative 4 continues to best meet the desired condition by providing the lowest overall fire activity index at 98 percent low. One percent each remains in the high and moderate categories. The no action alternative leaves 45 percent of the area in high condition with 8 percent in moderate. Again, all action alternatives lower the fire activity index. Alternative 2 causes 90 percent of the area to move to low. Alternative 3 moves 95 percent of the area to low, more than double that of the no action. Alternative 5 also almost doubles the no action alternative at 91 percent low fire activity index.

Cumulative Effects

Assumptions

For purposes of this cumulative effects analysis, the State of Utah has a history of working with landowners on improving defensible space around cabins. Some defensible space treatments on private lands have already occurred. Defensible space treatments will likely continue into the future as Utah Division of Forestry, Fire, and State Lands obtains cost sharing grant monies and as stewardship agreements with landowners are completed and implemented.

It is unknown where future private lands defensible space treatments will occur or at what scale or how much fuel will be removed. For purposes of this cumulative effects analysis, it is assumed that all private lands are treated similarly to what is being proposed for the action alternatives (i.e. conifer removal from aspen and basal area 90 in the mixed conifer and spruce/fir dominated stands).

The treatment areas for each of the action alternatives with the additional acreage from the Box Creek Fuels Reduction Project, Monument Peak Fuels Reduction Project, Cove Timber Sales, Marysvale Fire, private land treatments, and other past/present and reasonable foreseeable vegetation treatment projects/wildfires (Table 97, Table 98, and Table 99) in the aspen, mixed conifer, and spruce/fir dominated areas are included in this cumulative effects analysis.

Flame Lengths

All of the action alternatives lowered flame lengths across the treatment areas in the short-term. More acres exhibiting flame lengths less than 4 feet allow firefighters to use direct attack to limit fire spread. The existing condition in Figure 59 shows 51 percent with 0 to 4 foot flame lengths, about 8 percent with flame lengths between 4 and 11 feet, leaving 41 percent with 11 feet or higher flame lengths. All action alternatives more than doubled the acreage and percentage of the area with flame lengths below 4 feet: alternative 2 shows 92 percent, alternative 3 shows 95 percent alternative 4 shows 98 percent, and alternative 5 drops back down to 92 percent. Alternative 4 best lowers overall flame lengths across the cumulative effects area once all treatments are completed, thus increasing firefighters' abilities to directly attack flames near private lands.

Over the long-term wildfires are likely to occur within the analysis areas. The size and severity of these fires will vary. Based on past wildfires within the analysis area, the results will be an

improvement in diversity of plant species, vegetation structure and age classes for all vegetation types. Fuels will begin to increase over time as the stands re-establish.

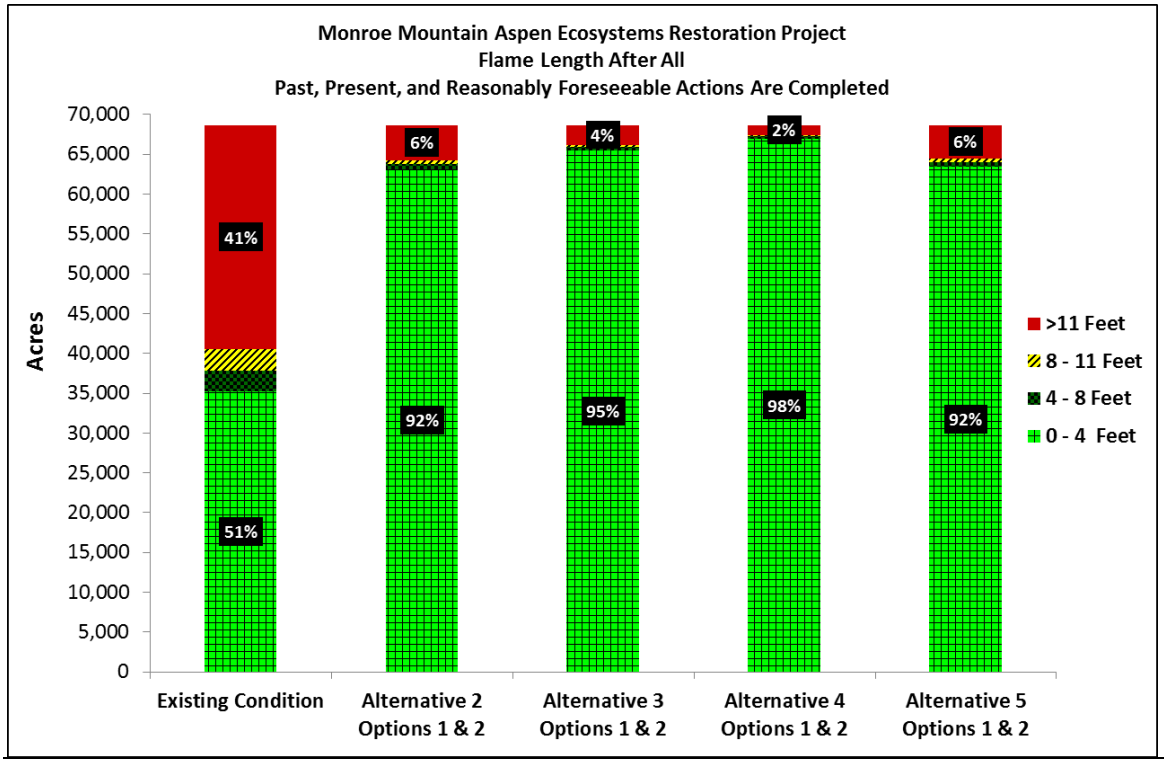


Figure 59. Flame length after all past, present, and reasonably foreseeable actions are completed.

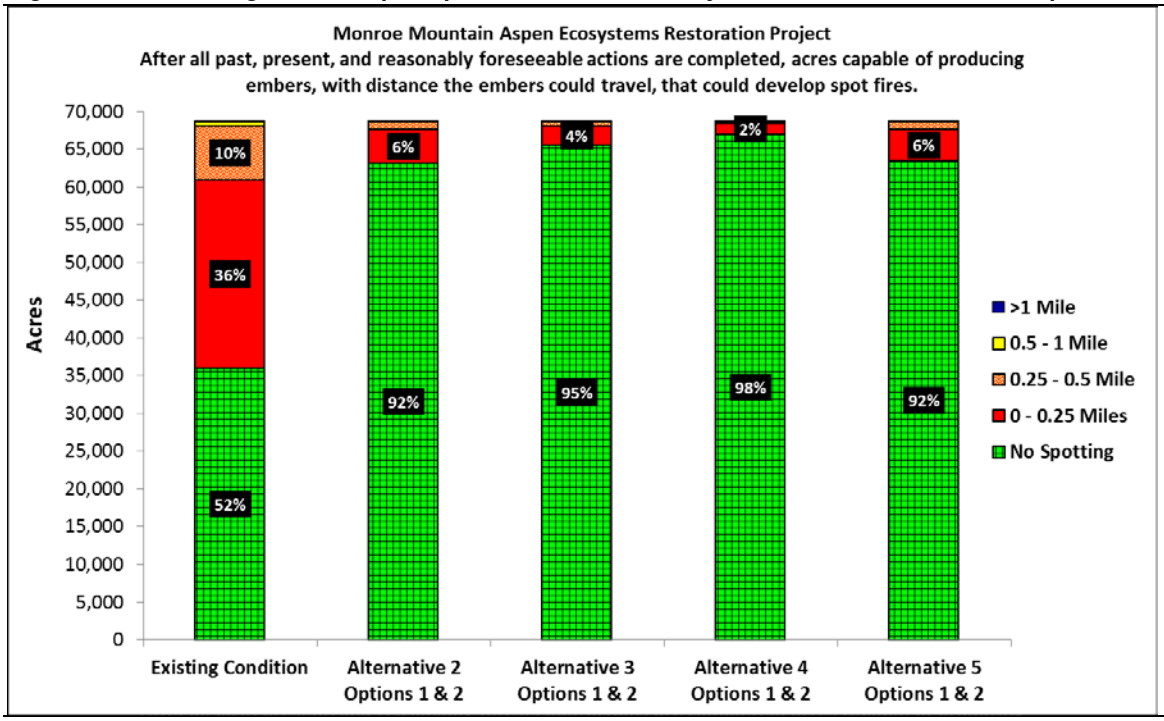


Figure 60. After all, past, present, and reasonably foreseeable actions are completed, acres capable of producing embers, with distance the embers could travel that could develop spot fires.

Spotting

All of the action alternatives lowered ember production across the treatment areas in the short-term. Figure 60 shows that with no action, no embers are created from 52 percent of the area, 36 percent of the area can produce embers up to 0.25 mile, 10 percent can produce embers 0.25 to 0.5 mile and less than 1 percent can produce embers, which can travel up to 1 mile. All action alternatives greatly lessen the total ember production. Alternative 2 exhibits no spotting over 92 percent of the area, 6 percent can produce embers up to 0.25 mile and 2 percent can produces embers, which can travel up to 1 mile. Alternative 3 exhibits no spotting over 95 percent of the area, 4 percent can produce embers up to 0.25 mile and 1 percent can produce embers which can travel up to 1 mile. Alternative 4 exhibits no spotting over 98 percent of the area, 2 percent can produce embers up to 0.25 mile and less than 1 percent can produce embers which can travel up to 1 mile. Alternative 5 exhibits no spotting over 92 percent of the area, 6 percent can produce embers up to 0.25 mile and 2 percent can produce embers which can travel up to 1 mile. Alternative 4 produces the best results for addressing Issue 2 with over 65,000 acres unlikely to produce any spots once all proposed treatments are completed.

Crown Fire

In Figure 61, the no action alternative exhibits 49 percent crown fire post-treatment across the cumulative effects area. All action alternatives result in less crown fire than the no action alternative. Alternative 2 shows 8 percent crown fire versus 49 percent crown fire under no action. Alternatives 3 and 5 show 5 percent and 8 percent, respectively, versus 49 percent crown fire under no action. Alternative 4 produces the best outcome with 3 percent crown fire versus 49 percent crown fire under the no action alternative after all proposed treatments are completed.

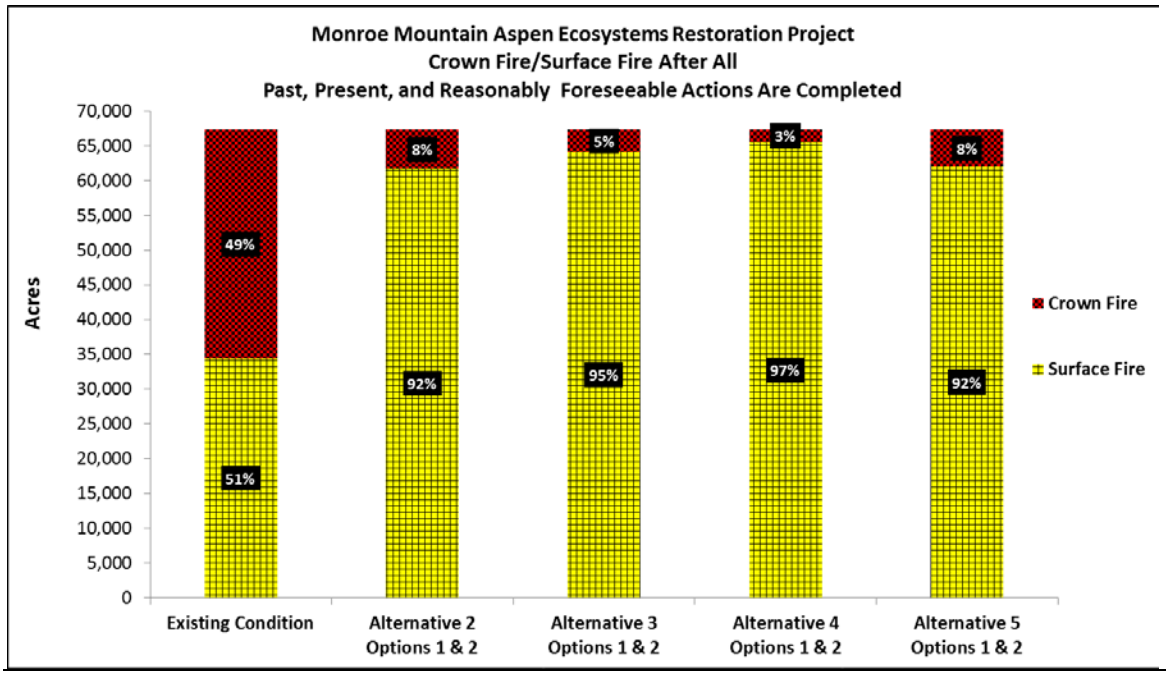


Figure 61. Crown fire/surface fire after all past, present, and reasonably foreseeable actions are completed.

Fire Activity Index

Once all treatments are completed, alternative 4 continues to best meet the desired condition by providing the lowest overall fire activity index at 97 percent low, as shown in Figure 62, 3 percent remains in the high and moderate categories. The no action alternative leaves 41 percent of the area in high condition with 7 percent in moderate. Again, all action alternatives lower the Fire Activity Index. Alternative 2 causes 92 percent of the area to move to low. Alternative 3 moves 95 percent of the area to low, more than double that of no action. Alternative 5 almost doubles the no action alternative at 92 percent low Fire Activity Index. Alternative 4 produces the best outcome with over 65,000 acres exhibiting a low Fire Activity Index.

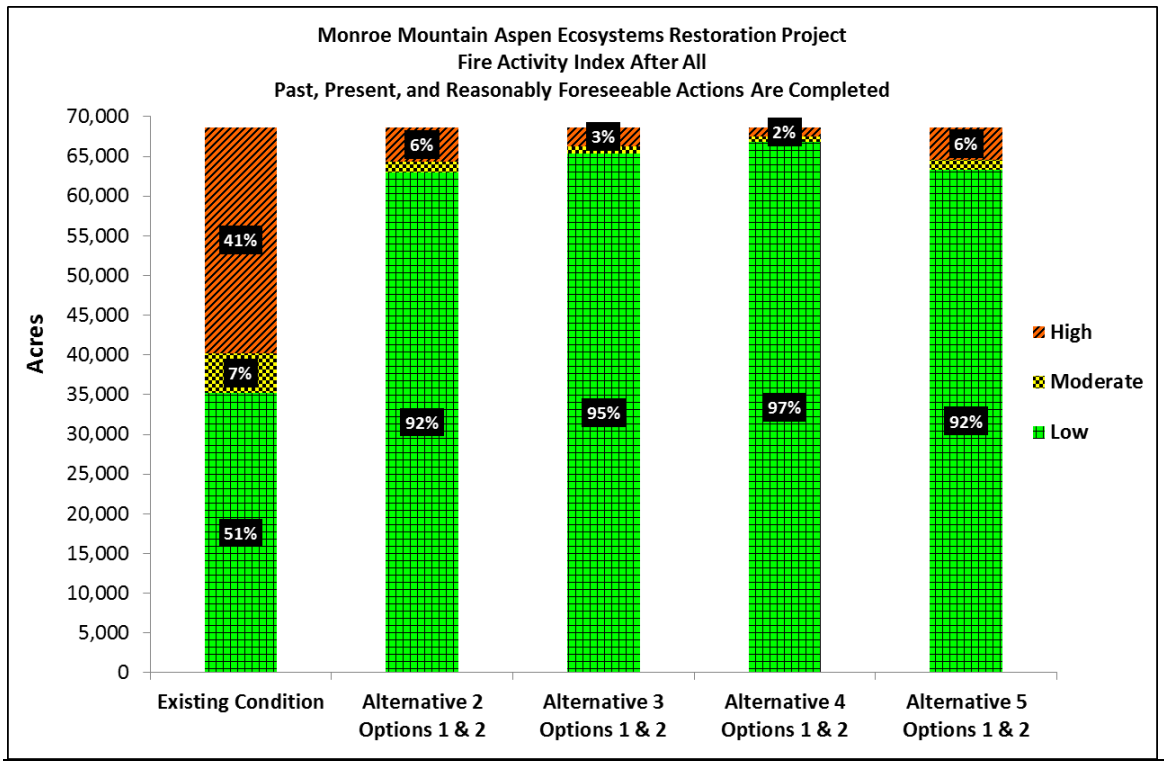


Figure 62. Fire Activity Index after all past, present, and reasonably foreseeable actions are completed.

3.2.5.3 Irreversible and Irretrievable Commitments of Resources

Excessive utilization needs to be addressed before fire or other treatments are returned to the system (USFS 1995). If one goal of management is to restore aspen, then animal use needs to be monitored, evaluated, and adjusted. Otherwise, animals utilizing the aspen regeneration can slow or defeat restoration efforts (Bartos in Hood and Miller 2007).

3.2.6 Conclusions

An increase in safety to firefighters and the public is expected from all action alternatives due to treated fuels exhibiting overall lower fire behavior. According to National Interagency Fire Center data, from 1990 to 2013, an average of 18 firefighters were killed annually in the line of duty. Seventeen firefighters have lost their lives while fighting fires in the state of Utah since 1961 (NIFC 2013).

Proactive fuels management has been shown to be effective in lowering risk to people and private property across the country, and that would be an expected outcome once all the treatments were complete. The largest increase in firefighter and human safety would result from alternative 4. The least risk to private property also results from alternative 4 as proposed. It treats the most acres both mechanically and with fire, reducing fuels and therefore lowering fire behavior across the treatment areas. Alternative 4 would best move the aspen ecosystems toward desired condition over time.

3.3 Issue 3 – Project activities may result in Northern goshawks being displaced

This discussion is extrapolated directly from the Wildlife Specialist Report (Rasmussen 2014).

3.3.1 Methodology for Analysis

The techniques and methodologies used in this analysis are considered the best available science. The analysis includes a summary of the credible scientific evidence, which is relevant to evaluating reasonably foreseeable impacts. The analysis also identifies methods used and references scientific sources relied on. The conclusions are based on the scientific analysis that shows a thorough review of relevant scientific information, and the acknowledgment of incomplete or unavailable information, scientific uncertainty, and risk.

A variety of methods have been used to search for and locate Northern goshawk territories on the District. Methods include Region 4 protocol goshawk surveys for proposed projects, aerial helicopter surveys in suitable habitat (winter months), monitoring existing territories annually, and reporting of nests randomly located by public or survey contractors for other projects. Known nest and alternate nests have been GPS recorded, and GIS mapped. Territorial boundaries were established by the District wildlife biologist working with the GIS shop. Boundaries are drawn according to aerial photomaps using best judgment of forested areas around the nest areas that may be used by goshawk adults and their young. These boundaries are in no way absolute, but are a good representation of suitable territorial habitat. As alternate nests and new territories are found the GIS database and District wildlife data base records are updated at the end of each field season.

3.3.2 Analysis Area

The area analyzed for direct and indirect effects to goshawk includes the aspen, mixed conifer, and spruce/fir areas described in the range of alternatives (1 through 5) (Figure 1). The survey area includes the areas described in the range of alternatives (1 through 5). The project analysis area is the actual area proposed within the range of alternatives and is 67,750 acres. The cumulative effects area for this project has been determined to be lands within the Monroe Mountain forest boundary (175,706 acres). Since wildlife respect no human imposed boundaries, private land, and any state lands will be included in the total acreage of the cumulative effects area.

3.3.3 Direct and Indirect Effects

For a detailed description of the life history for Northern goshawk, refer to (Rodriguez 2008).

Prescribed fire, wildfire, and mechanical thinning activities that occur within Northern goshawk territories may create habitat disturbances that would likely cause abandonment if not carefully mitigated by following the habitat recommendations identified in the LRMP (USFS 1986) and other sources of best available science such as Graham et al. 1999. Implementation of these best science practices are part of the actions identified for this project. If activities occur within nest areas (NA) and post-fledgling areas (PFAs), territory abandonment would likely occur if LRMP requirements were not followed. The displacement of adult and juvenile birds, if present, would likely result in mortality, and affect the viability of this species. The District has developed alternatives and project design criteria that would minimize the chance of Northern goshawks being displaced because of project activities (section 2.3). Some project activities may remove or degrade potential foraging habitat in the short-term (5 through 15 years). However, the quality and quantity of potential foraging habitat would likely increase in select areas as aspen recovers following project implementation. The amount of habitat potentially impacted by project activities varies by alternative, and depends on the alternative selected, weather related events, use of the area by ungulates, and other environmental factors. To understand which alternatives would impact the goshawk and its prey, more or less, it is important to discuss some of the key habitat requirements and guidelines that have been established by researchers.

Important to the architectural structure of a goshawk territory (including both the NA and PFA) is the combination of an older class of forest type vegetation (mixed conifer-aspen) including tall mature trees with interlocking crowns, large trees, large down woody debris, snags (mix of structural snags), water, understory vegetation, and openings. All these structural components are crucial to the existence and persistence of goshawk. Security habitat from predators (as the Great-horned owl (*Bubo virginianus*) known to prey on goshawk chicks and adults on the Forest) comes in the form of a balance of the above mentioned components maintained in an undisturbed fashion to protect goshawk young and adults. Nesting habitat structure with open conditions allows for the predation of goshawks, and especially their nestlings, by great horned owls (Boal and Mannan 1994; Moore and Henny 1983; Woodbridge and Detrich 1994). Nestling mortality may increase during periods of low food availability (Moore and Henny 1983; Rohner and Doyle 1992; Woodbridge and Detrich 1994; Zachel 1985).

Another crucial aspect of managing for the goshawk is management of vegetation for the bird and its prey. Reynolds et al. 1994 and Graham et al. 1999 both discuss the importance of managing a balance of habitat for the goshawk and its prey. Goshawks prefer to forage in closed canopy forests with moderate tree densities as compared to young open forests (Squires and Reynolds 1997). Goshawks take prey from small openings, although they usually hunt these areas from perches near the edge (Younk and Bechard 1994). Medium to large-sized birds (woodpeckers, robins, grouse, or jays) and mammals (ground and tree squirrels and hares) tend to dominate breeding season diets (Squires and Reynolds 1997).

In general, goshawks nest in mature to old forests with relatively large trees, high canopy closure (relative to surrounding areas), sparse ground cover, and open understories. Nests are often located near the bottom of moderately steep slopes, close to water, and often adjacent to a canopy break (Squires and Reynolds 1997). Important internal components of forests in Utah include snags, multiple canopies, and down woody debris (Reynolds et al. 1994).

The key comparison element for evaluating how the alternatives affect northern goshawk is the amount of nesting habitat affected (number of acres of aspen, or spruce/fir treated) and prey base affected (number of acres of foraging communities treated).

The underlying concern with a project of this scale is how treatments in goshawk territories would impact their continued use and return back to the territory post treatment. The Richfield Ranger District, and especially Monroe Mountain, has the largest concentration of goshawk territories known on the Fishlake National Forest. Of the 26 territories known on the District currently (2013 field season summarized to date), 20 are on Monroe Mountain, and 17 are within the direct and indirect effects area for this proposed project. Ongoing surveys and monitoring will continue through the 2014 field season and any updates would be verified and entered in the database at the conclusion of the field season.

In the event there are new nests discovered within the proposed project area, adjustments would be made to accommodate guidelines found in the Goshawk amendment (USFS 2000). Adjustments will be presented to the final document to minimize impacts to any newly discovered territories. Any new information and database changes will be presented in the biological evaluation, in the final Wildlife Specialist Report and the Record of Decision (ROD) for this project.

In a previous action on the Richfield Ranger District, in the Oldroyd-Monroe Meadows area on Monroe Mountain, a treatment within the PFA occurred. Implementation of the LRMP for goshawk management was implemented. These treatments were carefully evaluated prior to managing the area for hazardous fuels and it was determined that the risk of wildfire coming off the Forest to private lands was a substantial threat. Due to this threat, an experimental treatment was developed to try to reduce fuels and manage for the bird. Treatments were implemented to reduce fuels near private land and a cabin. Although LRMP Guidelines were implemented, abandonment occurred and the pair has not been back to the area for the past 2 years. Being able to determine the exact cause and effect is difficult; however, it is the judgment of the Forest and District biologists that it was a direct result of the vegetation treatments and not applying our best

knowledge about the needs of the bird. Managing for bird persistence in the same area as summer cabins and private lands is difficult. As a result, harvesting and burning treatments for this project in the Monroe area is a crucial component to the viability of the Northern goshawk population on the Forest. It is strongly recommended to prohibit any treatments in NAs on Monroe Mountain.

A thinning in a PFA may be designed to help prevent the spread of wildfire to private property while maintaining the integrity of the territory (Northern Goshawk Amendment, Guideline Z; USFS 2000).

In LRMP direction for the Northern goshawk, forest vegetation structural stage classes are discussed and how they relate to preference by goshawk for nesting, post-fledgling family areas, or rearing and teaching of young and foraging. Vegetation structural stage's (VSS) range from 1 to 6 (with 1 being smallest and 6 being largest). The VSS classes found on Monroe Mountain average in the "3" range with more in the 2, 3, and 4 range and with fewer 5s and 6s on the top end. We find that VSS 5 and VSS 6 trees found on Monroe Mountain are low in numbers. With this VSS class in limited supply, so is nesting habitat for the goshawk. Therefore, care must be taken to retain the largest trees on the landscape.

3.3.3.1 Effects of Alternative 1 - No Action

If the no action alternative were selected there would be no direct impacts on this species, and subsequently population numbers and viability of this species would remain intact.

Potential indirect effects may come due to natural succession events as the areas move from early to mid-seral species to late-seral communities. Portions of the analysis area would rotate from early to mid-seral to late seral, while other areas into early seral. If a large scale, high severity wildfire occurred this could impact habitat availability and effectiveness for the goshawk by reducing nesting and foraging habitat.

If no management were implemented, the area, through time, would remain susceptible to a wildfire event where lighting could cause a fire that may be difficult to manage, and impacts to key habitat components could occur. This could result in a wildfire that would be larger, without a mosaic pattern, the severity would be higher, and plant recovery and re-establishment would take longer. This type of large-scale uncharacteristic wildfire could be stand replacing, which could result in large patches of even-age regeneration across the landscape of Monroe Mountain. If large blocks of suitable habitat were burned, it would impact overall habitat effectiveness. If large blocks of regeneration and recruitment occurred, it could add to the diversity of the landscape depending upon the location, size, and configuration on the landscape. Wildfires on Monroe Mountain may not be detrimental to the goshawk and its prey. It would depend on the location of the fires and the proximity to nesting and PFA habitat. The uncertainty of wildfire in this landscape is difficult to predict and therefore impacts to this species and its prey from fire is speculation. However, science tells us that fire will occur, but the size, severity and location is an uncertainty.

Implementation of the no action alternative would result in an undetermined amount of habitat effectiveness change in an undetermined area, and therefore is not recommended as active management for this sensitive species.

3.3.3.2 Effects of Alternatives 2 through 5 - Mechanical treatments and/or prescribed burning

Alternatives 2, 3, 4, and 5 all consist of a combination of mechanical forestry practices and prescribed fire. Mechanical treatments and/or prescribed burning proposed range from 27,981 to 36,300 acres. The total number of acres of conifer bearing acres is 18,877. Of these acres a mix of spruce and firs are combined. In Alternative 2, 30 percent of spruce/fir is proposed for treatment, in Alternative 3, 37 percent of spruce/fir is proposed for treatment, in Alternative 4, 44 percent of spruce/fir is proposed for treatment, and in Alternative 5, 36 percent of spruce/fir is proposed for treatment. Of mixed-conifer acres in the proposed area, 50 percent treatment is proposed in all action alternatives (2 through 5).

Mature goshawks are known to hunt an area approximately 5,000 acres per territory foraging in a wide variety of forested habitat. Seral and stable aspen are found within their hunting territory. In alternative 2, 39 percent of seral aspen is proposed for treatment, in alternative 3, 48 percent of seral aspen is proposed for treatment , in alternative 4, 55 percent of seral aspen is proposed for treatment and in alternative 5, 44 percent of seral aspen is proposed for treatment. As for stable aspen in the proposed project, alternative 2 proposes 51 percent of stable aspen for treatment, in alternative 3, 56 percent of stable aspen is proposed for treatment, in alternative 4, 60 percent of stable aspen is proposed for treatment and in alternative 5, 55 percent of stable aspen is proposed for treatment (percentage taken from spreadsheet Table 100) (comparison of the proposed treatment acres by forest type against the total acres of forest type in the analysis area).

There are approximately 10,461 acres of PFAs within the proposed project area. There are approximately 2,817 acres of Nest Replacement Area acres in the proposed project area. Habitat for goshawks would be affected in all alternatives due to the combined size of the foraging areas (5,000 acres for each territory); however, an array of treatment options is proposed or not proposed within the different alternatives.

Goshawks are known to use a variety of habitats throughout their lifecycle. Removal of vegetation from a prescribed burn or mechanical thinning could have an indirect effect of decreasing foraging areas for an undetermined time until it regrows back into suitable foraging habitat to support prey species. This could take 5 to 15 years or it could be greater than 100 years depending upon the location of the treatment and the species that inhabit the area. Goshawks are known to prey on a variety of mammals and birds such as; rabbits, squirrels, chipmunks, flickers, grouse, and jays. Burning would decrease habitat and populations of some prey species (especially small mammals) as woody debris is burned and increase populations of others (such as jays or woodpeckers) as snags are created. The larger mammals are more advantageous for them to forage upon as they provide more energy for the effort. As stated above, it is difficult to determine how long suitable vegetation will take to regrow and provide habitat for prey. This can further be complicated as the area is managed for other resources such

Table 100. Vegetation affected by alternatives, percentage and acres treated compared to the analysis area

Compare CEA to Forested Type	Mechanical & Associated Slash Burning and Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned	Total CEA acres	% of CEA proposed
Mixed Conifer----Alt. 2	2,607	5,220	49.9
Seral Aspen	12,241	31,129	39.3
Stable Aspen	8,820	17,009	51.9
Spruce/fir	4,313	14,392	30.0
TOTAL	**27,981**	**67,750**	**41.3**
Mixed Conifer---Alt. 3	2,605	5,220	49.9
Seral Aspen	15,013	31,129	48.2
Stable Aspen	9,497	17,009	55.8
Spruce/fir	5,348	14,392	37.2
TOTAL	**32,461**	**67,750**	**47.9**
Mixed Conifer---Alt. 4	2,609	5,220	50.0
Seral Aspen	17,150	31,129	55.1
Stable Aspen	10,146	17,009	59.7
Spruce/fir	6,394	14,392	44.4
TOTAL	**36,300**	**67,750**	**53.6**
Mixed Conifer---Alt.5	2,605	5,220	49.9
Seral Aspen	13,742	31,129	44.1
Stable Aspen	9,406	17,009	55.3
Spruce/fir	5,191	14,392	36.1
TOTAL	**30,944**	**67,750**	**45.7**

as domestic and wild ungulates. Ungulates can slow or suppress suitable habitat for prey species, as well as weather events and storm patterns.

Goshawks can breed successfully in forests where timber harvesting has occurred (Reynolds et al. 1994; Woodbridge and Detrich 1994), but they appear to prefer stands of mature and over-mature trees for nesting and foraging (Bright-Smith and Mannan 1994). In addition, occupancy of the nest stand has been positively associated with patch size (Woodbridge and Detrich 1994). However, the effects of reducing the number and size of mature trees on existing goshawk densities or productivity are unknown. Population models for species in fragmented forest landscapes suggest that sharp declines in viability can occur if habitat decreases over the long-term (Franklin and Forman 1987; Lamberson et al. 1992). The removal of suitable nesting habitat through timber harvesting or other management activities can be a threat to the goshawk (McCarthy et al. 1989).

Alternative 2 presents the least impacts to goshawk territories as it proposes no treatments in the NAs or PFAs of any goshawk territory (see Table 101 and Table 102 below). This alternative allows for treatments within the foraging area that will open small areas up to enhance habitat for prey and opens areas up for foraging by the goshawk. This alternative also allows for management of down woody debris, and snag retention, which is crucial to the goshawk and prey management. No impacts to viability because of alternative 2 are expected.

Alternative 3 proposes no treatments in the NAs and treatments in the PFA that range from 14 to 61 percent (two territories range in the single digit range because they are on the edge of proposed treatment areas). This alternative will open small areas up to enhance habitat for prey and open areas up for foraging by the goshawk. While it allows for treatments within the foraging areas similar to alternative 2, it also allows treatments within 17 PFAs, which will create open areas and make fledglings and adults vulnerable to predators. Opening up the PFAs would impact the persistence of these territories, and impact the overall viability of the population. Management of down woody debris, and snag retention, is also included, which is crucial to the goshawk and prey management. Impacts from alternative 3 may affect the viability of the species.

Alternative 4 proposes treatments in the NAs that range from approximately 60 to 98 percent and treatments in PFAs that range from 35 to 85 percent (two territories range in the single digit range because they are on the edge of proposed treatment areas). This alternative will open small areas up to enhance habitat for prey and open areas up for foraging by the goshawk. While it allows for treatments within the foraging areas similar to alternative 2, it also allows treatments within NAs and PFAs. This would create open areas potentially impacting nesting adults and juveniles, and makes fledglings and adults vulnerable to predation within the PFAs. Opening up the NAs and PFAs would impact the persistence of these territories, and impact the overall viability of the population. Management of down woody debris, and snag retention, is also included, which is crucial to the goshawk and prey management. Impacts from alternative 4 may affect the viability of the species.

Alternative 5 proposes no treatments in the NAs and light treatments in two PFAs that range from 30 to 34 percent in two territories. This alternative would open small areas up to enhance habitat for prey and open areas up for foraging by the goshawk. While it allows for treatments within the foraging areas similar to alternative 2, it also allows treatments within two PFAs, which would create open areas and make fledglings and adults vulnerable to predators. Opening up the two PFAs (30 to 34 percent) would impact the persistence of these territories, and impact the overall viability of the population. Management of down woody debris, and snag retention, is also included, which is crucial to the goshawk and prey management.

Past treatments within PFAs have not only caused abandonment on the Fishlake but also on the Dixie National Forest to the South (Rodriguez 2014, personal conversation). Based on Fishlake data and observations from other goshawks biologists, not treating in the NAs for this project is important to the viability of the goshawk on Monroe Mountain and on the Fishlake National Forest. Treating within PFAs is generally not recommended in order to keep disturbance to a minimum. Table 101 and Table 102 display the correlation between territories and treatment type by alternative.

Table 101. Percent of Nest Replacement Areas affected by each alternative

		Alternative 1				Alternative 2				Alternative 3			
Nest Replace Areas	Approximate NRA Acres	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated
Big Table North	181	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Big Table South	183	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Brindley Flat	201	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Cove Nest	0	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Deer Spring*	601	0	0	0	0.0%	0	0	0	0.0%	56	0	56	9.3%
Doe Hole	177	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Eagle Flat	196	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Hunters Flat	192	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Langdon East	180	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Langdon West	180	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Magleby	222	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Manning Creek	213	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Nielsen Canyon	202	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
North Big Lake	0	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Oldroyd*	682	0	0	0	0.0%	0	0	0	0.0%	9	0	9	1.3%
Paxton	166	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Sherwood Forest	156	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Grand Total	3732	0	0	0	0.0%	0	0	0	0.0%	65	0	65	1.7%
		Alternative 4				Alternative 5							
Big Table North	181	178	0	178	98.3%	0	0	0	0.0%				
Big Table South	183	147	0	147	80.3%	0	0	0	0.0%				
Brindley Flat	201	119	0	119	59.2%	0	0	0	0.0%				
Cove Nest	0	0	0	0	0.0%	0	0	0	0.0%				
Deer Spring	601	56	0	56	9.3%	0	0	0	0.0%				
Doe Hole	177	154	0	154	87.0%	0	0	0	0.0%				
Eagle Flat	196	178	0	178	90.8%	0	0	0	0.0%				
Hunters Flat	192	188	0	188	97.9%	0	0	0	0.0%				
Langdon East	180	152	0	152	84.4%	0	0	0	0.0%				
Langdon West	180	125	0	125	69.4%	0	0	0	0.0%				
Magleby	222	170	0	170	76.6%	0	0	0	0.0%				
Manning Creek	213	169	0	169	79.3%	0	0	0	0.0%				

Nielsen Canyon	202	119	0	119	58.9%	0	0	0	0.0%
North Big Lake	0	0	0	0	0.0%	0	0	0	0.0%
Oldroyd	682	9	0	9	1.3%	0	0	0	0.0%
Paxton	166	118	0	118	71.1%	0	0	0	0.0%
Sherwood Forest	156	121	0	121	77.6%	0	0	0	0.0%
Grand Total	3732			2003	53.7%			0	0.0%

Table 102. Percent of Post-Fledgling Areas affected by each alternative

		Alternative 1				Alternative 2				Alternative 3			
Post-Fledgling Areas	Approximate NRA Acres	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated	Mechanical and Prescribed Fire	Prescribed Fire w/Mixed Burn Severity	Grand Total	Percent NRA Treated
Big Table North	619	0	0	0	0.0%	0	0	0	0.0%	348	0	348	56.2%
Big Table South	566	0	0	0	0.0%	0	0	0	0.0%	287	0	287	50.7%
Brindley Flat	617	0	0	0	0.0%	0	0	0	0.0%	163	0	163	26.4%
Cove Nest	600	0	0	0	0.0%	0	0	0	0.0%	263	0	263	43.8%
Deer Spring*	601	0	0	0	0.0%	0	0	0	0.0%	56	0	56	9.3%
Doe Hole	601	0	0	0	0.0%	0	0	0	0.0%	113	0	113	18.8%
Eagle Flat	618	0	0	0	0.0%	0	0	0	0.0%	378	0	378	61.2%
Hunters Flat	612	0	0	0	0.0%	0	0	0	0.0%	327	0	327	53.4%
Langdon East	593	0	0	0	0.0%	0	0	0	0.0%	294	0	294	49.6%
Langdon West	598	0	0	0	0.0%	0	0	0	0.0%	236	0	236	39.5%
Magleby	596	0	0	0	0.0%	0	0	0	0.0%	279	0	279	46.8%
Manning Creek	772	0	0	0	0.0%	0	0	0	0.0%	329	0	329	42.6%
Nielsen Canyon	616	0	0	0	0.0%	0	0	0	0.0%	184	0	184	29.9%
North Big Lake	589	0	0	0	0.0%	0	0	0	0.0%	278	0	278	47.2%
Oldroyd*	682	0	0	0	0.0%	0	0	0	0.0%	9	0	9	1.3%
Paxton	580	0	0	0	0.0%	0	0	0	0.0%	196	0	196	33.8%
Sherwood Forest	601	0	0	0	0.0%	0	0	0	0.0%	88	0	88	14.6%
Grand Total	10,461	0	0	0	0.0%	0	0	0	0.0%	3828	0	3828	36.6%
		Alternative 4				Alternative 5							
Big Table North	619	526	0	526	85.0%	0	0	0	0.0%				
Big Table South	566	434	0	434	76.7%	0	0	0	0.0%				
Brindley Flat	617	282	0	282	45.7%	0	0	0	0.0%				
Cove Nest	600	430	0	430	0.0%	0	0	0	0.0%				
Deer Spring	601	56	0	56	9.3%	0	0	0	0.0%				
Doe Hole	601	267	0	267	44.4%	0	0	0	0.0%				

Eagle Flat	618	556	0	556	90.0%	0	0	0	0.0%
Hunters Flat	612	515	0	515	84.2%	0	0	0	0.0%
Langdon East	593	446	0	446	75.2%	0	0	0	0.0%
Langdon West	598	361	0	361	60.4%	0	0	0	0.0%
Magleby	596	450	0	450	75.5%	0	0	0	0.0%
Manning Creek	772	498	0	498	64.5%	0	0	0	0.0%
Nielsen Canyon	616	302	0	302	49.0%	184	0	184	29.9%
North Big Lake	589	445	0	445	0.0%	0	0	0	0.0%
Oldroyd	682	9	0	9	1.3%	0	0	0	0.0%
Paxton	580	314	0	314	54.1%	0	0	0	0.0%
Sherwood Forest	601	210	0	210	34.9%	196	0	196	32.6%
Grand Total	10461	6101	0	6101	58.3%	380	0	380	3.6%

*Deer Springs (56 acres) and *Oldroyd (9 acres) goshawk territory nest replacement areas are shown to have acres proposed to be treated in Table 101; alternative 3. The intent of alternative 3 is to not treat any of the nest replacement areas. This correction will be made in the final wildlife specialist report and in the final EIS.

The following measures will be implemented on the Monroe Mountain project to ensure proper management is occurring and viability considered and met.

"Monitoring requirements" are found in appendix CC of the goshawk amendment for the six forests in Utah (USFS 2000) and discuss the following process:

- ID m-1--Question: Are known goshawk territories on national forests remaining occupies?
  - Item to Measure: Goshawk territory occupancy at the forest level.
  - Acceptable Range: Less than 20% decline in territory occupancy over a 3-year period.
  - Measurement Frequency: Annually (report every 3 years)

- ID m-2—Question: Are mitigation measures (standards and guidelines) employed during vegetative management project implementation sufficient to prevent territory abandonment?
  - Item to Measure: Goshawk territory occupancy following vegetative management treatments.
  - Acceptable Range: No territory abandonment on projects where mitigation measures are used.
  - Measurement Frequency: The first full breeding period following activity in all projects where pre-project surveys determined territory occupancy. (report annually)

- ID m-3—Question: Is habitat connectivity as represented by structural and species diversity and dispersion thereof, within and among 5th and 6th order watersheds (or equivalent ecological scale) being maintained?

- Item to Measure: Spatial dispersion patch size of mature and old forest groups within a 5th to 6th order watershed. Tree species composition mix within mature and old groups within a landscape.
- Acceptable Range: Approximately 40 percent of the coniferous and 30 percent of the aspen-forested acres within a landscape are in VSS 5 and 6 classes. Seral species characteristic of the cover type are well represented VSS 5 and 6 classes.
- Measurement Frequency: Completion of each landscape assessment (report every 5 years).

Other sections of the monitoring matrix speak of monitoring long-term for down woody material and snags.

Maintaining adequate structural components within the NAs and PFAs of goshawk territories to ensure habitat effectiveness, which encompasses the entire portion of their life cycle when they are on the forest, is crucial to maintain viability. It is also important to follow recommendations in foraging habitat to manage for prey species habitat. These structural components referred to in the goshawk amendment (USFS 2000) will help maintain a prey base for the adults to utilize during mating and rearing season as well as for the fledglings when they are old enough to hunt for themselves within the territory. Alternatives 3, 4, and 5 do not allow enough of the habitat requirements to maintain this need. Alternative 2 would allow enough habitat requirements to be maintained. Alternatives 3, 4, and 5 may cause territory abandonment across the Monroe landscape. This abandonment may result in dispersion from Monroe Mountain to other mountain ranges or make the birds susceptible to predation. We then would move further away from the LRMP goal of a viable population across the forest.

3.3.4 Cumulative Effects

Past, present and future activities in forested areas on Monroe Mountain may cause disturbance to goshawk in different ways. We have seen an increase in off-road traffic, camping, hunting, sightseeing, and private land development on Monroe Mountain. We have seen an increase in mechanical treatments, and natural and prescribed fire that have changed the density and patch size of older age aspen and mixed conifer on the mountain. All these types of disturbances can affect goshawk occupancy within their territory to some degree. As we move into the future for goshawk habitat management it is important to keep in mind Monroe Mountain currently provides prime habitat to foster the life cycle components needed to sustain a healthy population. The mountain has more goshawk territories per square mile than any other district on the Fishlake National Forest. A delicate balance is needed to provide current territorial features while planning for key habitat components in the future.

Section 5 of Rasmussen 2014 describes the cumulative effects area, it's size, relationship with the actual analysis area and the rational behind the selection of the boundaries. The section also decscribes past,present, reasonably foreseeable projects and vegetative projects or fires that have occurred on Monroe Mountain. Also explained are "other" activities that have been known to or do occur on the mountain. All these activities may or may not have an effect on wildlife species that use the mountain at some part of their life cycle.

3.4 Issue 4 – Project activities may result in Bonneville cutthroat trout and Boreal toad habitat near Manning Meadows Reservoir and Barney Lake being severely degraded

This discussion is extrapolated directly from the Biological Evaluation/MIS Report for Sensitive and MIS Aquatic Species (Whelan 2014).

3.4.1 Affected Environment

This section discusses the environment that would be affected, specifically as it relates to aquatic biota. The Forest Service Manual states that wildlife [and fisheries] habitat should be maintained to provide for viable populations of existing and approved introduced wildlife [and fish] species.

The project area contains a variety of habitat types including aspen, mixed conifer with remnant aspen, high elevation conifer stands, mountain sagebrush, mountain brush, herbaceous forbs and grasses, and streams and lakes with associated riparian habitats. Riparian areas may contain conifers, aspen, cottonwoods, willows, and birch along with a variety of lower shrubs, grasses, sedges, rushes, and forbs. On low to mid-elevation slopes, pinyon-juniper, and low sagebrush are common.

The project area encompasses elevations between about 5,600 feet at the lower elevation foothill slope breaks along the Forest boundary to over 11,200 feet on some of the peaks. The majority of the project is sited on the relatively gentle slopes of the plateau top of Monroe Mountain, but some components are on steeper slopes of all aspects, especially on some of the west facing drainages in Monroe Creek south to Dry Creek.

The different vegetative communities within the project area provides habitat for a variety of wildlife species. The project area supports mule deer, elk, coyote, bobcat, cougar, rabbits, squirrel, wild turkey, various raptor species, and small rodents. Fish species include native Bonneville cutthroat trout (BVCT), non-native trout, sterile hybrid trout, and non-game fish. These terrestrial and aquatic wildlife species contribute to ecosystem function in a wide array of habitats and settings. The many lakes, reservoirs, and streams support an active sport fishery. Manning Meadow Reservoir supports a critical BVCT broodstock operation that is important in restoring new conservation populations as well as providing the only pure BVCT lake fishery on the Forest. Barney Lake, with BVCT and sterile hybrid tiger trout, is a high quality recreational lake fishery. Amphibian species include boreal toad, boreal chorus frogs, and tiger salamanders. Monroe Mountain is part of the Sevier River Basin, a closed system draining into the Great Basin.

The Utah Division of Wildlife Resources (UDWR) manages the wildlife and fish populations. The Forest Service is responsible to focus on management of habitat to maintain viability of species that are within its jurisdiction. Close cooperation among the various agencies,

governments, and other jurisdictions is necessary to provide proper management of wildlife and fisheries resources.

3.4.2 Land and Resource Management Plan Management Area Description and applicable Goals, General Direction and Standard and Guidelines

The proposed project is primarily located within management area (MA) 4B – emphasis on Management Indicator Species (MIS). Other MAs are 6B – grazing, 7B – timber, 9F – watershed, and 5A – winter range. A small but important area of 4A – fisheries emphasis, is located along Manning Creek. There are Forest-wide goals, objectives, standards, and guidelines that apply to maintaining fisheries values in the project area (USFS 1986).

Applicable LRMP goals applying to aquatic biota and their habitat across all MAs are to: "protect aquatic habitats which are in good or excellent condition and improve habitats where ecological conditions are below biological potential" (IV-3), "identify and improve habitat for sensitive, threatened and endangered species including participation in recovery efforts for both plants and animals" (IV-4), "maintain water quality to meet State standards" (IV-4), and "maintain productive streams, lakes, and riparian areas…" (IV-4).

Applicable Forest-wide general direction for trout is to "Manage waters capable of supporting self-sustaining trout populations to provide for those populations" (IV-18). Four standard and guidelines tiered to this are: a) maintain 40 percent or more overhanging grasses, forbs, sedges, and shrubs along banks of streams, b) maintain 50 percent or more of total streambank length in stable condition where natural conditions allow, c) no more than 25 percent of stream substrate should be covered by inorganic sediment less than 3.2 millimeters in size where natural conditions allow, and d) maintain a [aquatic macroinvertebrate] [Biotic] Condition Index (BCI) of 75 or greater (IV-18, IV-19).

There are also riparian area management general direction, and standards and guidelines that apply Forest-wide. The main applicable direction is "special protection and management will be given to floodplains, wetlands, and all land and vegetation for a minimum of 100 feet from the edges of all perennial streams, lakes, and other bodies of water or to the outer margin of the riparian ecosystem if wider than 100 feet" (IV-33). The standard and guideline for this direction is to "maintain riparian dependent resource values including wildlife, fish…in a stable or upward trend" (IV-33 to 34).

There are general management requirements given in the LRMP for vegetation treated by burning (FP IV-48 thru 49) that apply to wildlife and fisheries habitat. These are to use prescribed fire from planned and unplanned ignitions to accomplish resource management objectives, such as reducing fuel load buildup, wildlife habitat improvement, etc., and limit use of prescribed fires on areas adjacent to riparian areas to protect riparian and aquatic values.

Management area 4A is managed for emphasis on fish habitat improvement where aquatic habitat is below productive potential. The one area of MA 4A within the project area is Manning Creek downstream from Manning Meadow Reservoir to the Forest boundary. It does not include the tributaries. The goals of management are to maintain or improve aquatic habitat condition for fish at or above a good habitat condition rating, maintain stable stream channels, meet water quality standards for cold-water fisheries, and provide healthy, self-perpetuation riparian plant communities (FP IV-85). General direction, and standards and guidelines for MA 4A are similar to and tier to these goals and can be found in the LRMP on pages IV-86 to IV-94. There are two applicable general directions: "prevent stream channel instability, loss of channel cross-sectional areas, and loss of water quality resulting from activities that alter vegetative cover," and "determine the effects on water quality and sediment yields from vegetation manipulation and road construction projects through the use of appropriate modeling and quantification procedures" (IV-91).

Other MAs do not have any specific general direction or standards and guidelines that apply to aquatic biota, but the Forest-wide general direction and standards and guidelines apply across all MAs.

3.4.3 Aquatic Biota Cumulative Effects Area

The cumulative effects area (CEA) for the aquatic species that will be analyzed in this document includes the aquatic habitat contained in the sub-watersheds within the Monroe Mountain unit Forest Boundary that contains the project area. See Figure 63 for a map of the modified Hydrological Unit Code (HUC) 6th field watersheds [afterwards called HUC6] that are included in this CEA.

Many of the HUC6s as nationally defined include large areas of face drainages (i.e. short slopes) on the sides of mountains that do not interact with the main tributary stream on the Forest, but instead include a segment of the larger valley bottom stream channel, and even areas across these major streams such as Otter Creek and the Sevier River (for example see the Thompson Creek – Sevier River HUC in Figure 63). In most cases, streams become disconnected near the Forest boundary by irrigation diversions. These were often placed near the head of alluvial fans and losing reaches. Due to this disconnect, analysis of the complete HUC below the diversion is unwarranted. It also artificially diminishes the calculated affects from projects on the Forest. Using a pour point at the diversion ensures that the area that supports the aquatic populations and the areas of maximum effects are included in analysis, while extraneous areas that would artificially dilute effects are not.

Therefore, many of the HUC6 subwatersheds were modified to a pour point at the diversion structure, losing reach, or Forest boundary. The redefined HUC6s that support important aquatic resources – major lakes and streams with fish populations and/or boreal toads have been analyzed in more detail using GIS tools for the analysis section of the document. In addition,

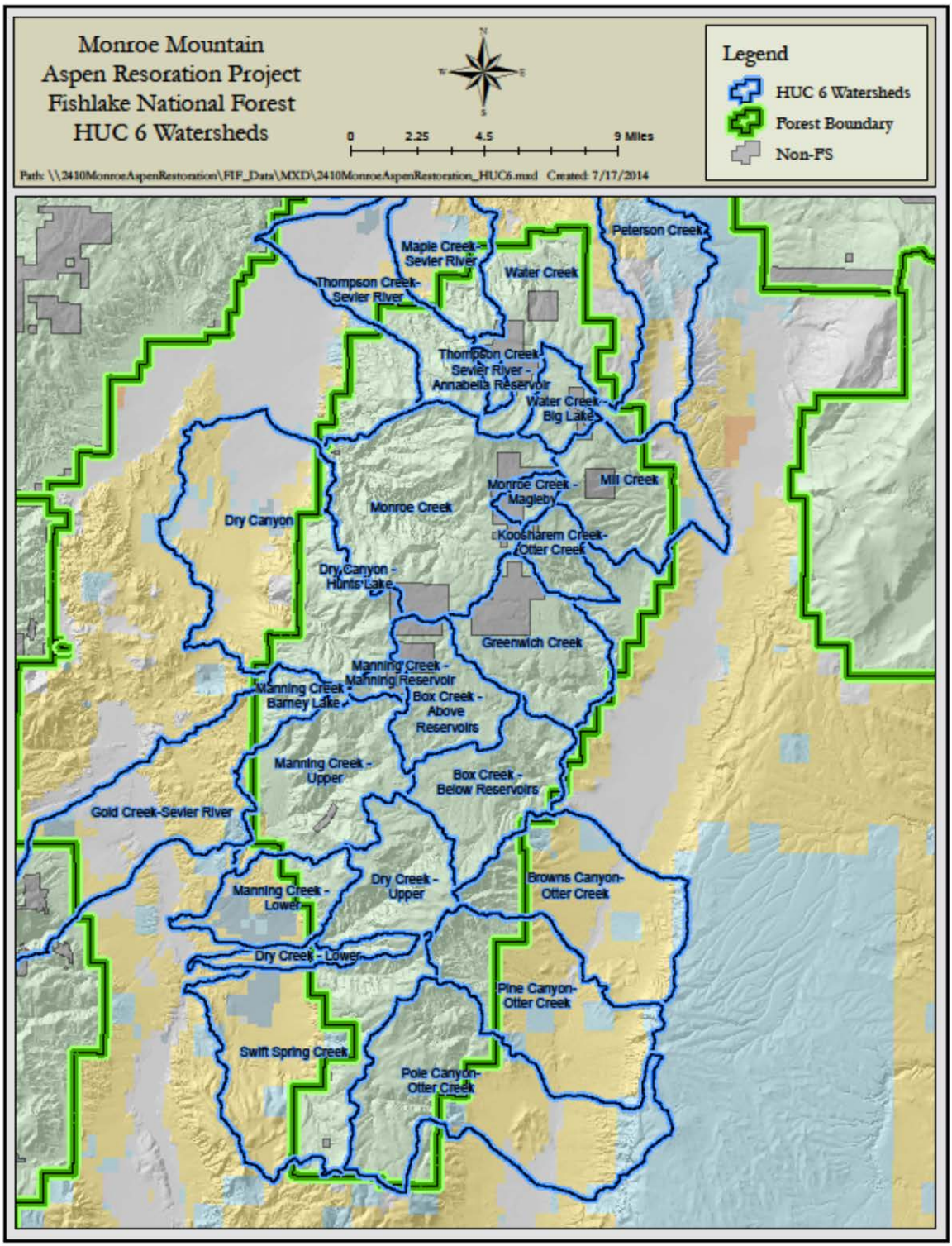


Figure 63. Project area HUC6 map and cumulative effects area (see text for additional description).

smaller HUC7 and HUC8 subwatersheds within these HUC6s were broken out where they contained important lakes that are high value for fisheries and boreal toads. To simplify GIS analysis, the GIS runs were done one time for all the polygon pieces (i.e. in upper Manning Creek analysis included one polygon for most of the subwatershed, and two smaller ones that were split out with lakes). For an overview of the entire modified HUC6, the three polygons were recombined into the tables arithmetically.

Starting in the southwest corner of the Monroe Mountain CEA and working clockwise, which is the order they are discussed in following sections of the document, the subwatersheds analyzed in detail are: Upper Dry Creek; Upper Manning Creek (with subwatersheds Barney Lake and Manning Reservoir); the subwatershed Hunts Lake in Dry Canyon (the main Dry Canyon does not support aquatic resources with the exception of some potential and relatively minor boreal toad use areas in the headwaters); Monroe Creek (with subwatershed Magleby Lake); Thompson Creek - only some GIS criteria were developed due to the HUC configuration (including subwatershed Annabella Reservoir); Water Creek - only some GIS criteria were developed due to the HUC configuration (including subwatershed Big Lake); Koosharem Creek; Greenwich Creek; and Box Creek – split into upper and lower subwatersheds.

3.4.4 Threatened, Endangered, and Candidate Species

Current policy for threatened and endangered species as stated in the Forest Service Manual 2670.3 (Washington Office Amendment 2600-95-7; USFS 1995) includes the following direction:

1. Place top priority on conservation and recovery of endangered, threatened, and proposed species and their habitats through relevant National Forest System, State and private gorestry, and tesearch activities and programs.
2. Establish through the Forest planning process objectives for habitat management and/or recovery of populations, in cooperation with States, the U.S. Fish and Wildlife Service (USFWS) (or National Marine Fisheries Service (NMFS)), and other Federal agencies.
3. Through the biological assessment process, review actions and programs authorized, funded, or carried out by the Forest Service to determine their potential for effect on threatened and endangered species and species proposed for listing.
4. Avoid all adverse impacts on threatened and endangered species and their habitats except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the USFWS; when an exemption has been granted under the act, or when the USFWS biological opinion recognizes an incidental taking. Avoid adverse impacts on species proposed for listing during the conference period and while their Federal status is being determined.
5. Initiate consultation or conference with the USFWS or NMFS, when the Forest Service determines that the proposed activities may have an adverse effect on threatened, endangered species; is likely to jeopardize the continued existence of a proposed species; or result in the destruction or adverse modification of critical or proposed critical habitat.

6. Identify and prescribe measures to prevent adverse modification or destruction of critical habitat or other habitats essential for the conservation of endangered, threatened, and proposed species. Protect individual organisms or populations from harm or harassment as appropriate.

Field surveys were completed within the project area to analyze habitat for aquatic species and their populations numerous times between 1999 and 2014. As a result of these visits and through consultation with state and federal agencies, it is known that there are currently no threatened, endangered, or candidate aquatic species on the Fishlake National Forest. Since no threatened, endangered, or candidate aquatic species are present on the Forest, and therefore none within the aquatic biota CEA described above, there will be no effect to any threatened, endangered, or candidate aquatic species from this project. Therefore, there will be no further discussion for aquatic species in these categories.

3.4.5 Sensitive Species

Forest Service Manual (FSM) 2670 provides management direction for threatened, endangered, and sensitive plants and animals (FSM 2670). Forest Service policies for designated sensitive species (FSM 2670.32) states:

1. Assist States in achieving their goals for conservation of endemic species.
2. As part of the National Environmental Policy Act (NEPA) process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species.
3. Avoid or minimize impacts to species whose viability has been identified as a concern.
4. If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. (The line officer, with project approval authority, makes the decision to allow or disallow impacts, but the decision must not result in loss of species viability or create significant trends toward Federal listing.)
5. Establish management objectives in cooperation with the States when projects on National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for Federal candidate species, in cooperation with the USFWS or NMFS and the States.

The Forest Service follows a two-tier planning process. The first tier is the Fishlake Land and Resource Management Plan (LRMP; USFS 1986); the second is the site-specific project planning level which is represented by the NEPA analysis.

The LRMP was prepared in accordance with the NFMA of 1976, the regulations in 36 CFR 219, and the NEPA of 1979. The LRMP was approved in June 1986 (USFS 1986).

A goal documented in the LRMP is to “identify and improve habitat for sensitive, threatened, and endangered species including participation in recovery efforts for both plants and animals”. In addition the LRMP states, “Current habitat of threatened and endangered species will be

maintained. No adverse effects from management activities will be allowed". General direction in this plan states, "Maintain habitat for viable populations of existing vertebrate species. Habitat for each species on the Forest will be maintained by protecting at least 40 percent of the ecosystems for existing species. Proper juxtaposition of ecosystems must be considered. Manage and provide habitat for recovery of endangered and threatened species. Do not allow activities that would negatively impact endangered, threatened, or sensitive plant or animal species. Follow direction in recovery plans."

Suitable habitat is present in the project area for BVCT and boreal toads. A summary of Forest aquatic biota sensitive species is included below in Table 103, below.

Table 103. Suitability of habitat for Intermountain Region sensitive aquatic species found in the project area

Species	Suitability of Habitat for Sensitive Aquatic Species		
	Status	Suitable Habitat in Project Area	Rationale/Comments
Colorado River Cutthroat Trout *Oncorhynchus clarki pleuriticus*	S/MIS		Outside of native range. No Colorado River cutthroat trout exist in project area waters, and there is no plan to reintroduce this species. Waters outside of native range are not normally considered for recovery purposes.
Bonneville Cutthroat Trout	S/MIS	X	Within historic native range. A BVCT core conservation population exists in project area waters in Manning Creek and its tributaries. Manning Meadow Reservoir is a critical southern region UDWR BVCT broodstock. The Manning Creek drainage has the only BVCT occupied lake habitat on the Forest. BVCT are managed under a Conservation Agreement that the Forest Service R4 is a member signatory of BVCT State of Utah Conservation Team (2008). Rodriguez (2008) has life history information and overall Forest trend information on BVCT.
Southern Leatherside* *Lepidomeda aliciae*	S		Not known from Monroe Mountain. Historically occurred in the Sevier River drainage. Some use ***may*** have occurred in the lower most stream reaches on Monroe Mountain below the project treatment areas but within the project CEA. There is no evidence

			that southern leathersides currently occur in any of these waters (UDWR 2009). Since Forest, streams are generally disconnected from downstream waters by diversions and dry sections there will be no effects that could carry to currently occupied habitat.
Boreal toad	S	X	Boreal toads are widespread across Monroe Mountain at elevations above 8,000 feet. Was considered a Utah stronghold, with relatively stable numbers but monitoring methods have not been rigorous enough to quantitatively determine trend. Chytrid fungus (*Batrachochytrium dendrobadidis*), which is associated with population declines in other portions of their range, has recently been detected in all areas of Monroe Mountain. Declines may now be starting to be evident in some areas of Monroe Mountain. Besides their Forest Service sensitive species status, they are considered a state sensitive species in Utah and managed under a UDWR Conservation Plan that other agencies are not signatories to (Hogrefe et al. 2005).

Life history information regarding BVCT can be found in *Life History and Analysis of Endangered Threatened, Candidate, Sensitive, and Management Indicator Species of the Fishlake National Forest* (Rodriguez 2008), hereby incorporated by reference. This document contains summarized population trend and monitoring information, which can also be found in Hadley et al. (2011a) and Hepworth et al. (2003). For general life history information on boreal toads, this report tiers to Rodriguez (2012) and Hogrefe et al. (2005). The Uinta-Wasatch-Cache National Forest habitat recommendations also include some general toad information, although more geared towards northern Utah (Appendix E of Aquatics Specialist Report). Finally, Goates et al. (2007) and Goates (2006) provides life history information gleaned from the 2003-2004 radio-tracking project established to validate design features developed for an earlier Monroe Mountain planning project. Additional boreal toad information on habitat use, movements, and response to treatments is also found in the analysis section.

Due to population declines throughout their range, boreal toads were petitioned for listing as a threatened species. The USFWS determined that the southern Rocky Mountain population did not warrant listing, but that the eastern clade (which occurs in Utah) did warrant a full status

review. Higher priority species are currently ahead of boreal toads in the process, but the full status review must be completed by USFWS by September 2017. It is important that boreal toad habitat and population levels in the project area not be adversely affected by project activities, as it could add pressure towards a listing decision.

To aid the reader, a short general (uncited – see above for sources of more specific information) synopsis of boreal toad general life history and habitat use on Monroe Mountain is included. Boreal toads inhabit areas of Monroe Mountain over 8,000 feet, typically over 8,500 feet. Across their range, they use many habitat types and are known to travel cross-country considerable distances, even going over mountain passes in Colorado. On Monroe Mountain, they seem closely tied to water, however, in the professional opinion of the fisheries biologist, due to the warmer and drier conditions than often found in their range. They use small mammal burrows (Photo 3) for cover and hibernate through the winter typically in a root chamber, associated with spruce-fir and willows, over a small perennial stream (Photo 11 and Photo 12). Beaver dams are important habitat features (Photo 4 and Photo 5), and can serve as hibernacula. They emerge from hibernation in early spring, breeding in slack water (ponds to depressions). By mid-summer, they disperse across the landscape, usually along streams, moving towards hibernacula in late summer. Tadpoles emerge as small toadlets in late summer, usually (based on literature studies in other areas) experiencing high mortality (adult survival, minus special stressors, is usually fairly high). Experience on Monroe has shown they occur in relatively low density even in prime habitat. Chytrid fungus has been a major factor in boreal toad population declines across their range. Monroe Mountain had been considered chytrid free, with 2006 samples all negative, but in 2012 samples documented chytrid in the Manning Creek watershed at Manning Reservoir and Barney Lake and the Monroe Creek watershed at Magleby Reservoir. Surveys in 2013 found chytrid at all locations submitted for testing, but not every sample (i.e. toad) was positive (Forest files data). Maintaining healthy riparian areas along streams and lakes with cool microsites (toads favor warm shallow water for laying their eggs to speed tadpole development, but need cooler and moister conditions for themselves on land), large wood (Photo 1 and Photo 2), diverse habitats with minimal human disturbance, good water quality in lakes, and good watershed function in streams are all important for long-term boreal toad persistence.

Photo 1. Large wood forms an important habitat component for boreal toads at the upland/water interface for cover, shelter, food. Searching for toads near large wood at Manning Meadow Reservoir.

Photo 2. This large log at Barney Lake often was host to several basking toads that could retreat into the large fissure for cover.

Photo 3. Boreal toads use small mammal burrows for shelter and cover, but this raises the risk that toads con become trapped and entombed in burrows that are crushed by equipment. This photo shows a boreal toad in a burrow in upper Manning Creek

Photo 4. Beaver pond in upper South Fork of Box Creek

Photo 5. Radio tracking a boreal toad on North Fork of Box Creek. Note the beaver pond in the background.

3.4.6 Aquatic Management Indicator Species

Planning regulations in the first round of forest planning directed Forests to identify management indicator species (MIS; Table 104). These species are selected and monitored to indicate change in habitat quality resulting from activities on the Forest.

Aquatic MIS that were selected for the Forest include BVCT (emphasis MIS and also a Forest Service Region 4 sensitive species), resident trout, and aquatic macro-invertebrates. Trout species that represent resident trout in the project area are brown, cutthroat, rainbow and brook trout. Information regarding MIS can be found in *Life History and Analysis of Endangered Threatened, Candidate, Sensitive, and Management Indicator Species of the Fishlake National Forest* (Rodriguez 2008). This document contains summarized population trend and monitoring information for the Forest. Site specific and more recent information is included in this aquatic

biota report, while more general information can be found Rodriguez 2008 (hereby incorporated by reference).

Many of the selected MIS occur and range far beyond a local scale such as a project analysis area. Individuals, family groups, or herds of some animals such as elk or birds, annually use areas much larger area than a typical project area and population trend must be examined on a much larger scale to be meaningful. For NFMA implementation, this scale is the Fishlake National Forest. For aquatic species, populations are often best monitored at the watershed or sub-watershed scale (depending on species distribution, barriers, etc.). For aquatic species such as trout, population samples can be obtained at the project level to determine the approximate number utilizing habitat within the project area. Samping is easier for true aquatic species since they are confined to the water habitat. At a site-specific project level there is fluctuation in numbers, however, due to both yearly variations and spatial shifts of individuals. These population samples are really index samples rather than true population estimates. It would be difficult to detect minor changes in local numbers using an area, but large changes due to major habitat degradations or major habitat improvements have been noted in Forest sampling. It must be kept in mind that a individual project area may contribute to the total population trend but does not usually make up the entire population and trend, unless they are a locally endemic or restricted species. For this reason, it is not necessarily always appropriate to determine population trend at a local level.

Population trend for threatened, endangered and candidate species is addressed using recovery plans or conservation assessments, strategies and agreements. These broad scale documents are used because they occur and range far beyond the scale of the forest.

The following information was used to determine if aquatic management indicator species or their habitat is present within the project area:

- *Life History and Analysis of Endangered, Threatened, Candidate, Sensitive, and management Indicator Species of the Fishlake National Forest* (Rodriguez 2008).
- Information and response from the UDWR and USFWS.
- Aquatic biota field surveys including fish population transects and aquatic macroinvertebrate sample collection.

Based on office file review, field review, discussion with hydrologists, and UDWR biologists, the aquatic resources of concern, in roughly descending order in the project area are the BVCT broodstock in Manning Meadow Reservoir, boreal toads and their habitat across the mountain, the BVCT population in Manning Creek and its tributaries, the BVCT lake habitat and trophy/high quality fisheries in Barney Lake (also includes sterile tiger trout) and Manning Meadow Reservoir, recreation lake fisheries, and resident trout streams.

Table 104. Names and status of aquatic Management Indicator Species (MIS) known or suspected to occur in the project area, as well as suitable habitat. See UDWR web page for current stocking information. Above information was verified on the 2014 stocking page. In addition, native BVCT are stocked into Manning Meadow Reservoir and Barney Lake (see Table 103 above) and sterile hybrid tiger trout are stocked into upper and lower Box Creek reservoirs and Barney Lake.

Common/Scientific Name	Status	SUITABLE HABITAT IN PROJECT AREA	Rationale/Comments
Lake Trout *Salvelinus namaycush*	MIS		Not in project area. Requires deep, cold lakes with good (clear and limited nutrients) water quality.
Brown Trout *Salmo trutta*	MIS	X	Occur in project area.
Cutthroat Trout *Oncorhynchus*	MIS	X	Hybrid cutthroat trout (not pure BVCT) may occur in some project area waters.
Rainbow Trout *Salmo gairdneri richardson*	MIS	X	Occurs in project area. Catchable rainbows are stocked into Annabella Reservoir, Big Lake, Deep Lake, and upper and lower Box Creek Reservoirs.
Brook Trout *Salvelinus fontinalis*	MIS	X	Occurs in project area. Stocked into Box Creek Reservoirs. Common in upper Box Creek and headwaters of Monroe Creek.
Aquatic Macro-invertebrates	MIS	X	Occur in project waters.

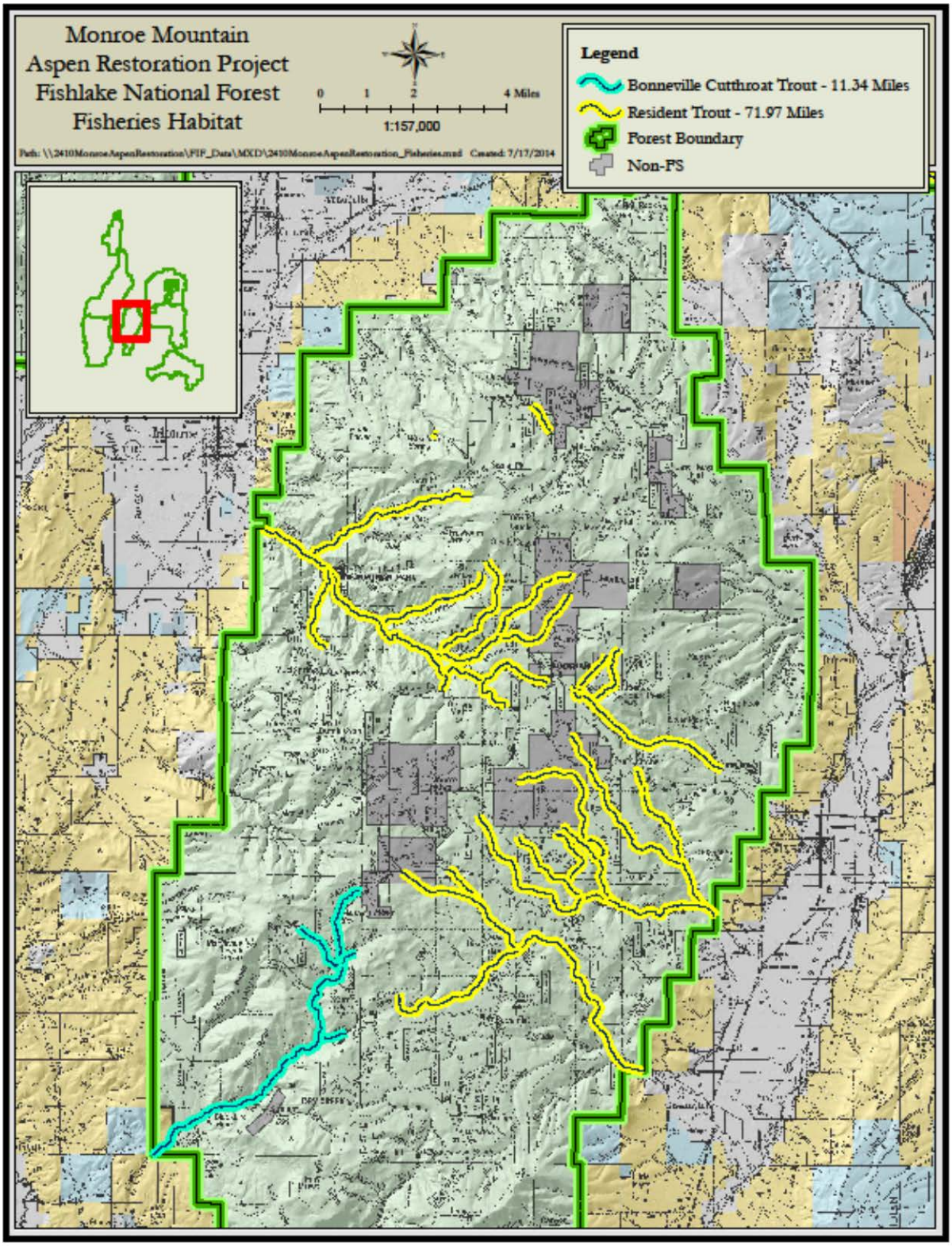


Figure 64. Stream fisheries resources on Monroe Mountain

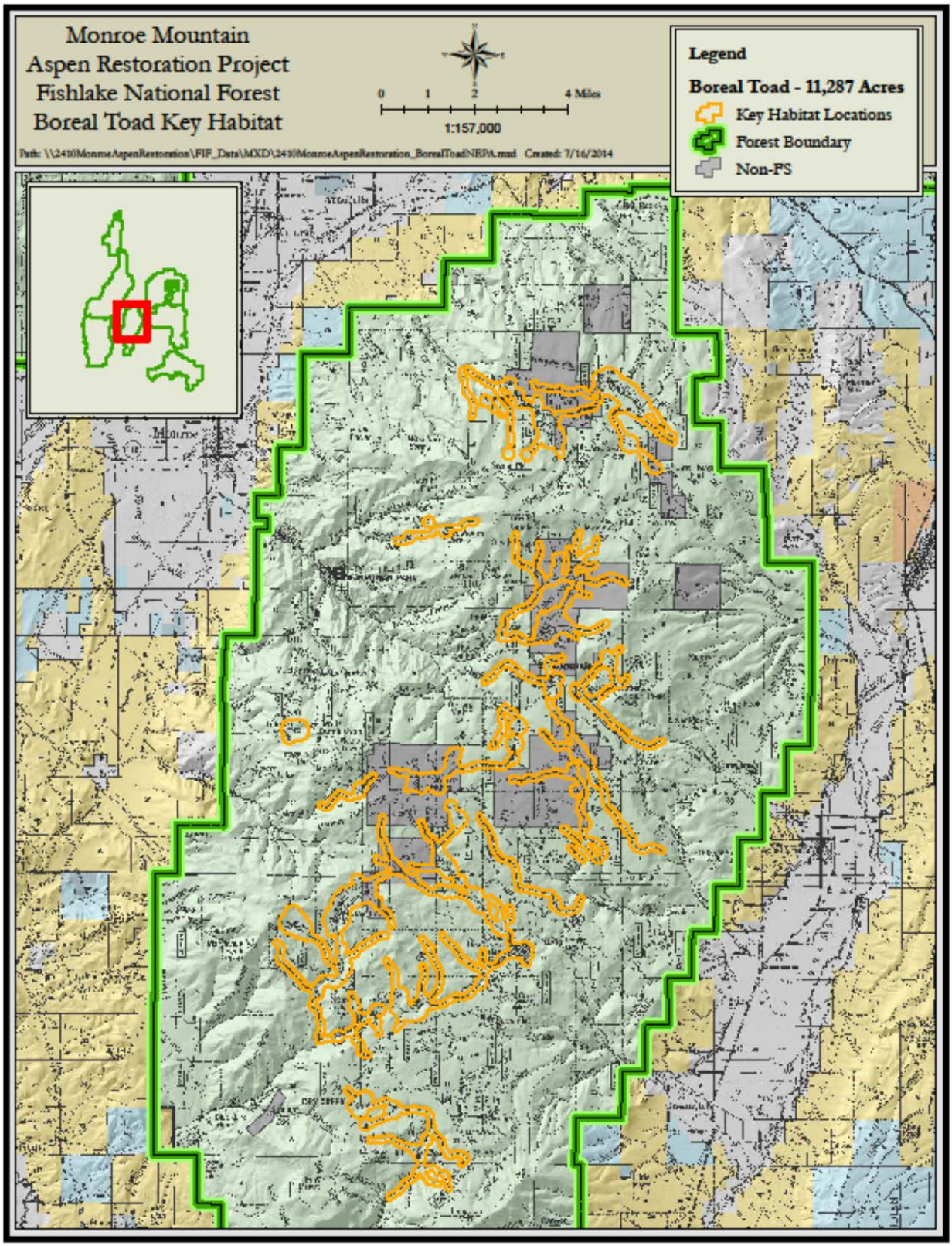


Figure 65. Mapped key boreal toad habitat

3.4.7 Aquatic Field Review

For the aquatic review and analysis sections, the Monroe Mountain subwatersheds containing aquatic resources are described from the southwest part of the mountain in Dry Creek clockwise around to Box Creek.

3.4.7.1 Dry Creek HUC6- 160300030102 (Dry Creek)

General Field Inspections

Dry Creek is an important drainage for boreal toads in its upper elevations. Water flow is relatively low. Livestock use in the drainage bottom seems high when observed mid-late season, at or above grazing standards.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

No Integrated Riparian Evaluation (IRE) surveys have been conducted in this drainage. Due to its importance for boreal toads, they should be conducted in the future.

Project Area Fisheries Surveys

Dry Creek has too low of streamflow to support fish.

Aquatic Macroinvertebrate Inventory

Aquatic macroinvertebrates occur in Dry Creek, but given that the stream does not support trout, their use as a MIS does not apply.

Boreal Toad

Dry Creek was first surveyed for boreal toads in recent times in 1998, when several juvenile toads and about 500 tadpoles were seen in 3 different areas in the upper Dry Creek drainage, including a small pond, a small pond near the Dry Creek Guard Station, and a stock watering pond (Fridell et al. 2000). Boreal toad reproduction could often be found at this stock pond in the 2000 to 2010 timeframe. This area was studied with radio tracking in 2003 to 2004, including by the Forest fisheries biologist, documenting movements between the stock pond and Dry Creek Guard Station (results summarized in Goates et al. 2007 and Goates 2006).

Five boreal toads were found on two tributaries of Dry Creek in 2014 UDWR surveys (Wheeler and McCormick 2014). It was the first time these tributaries had been surveyed for boreal toads.

3.4.7.2 Upper Manning Creek HUC6- 160300030104 (Manning Creek, Manning Meadow Reservoir, Barney Lake)

General Field Inspections

Field observations have been made by the Forest fisheries biologist on Manning Creek from 1999 to 2014. These field visits showed that overall the Manning Creek watershed is in good condition. Use levels range from moderate to relatively high but generally within standards in the uppermost watershed, depending on the year and weather conditions, by both livestock and elk. There are other land use impacts in this area, including high levels of off-road use, dispersed camping, and general recreational use, and cabin development on private land. Below the road, crossing the stream becomes quickly inaccessible with nearly pristine conditions. The lower watershed near the Forest boundary does have some impacts from livestock trailing up Straight Canyon, which is an intermittent tributary, a low-standard road, and an old diversion structure.

Nutrient loading is known to be a problem in Manning Meadow Reservoir. The underlying geology on Monroe Mountain is high in phosphates. Activities that disturb the soil, and put sediment into watercourses can increase nutrient levels, as can wildfires and prescribed burning. Animal manure is also high in nutrients. Cattle graze the area above Manning Meadow Reservoir and there are high numbers of elk using the area. Finally, cabin development on private land above the reservoir is likely contributing nutrients from septic systems. The Forest collected additional water quality monitoring samples in cooperation with the State of Utah in late 2006 and early 2007. Water samples show high phosphate levels in the lake and low oxygen levels at depth.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

Manning Creek

Petty (2004) measured an average stream slope of 9 percent for Manning Creek, and a mean Pfankuch stability rating of 48.1, which indicates a very stable and erosion resistant stream. Manning Creek was composed of 21 “A” channel types and 7 “B” channel types.

Petty (2004, page 3) described the trout habitat in Manning Creek, noting, “The trout habitat was very good and many were seen above reach F1-7. Deep pools scoured by log and rock pourovers as well as undercut banks characterize much of the habitat. Spawning and macro invertebrate habitat may be limiting the size and production of fish, although fish were abundant in most of the creek. Fish migration upstream will not occur due to the waterfalls noted in reaches F1-20 and F1-22. Several anglers were seen on the creek above reach F1-28. The terrain of the middle reaches prevents access to the casual angler, but for those who are willing to either hike several miles or scale 30 to 40 foot cliffs, the fishing should be very good.”

Petty (2004, page 6) summarized the riparian vegetation condition, noting, “The condition of the riparian vegetative resource along Manning Creek is excellent and flourishing. The only exception is the existence of invasive weeds, especially in areas that are frequented by various recreation and other human impacts.”

Petty (2004, page 6) recommendations were "The management of Manning Creek appears to be maintaining stable hydrologic and vegetation resources… …Cattle grazing was most apparent during our survey in reaches F1-30 through F1-33, although forage resources are maintaining adequate cover and vigor through what appears to be moderate utilization. However, annual utilization surveys in these upper meadows would insure these valuable resources are maintained. Trout are thriving in the creek and habitat is well maintained."

Barney Creek

Barney Creek is marginal, and fish surveys only found trout use in the lower half. Petty (2004) surveyed the stream and did not note fish. Petty (2004) measured an average stream slope of 10.7 percent and a mean Pfankuch stability rating of 48.7, which is considered good. Barney Creek was mostly "A" channels with the lowest reach being a "B" channel type. The primary resource issue of concern Petty (2004) noted was off-road use, documenting pioneering off-road use down the creek below the reservoir. Petty (2004) did not observe any evidence of cattle grazing along Barney Creek.

Collins Creek

Collins Creek is a fishless tributary to Manning Creek. Petty (2004) measured an average stream slope of 12.7 percent. The stream was composed of "A" channel types. The mean Pfankuch stability rating was 65.3, which is considered good. Petty (2004, page 10) summarized conditions by noting, "The current management of Collins Creek is maintaining the riparian resource in good to excellent condition. Impact by humans was difficult to find, although the herbaceous vegetation community was heavily grazed around the spring in the upper portions of reach F3-7."

East Fork Manning Creek

East Fork Manning Creek is a small tributary to Manning Creek that fish go a short ways up. Petty (2004) measured an average stream slope of 4.3 percent. The stream was composed of primarily "B" channel types. The mean Pfankuch stability rating was 57, which is considered good. Concerning vegetation conditions on East Fork of Manning Creek, Petty (2004 pages 11 and 12) found that "The vegetation documented in the riparian areas of the East Fork of Manning Creek is in good to excellent condition. This area could be used as an example of the potential of mountain meadow streams. Cattle grazing was noted, but the impacts of grazing were negligible. Elk have been using the upper meadow in reach F4-2b more than cattle."

Vale Creek

Vale Creek is a small tributary to Manning Creek that is used by fish. Petty (2004) measured an average stream slope of 6 percent. The stream was composed of primarily "B" channel types. The mean Pfankuch stability rating was 62.5, which is considered good. Petty (2004) noted some grazing in the upper meadows but found the stream to be stable and in generally good condition.

Straight Canyon

Straight Canyon is an intermittent small fishless tributary to Manning Creek. Petty (2004) measured an average stream slope of 14.9 percent. The stream was composed of "A" channel types. The mean Pfankuch stability rating was 97, which is considered fair. Petty (2004) noted that this was the only area in the Manning Creek watershed where he observed heavy cattle grazing. Petty (2004) recommended that cattle grazing management should be investigated in this drainage, especially the trailing along the creek. Petty (2004) also noted off-road problems in this drainage.

IRE Streambank Stability Summary

When adjusted for channel type, the Pfankuch stability ratings for Manning Creek and its tributaries were 77.5 percent good, 14.4 percent fair, and 8.1 percent poor (see Appendix I, Table I-2 in Whelan 2014).

Project Area Fisheries Surveys

Stream Monitoring

Manning Creek and its tributaries were monitored for fisheries in 2001 by electroshocking. The data is summarized in Hepworth et al. (2003). Three stations were conducted along the mainstem, the lowermost on Bureau of Land Management lands, the middle a little above the Forest boundary, and the upper near the confluence with Collins Creek. Some of the most pristine and difficult to access terrain was not monitored. If the native BVCT are doing well at the monitoring sites selected, however, they will also be doing well in the more rugged stream reaches. The 2001 data found 451 fish per mile and 40 pounds per acre at the upper station a little below the road crossing below Manning Meadow Reservoir. The station near the Forest boundary in the lower part of the project area had 933 fish per mile and 92 pounds per acre. Finally, the Bureau of Land Management site had 515 fish per mile and 52 pounds per acre (data in Hepworth et al. 2003). This data shows good fish numbers and about average biomass. Reproduction and multiple age classes were found in all parts of the stream. Given the relatively recent reintroduction of BVCT into this stream, following renovation treatments in 1996, the results of this monitoring was considered satisfactory. Manning Creek was re-monitored in 2008; the data are summarized in Hadley et al. (2011a). Occupied stream miles stayed the same for the mainstem and all tributaries. When all three stations were averaged, the 2008 sampling showed a 13 percent increase in fish biomass compared to 2001 (Hadley et al. 2011a).

Three tributaries were also monitored. Barney Fork is marginal and fish only use the lower half of the stream. In 2001, this station had 64 fish per mile and 5.2 pounds per acre (Hepworth et al. 2003). By 2008, this station's biomass had increased an incredible 350 percent (Hadley et al. 2011a). It is likely that wetter conditions and thus higher stream flow attracted more fish up this drainage compared to the earlier sample. In 2001, East Fork of Manning Creek also has low flow, and had 32 fish per mile and 12.9 pounds per acre (Hepworth et al. 2003). In 2008, East Fork of Manning Creek station's biomass had negligibly increased (less than 10 percent, Hadley

et al. 2011a). The slightly larger Vale Creek had 821 fish per mile and 12.8 pounds per acre in 2001 (Hepworth et al. 2003). By 2008, Vale Creek station's biomass had increased 21 percent (Hadley et al. 2011a). It appears that these tributary streams are all important spawning areas for BVCT.

Manning Meadow Reservoir

Manning Meadow Reservoir is an important broodstock, producing BVCT eggs for the southern Utah region of the UDWR. Fishlake National Forest fisheries personnel assist in the broodstock operation. The fish produced from this broodstock are used both to start new conservation populations and for sport fishing, where they have replaced the use of the non-native subspecies Yellowstone cutthroat trout. Yearly monitoring of the egg take provides trend data for the broodstock operations.

Data up to 2004 was summarized in Hepworth et al. (2004). The broodstock first began operation in 1992. By 1999, the broodstock was producing nearly 200,000 eggs. Production slipped slightly to about 173,000 eggs in 2000, but was over 200,000 eggs per year from 2001 to 2004 (Hepworth et al. 2004). Results from 2005 were about average, but in 2006 a missing age class and loss of some of the over-mature fish from the population resulted in a decline with about 130,000 eggs taken. The operation rebounded in 2007 with a new age class reaching maturity, however, resulting in a record egg take of over 400,000 eggs.

More recent egg take figures are included in Hadley and Hepworth (2013). Egg numbers peaked in 2011 at over 600,000 but took a large decline in 2013 with only 228,000 eggs collected (Hadley and Hepworth 2013). These lower numbers can be problematic, as some fish are lost in various stages of rearing in the hatchery system. In 2013, 43 percent of the eggs were successfully raised to fish for stocking. This was barely adequate to cover the southern region UDWR stocking quota needs (Hadley and Hepworth 2013), and does not leave any extra for special projects or unforeseen needs.

In 2014, the Manning Meadow broodstock spawning operation collected over 500,000 BVCT eggs. Good survival in the hatchery led to an abundance of BVCT for fall stocking. These high numbers of BVCT were crucial, in addition to normal uses/waters, as considerable BVCT were needed for jumpstarting the Clear Creek metapopulation following the completion of rotenone treatments that followed severe fish declines from post-fire flooding off the Twitchell Canyon fire. This included conservation population stocking in lower Clear Creek, Mill Creek, Fish Creek, upper Clear Creek, and Shingle Creek. In addition, a supplemental plant of BVCT was made into Pine Creek (Bullion Canyon) and a sport-fish planting in Oak Creek. With many tens of miles of fish habitat needing reintroductions, the Manning Meadow broodstock was a critical resource in this projects success (Photo 6 below).

Gill netting of Manning Meadow Reservoir takes place each year with broodstock operations, in part to monitor population status, critical for maintaining egg take, and to help in fish collection for disease certification. Hadley (2013a) is the latest report on lake monitoring. Hadley (2013a) found that the low numbers of eggs taken in 2013 were due to an issue with the 2009 plant (cohort), but that the 2010 stocking was doing well, which would indicate a likely increase in

eggs in 2014 [which turned out to be the case]. Hadley (2013a) recommended maintaining the current stocking regime.

Water quality is a concern at Manning Meadow Reservoir. Much of the year the majority of the water column is too deficient in oxygen (anoxic) to support trout, which are thus limited to the upper surface layer. The above description shows that the broodstock is sufficient to meet needs on a good year, but clearly, the excess nutrients are limiting the biomass that the lake could support, and if water quality were improved, recreational fishing would likely improve. Conversely, additional nutrients would likely reduce broodstock production and fishing quality. Probable current sources of the excess nutrients are the volcanic geology, private cabin development above the reservoir, the road alongside the reservoir (a project was undertaken in 2010 to reduce road impacts to the lake), livestock and wild ungulate grazing (the area upstream of the reservoir holds a large herd of elk for much of the summer).

Photo 6. Stocking a new conservation population stream segment on lower Clear Creek on the Fishlake National Forest, Beaver Ranger District with about 15,000 Manning Meadow Reservoir broodstock BVCT fry in October 2014

Barney Lake

Barney Lake is a high quality recreational fishery containing native BVCT and sterile tiger trout. It is known to produce some nice fish to the angler, but can be hard to fish. There is no natural reproduction so fishing success, fish numbers, size, and condition is set by the interplay of angler use, harvest, and stocking (species, numbers, size, and season). As a put-and-take fishery, habitat conditions are secondary up to the point that they are not detrimental to the fishery. Increasing sedimenation of the lake was noted due to off-road use around the lake in the late 2000s, which did raise habitat concerns.

To assess fisheries trends, make stocking change recommendations, and evaluate changes, Barney Lake was gill netted in summer 2008 (Hadley 2008) and 2013 (Hadley 2013b).
In 2008, the gill netting found greatly increased numbers of tiger trout and decreased numbers of BVCT compared to the previous netting in 1994, 1997, and 2001. The largest tiger trout caught was 20 inches long and weighed 2.8 pounds. Hadley (2008) recommended increasing the number of BVCT, stocking them at larger sizes, Hadley (2008) noted that water qaulity issues and/or higher tiger trout stocking may have impacted the BVCT. In 2013 survey was conducted to see changes resulting from stocking BVCT as holdovers (7-inch) verses fry (2-inch) and stocking reduced numbers of tiger trout. The catch rate was up, with considerable more BVCT, and length, weight, and condition of both species was at or above long-term means (Hadley 2013b). Due to a decrease in angler catch rates, Hadley (2013b) did recommend increasing tiger trout stocking slightly from recent numbers. Hadley (2013b) also noted that ATV fencing was installed by the Forest (in a multi-agency cooperative project) in 2010 along with a parking area to reduce vehicle disturbance around the lake and improve water quality.

Aquatic Macroinvertebrate Inventory

Four aquatic macroinvertebrate sample stations have been collected on the Fishlake National Forest portion of Manning Creek since 1988 in the project area. A comprehensive analysis of aquatic macroinvertebrates on Manning Creek was undertaken to assess the effects of the renovation treatments on them, and determine if additional mitigation measures were necessary (Whelan 2002). This monitoring shows that the upper watershed stations have generally been above the LRMP standard and guideline level with static trend. The lowest station near the Forest boundary had been below the LRMP standard and guideline level with static trend (Whelan 2002). The reasons for the lower score near the Forest boundary are not fully understood, but are likely partially related to effects from the low-standard road, a diversion structure (impacts from the construction and maintenance of this structure were noted by Petty (2004), and livestock trailing and general use up Straight Canyon.

Boreal Toad

The upper Manning drainage was first surveyed in modern times in 1995, when numerous adults and 10 egg stands were documented in Manning Meadow Reservoir and 32 adult toads were seen at the Manning Barney confluence (Fridell et al. 2000). The beaver ponds at this confluence were re-checked in 1996 and 3 toads and 28 tadpoles were observed (Fridell et al. 2000). Numerous areas were checked in 1997 when 6 toads were found at the confluence in spite of the beaver dam being breached (i.e. poorer habitat). At Barney Lake 25 toads were

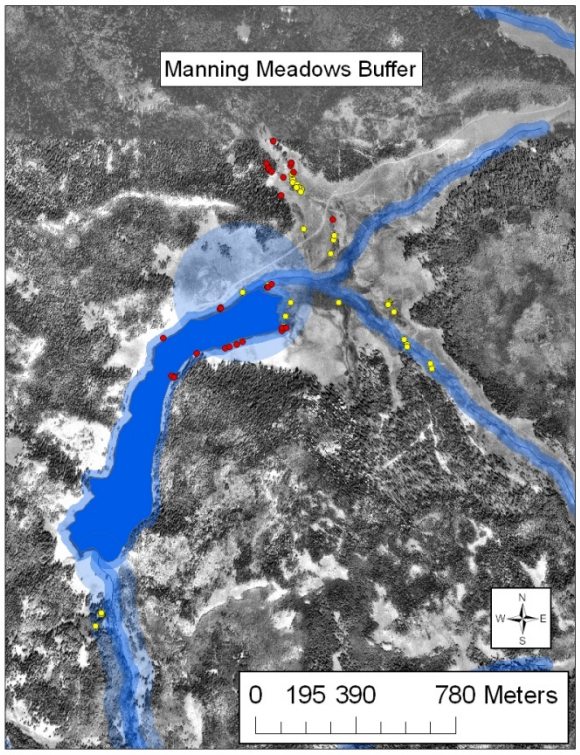


Figure 66. Boreal toad locations mapped over aerial photos and vegetation maps with 300-foot streamside and 900-foot breeding site buffers (2003 through 2004 data with original 2000 Monroe Mountain EIS project buffer zones). This map shows heavy toad use along a small unmapped (in corporate GIS dataset) perennial stream northeast of the lake.

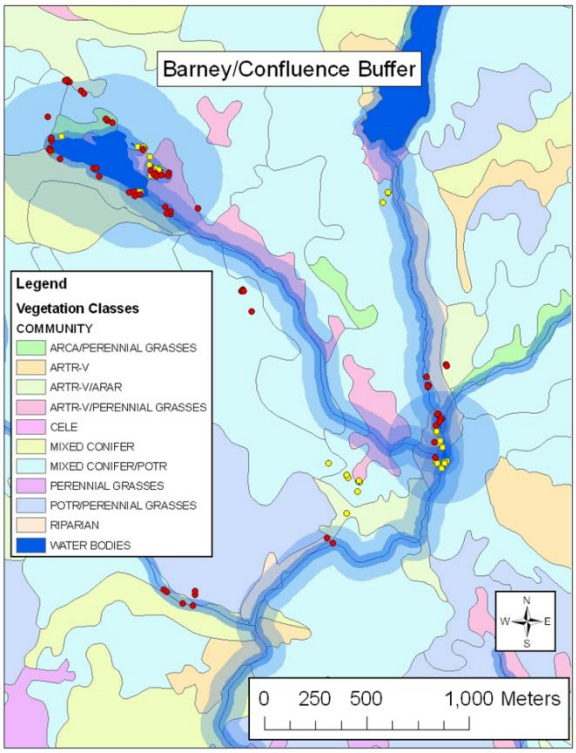


Figure 67. This map shows the importance of the larger buffer around an important breeding lake

found and observed leaving and entering small mammal burrows. They also documented a boreal toad mortality in 1997 on Forest Road 083 (Fridell et al. 2000). In 1998 surveys documented 4 adults and 580 plus tadpoles at Manning Meadow Reservoir, several adults at the Manning/Barney confluence, a boreal toad on East Fork of Manning Creek, and 29 adults and 530 tadpoles at Barney Lake (Fridell et al. 2000).

The Manning Creek drainage was considered a key boreal toad area in the early 2000s, where toads, egg masses, and tadpoles were always easy to find. It was a core area studied in the 2003 through 2004 radio tracking study (Goates et al. 2007; Goates 2006; also see Figure 66 and Figure 67 for examples of toad location data plotted in this drainage).

Utah Division of Wildlife Resource surveys in 2010 documented three boreal toads at Barney Lake, including an adult female missing a right hind leg, and six adult toads at Barney Kettle, with active reproduction occurring and one previously deposited egg mass (Lien and Wheeler 2010). At the Barney/Manning confluence 3 adult toads, 13 juvenile toads, and 1 egg strand were documented, and at Manning Meadow Reservoir 6 adult toads (1 dead, and 1 with leeches), 2 juveniles, and 2 egg strands were observed (Lien and Wheeler 2010).

Surveys of the Barney Kettle in 2014 documented no boreal toads or reproduction, the fourth year no reproduction was found (Wheeler and McCormick 2014). Only one boreal toad was found at the confluence in these surveys and no reproduction, although there is no recent beaver activity and low water in remnant ponds. This was the lowest number of boreal toads observed at the site since 1997 (Wheeler and McCormick 2014). A visit in later July by UDWR did find two adult females at Manning Meadows Reservoir, two adult females at Barney Lake, but no boreal toads at the Barney Kettle (Wheeler 2014). The Forest fisheries biologist did not document any boreal toads at Manning Meadow Reservoir, Barney Lake, or the confluence in 2014 in two field visits. This would have been considered unfathomable 10 years earlier. The UDWR breeding surveys should be considered presence/absence, and it is not considered reliable to infer trend data from it (K. Wheeler, UDWR Native Aquatics biologist, email communication July 28, 2014). In 2014, for surveys of less checked areas, one boreal toad was encountered in 2014 between the Barney/Manning confluence and Collins Creek and a dead boreal toad was found at White Ledge Spring (Wheeler and McCormick 2014). These surveys found heavy grazing in the East Fork of Manning Creek drainage.

3.4.7.3 Dry Canyon HUC6 - 160300030303 (Hunts Lake)

General Field Inspections

Hunts Lake contains fish, tiger salamanders, and boreal toads. Small carp are known from this lake. It is not an important recreational fishery.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

The small area surrounding the lakes does not really warrant these surveys.

Project Area Fisheries Surveys

No fish surveys occur in Hunts Lake.

Aquatic Macroinvertebrate Inventory

Does not apply as an MIS for lake habitat.

Boreal Toad

Hunts Lake was first surveyed in recent times for boreal toad in June 1995, when two egg strands were found in the middle pond with emergent vegetation, and in 1998 when an adult was found at the middle pond (Fridell et al. 2000). Boreal toads have been seen by the Forest's fisheries biologist in the early to mid-2000s in this area.

3.4.7.4 Monroe Creek HUC6- 160300030308 (Monroe Creek, Magleby Reservoir)

General Field Inspections

The headwaters of Monroe Creek are important boreal toad habitat. They have not been well looked at for other uses.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

Monroe Creek has not been surveyed using the IRE methodology. Given its importance for boreal toads, recreational fisheries, wildlife habitat, and watershed function, it should be surveyed in the future.

Project Area Fisheries Surveys

A fish population transect was sampled on lower Monroe Creek near Monrovian Park in about 2000. This survey found good biomass, but it was comprised of very high numbers of small wild rainbow trout. This drainage needs additional fisheries surveys.

Aquatic Macroinvertebrate Inventory

No aquatic macroinvertebrate samples have been collected from Monroe Creek. They should be collected in conjunction with future fisheries surveys.

Boreal Toad

Magleby Reservoir, which sits on private land, has been known for some time as an important boreal toad area. The UDWR surveys in 2010 documented 4 adult toads and over 1,500 tadpoles in 5 groups (implying 5 egg masses and reproduction events) (Lien and Wheeler 2010).

Two boreal toads were found on surveys of upper Monroe Creek in 2014 (Wheeler and McCormick 2014) where a previous survey in 2001 found 4 adults, 6 juveniles, and over 350 tadpoles. One adult female boreal toad was observed at Magleby Reservoir in 2014 (Wheeler 2014).

3.4.7.5 Thompson Creek HUC6- 160300030314 (Annabella Reservoir, Deep Lake)

General Field Inspections

Field observations have been made by the Forest fisheries biologist while traveling through the area several times from 1999 and 2014. Some livestock grazing use was noted around the reservoirs, but there was also disturbance from off-road and recreational use around the lakes. The primary concern noted with these lakes is water fluctuation due to water management and a propensity to winterkill due to the shallow water levels.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

There is no IRE Level II survey data.

Project Area Fisheries Surveys

Not sampled. Sampling of Annabella Reservoir and Deep Lake by gill netting is planned for fall 2014 or summer 2015.

Aquatic Macroinvertebrate Inventory

As noted above, due to the lack of trout supporting streams, aquatic macroinvertebrate sampling does not apply.

Boreal Toad

The UDWR surveys at Deep Lake in 2010 found 4 adult and 1 dead juvenile toad (Lien and Wheeler 2010). Survey of a meadow north of Deep Lake found one adult and one juvenile toad, with deep off-road ruts made through the meadow, although a recent closure appeared to block further off-road traffic through the meadow (Lien and Wheeler 2010).

No boreal toads were observed at Deep Lake in 2014, despite the fact that they have been observed there most years since 2000 (Wheeler and McCormick 2014) and the fact that the 2013 survey found seven adults and six egg strands. One boreal toad was found in surveys of ten ponds near Annabella Lake (Wheeler and McCormick 2014).

3.4.7.6 Water Creek HUC6- 160300030316 (Big Lake)

General Field Inspections

Field observations have been made by the Forest fisheries biologist while traveling through the area several times 1999 and 2014. Some livestock grazing use was noted around the reservoirs, but there was also disturbance from off-road and recreational use around the lakes. The primary concern noted with these lakes is water fluctuation due to water management and a propensity to winterkill due to the shallow water levels.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

There is no IRE Level II survey data.

Project Area Fisheries Surveys

In 2007, hook-and-rod sampling was conducted at Big Lake in early summer. Several catchable rainbow trout were caught in less than an hour, which shows good sport fishing conditions. Additional sampling by gill netting is planned for fall 2014 or summer 2015.

In September 2014, A. Solt, Fishlake National Forest hydrologist, noted a cyanobacteria bloom (blue-green algae pond scum) on Big Lake, indicative of nutrient issues.

Aquatic Macroinvertebrate Inventory

As noted above, due to the lack of trout supporting streams, aquatic macroinvertebrate sampling does not apply.

Boreal Toad

The fisheries biologist has seen adult boreal toads and tadpoles in Big Lake in the 2000 through 2010 timeframe. Surveys in 2013 found 11 boreal toads and over 1000 tadpoles on the Central Pasture and Christensen Spring tributary above Big Lake, where much of the habitat surveyed was within conifer stands (Wheeler 2013). Boreal toads were also observed in Henries Hollow and Long Flat tributaries a boreal toad and about 190 tadpoles in the White Pine Creek tributary (Wheeler 2013).

3.4.7.7 Koosharem Creek HUC6- 160300030406 (Koosharem Creek)

General Field Inspections

Field observations have been made by the Forest fisheries biologist in the project area between 1999 and 2014. These field visits showed that the mid-lower elevation ranges of these creeks are generally inaccessible to livestock and motorized vehicle use and are in good to excellent

condition. The upper elevation ranges are more accessible to livestock, motorized vehicle use, and other human recreational impacts. Wildlife use levels, deer and elk, are also high. In general, these reaches are in fair condition with some areas of poor and some areas of good condition. Koosharem Creek is in generally better condition.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

Petty (2006b) measured a mean gradient on Koosharem Creek of 6 percent with gradients over 10 percent in the middle reaches. Half of the stream channels were Rosgen "A" types, with some "B", "G", and "E" type channels. The mean Pfankuch stability rating was 64, which is considered good.

Petty (2006b, page 2) noted on Koosharem Creek that, "The aquatic habitat seemed adequate to support a fishery; however, fish were rarely seen and not seen at all above reach N1-9. The trout noted in the lower reaches were thought to be German browns. Aquatic habitat may be limited by deep pools and cover habitat."

With regard to riparian vegetation, Petty (2006b, page 8) noted, "Riparian plant communities along the upper reaches of Koosharem Creek (N1-12 to N1-17) are characterized by lush cover of perennial grasses and grass-like species in the understory, tall coniferous tree cover in the overstory and abundant willow cover in the mid-canopy levels. Reaches N1-15 and N1-14b are dominated by lush mesic graminoid meadows."

In his management recommendations, Petty (2006b, page 9) stated, "The management of Koosharem Creek appears to be maintaining stable hydrologic and vegetation resources. Evidence of cattle grazing was not noted in the riparian complexes and impacts by livestock grazing have been minimal. Evidence of four wheeler use in reaches N1-16 and N1-17 has damaged wet riparian meadows and caused soil loss. The use of off-highway vehicles should not be allowed in these areas. This stream would be an ideal location for the reintroduction of beaver, as the lack of deep pools is most likely preventing trout from using much of the upper sections of this creek."

IRE Streambank Stability Summary

When adjusted for channel type, the Pfankuch stability ratings for Koosharem Creek were 86.1 percent good, 8.4 percent fair, and 5.6 percent poor (see Appendix I, Table I-3 in Whelan 2014).

Project Area Fisheries Surveys

There is no fish population monitoring stations on Koosharem Creek.

Aquatic Macroinvertebrate Inventory

There are no aquatic macroinvertebrate monitoring stations on upper Koosharem Creek. One station was collected just upstream from the diversion on lower Koosharem Creek in 2010. This sample is currently being analyzed at the laboratory.

Boreal Toad

Boreal toads have been known from upper Koosharem Creek for some time, and have been seen by the Forest's fisheries biologist in the 2000 to 2010 timeframe. In the 2002-2004 timeframe, an interesting finding one summer was boreal toad breeding in a tire track crossing a small seep on a rutted road into a timber sale.

No boreal toads were found in UDWR surveys of Milo's Kitchen in 2014 (Wheeler and McCormick 2014) but the area appeared to be good habitat for boreal toads.

3.4.7.8 Greenwich Creek HUC6- 160300020407 (Greenwich Creek)

General Field Inspections

Field observations have been made by the Forest fisheries biologist in the project area between 1999 and 2014. These field visits showed that the mid-lower elevation ranges of these creeks are generally inaccessible to livestock and motorized vehicle use and are in good to excellent condition. The upper elevation ranges are more accessible to livestock, motorized vehicle use, and other human recreational impacts. Wildlife use levels, deer and elk, are also high. In general, these reaches are in fair condition with some areas of poor and some areas of good condition. Observations of upper Greenwich Creek watershed are that the several tributaries have more areas of fair to poor condition compared to other Monroe Mountain drainages.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

Petty (2006b) measured a mean gradient on Greenwich Creek of 8 percent. The majority of the stream channels were Rosgen "A" type channels. The mean Pfankuch stability rating was 67, which is considered good, but 3 reaches were rated fair. Greenwich Creek is a marginal fishery stream that Petty (2006b) indicated could support a limited fishery, but he only saw fish in the lower 4 reaches below the confluence with Thurber Creek. Grazing management was noted as adequate on this stream.

On the Thurber Creek tributary to Greenwich Creek Petty (2006b) noted that the upper watershed was gentler, with a mean gradient of 8 percent and a mix of Rosgen "A", "B", and "C" stream channel types. The lower stream had a mean gradient of 16 percent and was composed of Rosgen "A" channel types. The mean Pfankuch stability rating was 83, which is considered fair, but reach M5-6 was rated as poor. Petty (2006b) found this stream to be water limited for supporting a fishery, and recommended better grazing management in livestock accessible areas.

On the South Fork of Greenwich Creek Petty (2006b) measured a mean stream gradient of 8 percent. Rosgen stream types were mostly "A" with four "B" channels and one "E" channel. The mean Pfankuch stability rating was 70, which is considered good, but 5 reaches were rated poor. Petty (2006b) recommended better grazing management in the upper reaches of this stream.

Petty (2006b) also looked at three tributaries to South Fork of Greenwich Creek. These had mean stream gradients of about 6 to 8 percent. Two of the tributaries had mean Pfankuch stability ratings of 72 to 73, while 1 had a rating of 101, which is fair. These streams were all water limited and marginal for fisheries, and had some reaches with livestock concerns.

IRE Streambank Stability Summary

When adjusted for channel type, the Pfankuch stability ratings for Greenwich Creek and its tributaries were 57.1 percent good, 6.3 percent fair, and 36.6 percent poor (see Appendix I, Table I-4 in Whelan 2014).

Project Area Fisheries Surveys

There are no fish population monitoring stations on Greenwich Creek.

Aquatic Macroinvertebrate Inventory

There are no aquatic macroinvertebrate monitoring stations on upper Greenwich Creek. One station was collected just upstream from the diversion on lower Greenwich Creek in 2010. This sample is currently being analyzed at the laboratory.

Boreal Toad

Boreal toads are known to use these drainages. Toads were radio tracked in this watershed by the Forest's fisheries biologist in the trial year of 2002, but due to lower toad density and the desire for larger sample sizes, the area was not included in the 2003 to 2004 project. Surveys in 2013 did not document any boreal toads (Wheeler 2013).

3.4.7.9 Box Creek HUC6- 160300020408 (Box Creek, Box Creek Reservoirs)

General Field Inspections

Field observations have been made by the Forest fisheries biologist in the project area between 1999 and 2014. These field visits showed that the mid-lower elevation ranges of these creeks are generally inaccessible to livestock and motorized vehicle use and are in good to excellent condition. The upper elevation ranges are more accessible to livestock, motorized vehicle use, and other human recreational impacts. Wildlife use levels, deer and elk, are also high. In general, these reaches are in fair condition with some areas of poor and some areas of good condition. North Fork of Box Creek are in generally better condition, although lower North Fork of Box Creek did have higher use impact levels in the 2000 to 2001 timeframe. South Fork of Box Creek has more areas of fair condition with some areas of poor condition. Stream flows are low in this stream and trout are restricted to a few higher flow areas and beaver ponds.

Integrated Riparian Evaluation Level II Surveys / Stream Channel Types

Petty (2006a) measured the average gradient below upper Box Creek reservoir as 8 percent. The stream was mostly Rosgen "A" type channels with the lower 2 reaches being "B" channels. The mean Pfankuch stability rating was 64, which would be considered good. When Petty (2006) was conducting his survey he found high water discharges (approximately 20 cubic feet per second (cfs) from the dams in early September, which was causing some resource concerns.

Petty (2006a, page 3) noted about the lower section of Box Creek that, "The aquatic habitat below the lower reservoir is protected from grazing in all but reach M1-10, where the stream is being impacted by very heavy cattle grazing. Beaver have built a series of dams on reaches M1-9 and M1-8 that provide deep-water habitat; trout are abundant in this area." Petty (2006a) also noted that, "The stream in the lower reaches is well shaded by dense stream bank shrubs."

Petty (2006a) measured the average gradient on North Fork of Box Creek at 4.0 percent. The stream was mix of Rosgen "A" and "B" channels types. The mean Pfankuch stability rating was 63, which would be considered good.

Describing the North Fork of Box Creek, Petty (2006a, page 17) noted, "Aquatic habitat found on the stream was sufficient to support trout, and many fish were seen below reach M2-10. The beaver ponds provide deep-water habitat that would not be available otherwise, and gravels appear to be well sorted to provide spawning and invertebrate habitat. Trout were seen in most reaches below the road, and fish over 14 inches in length were observed in the larger dams. Overall the aquatic habitat and fisheries were functioning well, considering the physical limits of the stream."

Petty (2006a) found grazing use on North Fork of Box Creek to be moderate. In his recommendations Petty (2006a, page 22) noted, "Current management of North Fork Box Creek appears to be maintaining stable hydrologic and vegetation resources. Evidence of cattle grazing was not noted in the riparian and impacts by livestock grazing appear minimal. However, because beaver activity is critical within this watershed for trout deep water habitat and boreal toads, potential conflicts with livestock grazing should be closely monitored to ensure adequate regeneration of shrubs and trees used by beaver."

On the west fork of the upper North Fork of Box Creek Petty (2006a) found the mean stream gradient to be 4 percent. He found a mix of "A" and "B" stream types. The mean Pfankuch stability rating was 80, which is considered fair. In his recommendations on this fork, Petty (2006a, page 24) noted, "The management of Unnamed Tributary North Fork Box Creek appears to be maintaining stable hydrologic and vegetation resources. Evidence of cattle grazing was noted in the riparian but grazing impacts appear to be concentrated at the confluence with the North Fork. Consideration should be given to limiting grazing activity in the riparian area. Although post-fire erosion appears to be stabilizing, monitoring should be considered to continue to assess this recovery."

Petty (2006a) measured the average gradient above upper Box Creek reservoir at 2.5 percent. The stream was mix of Rosgen channels types. The mean Pfankuch stability rating was 90.1, which would be considered fair.

Petty (2006a, page 3) noted about the upper South Fork that, "The aquatic habitat above the upper reservoir is limited due to stream instability, lack of shade and the abundance of fine sediment. This area is not near its aquatic functioning potential, primarily due to impacts from livestock grazing. Trout were frequently seen in this creek, although fish of over 6 inches were seldom seen [this may be primarily due to brook trout stunting from overbreeding, a trait common to this trout species], despite the abundance of beaver ponds and deep-water habitat." Petty (2006a) generally found grazing to be heavy on grass in the upper watershed.

IRE Streambank Stability Summary

When adjusted for channel type, the Pfankuch stability ratings for Box Creek and its tributaries were 54.2 percent good, 23.5 percent fair, and 22.3 percent poor (see Appendix I, Table I-5 in Whelan 2014).

Project Area Fisheries Surveys

The west fork of the North Fork of Box Creek was extensively monitored for fisheries and aquatic effects from the Oldroyd wildfire (Whelan 2003). Two stations were established, one above a high severity burned reach, and one at the lower end of the high severity burned reach. The fishery in this area was dominated by brook trout and the mean fish size was quite small. Stream flow was very low, below which (0.5 cfs late summer) trout can often survive, but the presence of deep holding pools allowed this stream reach to support the larger trout; the shallow riffle areas were used by the young fish (Whelan 2003).

Fish numbers in these 2 stations was quite high, ranging from 739 fish per mile up to 1464 fish per mile (Whelan 2003). Biomass was not determined the first year (2000) but was monitored in 2001 and 2002. In 2001, biomass ranged from 72-81 pounds per acre, which is slightly above average for the Forest (Hepworth 2005; Platts and McHenry 1988). In 2002, after drought reduced streamflow further and concentrated fish even more the biomass rose in the upper station to 165 pounds per acre, which is above average for the Forest. The lower station in the burned area remained at 84 pounds per acre, which may have indicated some pool filling effects from the fire (Whelan 2003). Still, overall effects from the Oldroyd wildfire were less than expected by the Forest fisheries biologist. This monitoring indicates a healthy viable wild fishery in this tributary of North Fork of Box Creek. The monitoring was repeated in 2006 and the stream still held good numbers and biomass of trout (Fishlake National Forest file data).

Water chemistry samples taken on North Fork of North Creek showed a considerable spike in phosphorus [nitrate was not tested for] in October 2000 after the Oldroyd burn, despite the fact that that the sample was not timed in order to hit expected peak levels (during or immediately initial storms over the burn) (Whelan 2003). This could indicate the prescribed burn treatments and wildfires could lead to large nutrient pulses moving down streams. These would likely be of small consequence in stream systems, but could be important if draining into the fish supporting water reservoirs on Monroe Mountain, which are already nutrient laden.

There is no fish population monitoring stations on South Fork of Box Creek. The intermittent nature of the upper and lower portions of this Creek, with trout restricted to beaver ponds and the

middle more inaccessible reaches, makes stream population transect monitoring unfeasible for many parts of the creek. Periodic walk through inspections of the drainage to monitor the distribution of trout is recommended instead.

Upper and lower Box Creek Reservoirs have been stocked with rainbow and brook trout. The reservoirs function as put-and-take fisheries, and with the extreme water fluctuations due to irrigation, were managed with catchable sized rainbow stocking with little expectation of carry over. The reservoirs were monitored in 2013 by gill netting (Hadley 2013c). This sampling found rainbows to dominate the upper reservoir, with brook trout more prevalent in the lower reservoir. Good numbers were caught, but both rainbows and brook trout showed poor condition (Hadley 2013c). One interesting finding was the presence of non-native red-sided shiner, the result of an illegal introduction, likely for bait fishing. This is likely exacerbating the poor condition of the rainbow and brook trout. Based on these findings, Hadley (2013c) recommended replacing half the brook trout stocked with tiger trout, which can potentially feed on the introduced non-native non-game red shiners.

Lower Box Creek reservoir was checked by the Forest's fisheries biologist in summer 2013, following receiving a complaint from an angler from Las Vegas, Nevada. Apparently, the Box Creek reservoirs was their planned fishing/camping destination the previous fall, but they found the water quality to be so poor (particularly the lower reservoir) as to be unsatisfactory [the descriptions used by the complainant are not suitable for use in a report like this], requiring them to change locations. During the 2013 visit, a considerable algal bloom was noted including cyanobacteria (blue-green algae pond scum), indicative of nutrient issues, on the lake. Probable sources of the excess nutrients are the volcanic geology, livestock grazing (cows were around the lake during the visit), the road accessing the lake (all water off the road drains into the lake), and the upstream vegetation treatments and 2012 planned Box Creek fire that escaped prescription.

Aquatic Macroinvertebrate Inventory

One aquatic macroinvertebrate station was collected from lower Box Creek near the Forest boundary in 1995. This BCI at this station was 67, which is slightly below the LRMP standard and guideline level (Rodriguez 2008). Given the relative good condition noted in the canyon above this station, the reason for this lower BCI is not fully understood. This station was repeated in 2010. This sample is currently being analyzed at the laboratory.
One aquatic macroinvertebrate station was collected from lower North Fork of Box Creek just above upper Box Creek reservoir in 1999, 2000, and 2001. The BCI for this station was slightly below LRMP standard and guideline levels with a generally static trend (Rodriguez 2008). This station may be affected by beaver, water management levels in the reservoir, and livestock grazing, as some livestock concerns were noted in the reaches above this station in these years as well.

Two stations were collected on the west fork of North Fork of Box Creek in 2000 and 2001 (twice in 2001). These stations had BCI levels ranging from 73 to 78, which is near LRMP standard and guideline levels, with a static trend (Rodriguez 2008 and Whelan 2003), despite the effects of the Oldroyd fire.

One aquatic macroinvertebrate station was collected from South Fork of Box Creek just above upper Box Creek reservoir in 1999. The BCI at this station was below the LRMP standard and guideline level (Rodriguez 2008). Intermittent stream flow and beaver activity may be part of the reason for the low level, as when this station was revisited for later samples it was determined that the water was generally stagnant and the station could not be repeated (this was a drought year; the station supports flowing water in good years). Therefore, there is no trend data for this station.

Boreal Toad

Box Creek was first surveyed for boreal toads in recent times in 1998, when four toads were seen along North Fork of Box Creek (Fridell et al. 2000). Boreal toads were common in both the North and South Forks in the early 2000s and boreal toads were radio tracked in these drainages in the 2003 to 2004 study (Goates et al. 2007, Goates 2006). The study documented a large movement by one toad that was radio tagged on a beaver pond on the North Fork. After moving downstream it was lost, only found late in the season on a side tributary to the South Fork after the fisheries biologist hiked up the South Fork from upper Box Creek Reservoir on a hunch.

No boreal toads were seen in a survey on a North Fork side tributary in 2013 surveys (Wheeler 2013). Eight adult boreal toads were observed in 2013 surveys on South Fork of Box Creek tributaries in 2013, with areas of heavy grazing, willow browsing, and abundant elk sign noted (Wheeler 2013).

3.4.7.10 Aquatic Macroinvertebrate Summary Information

The LRMP requires sampling from five Forest streams per year to determine BCI trend from across the Forest, as discussed in Rodriguez (2008). While an older methodology, BCI does provide a quantitative measure of aquatic health due to overall watershed condition, land management activities, and natural disturbances. Its use would still be appropriate, particularly when combined with other aquatic macroinvertebrate indices. Workforce resources and priorities have not yet allowed for the inclusion and analysis of other indices. Note that the aquatic macroinvertebrate sampling used by the Forest only applies to streams and not lake environments. The BCI score is derived by dividing the potential or predicted Community Tolerance Quotient (CTQp) [based on site conditions and water quality] by the dominance weighted actual Community Tolerance Quotient (CTQd) [an index based on the mean weighted tolerance of the actual taxa found in the sample] multiplied by 100. Some information on sampling by watershed was included in the above section. A summary of the BCI results for Monroe Mountain are shown in Table 105.

Table 105. Monroe Mountain aquatic macroinvertebrate biotic condition index (BCI) summary table. Note: Biotic Condition Index data for the table is found in Mangum (various dates) and Vinson (various dates). These reports are on file at the Fishlake National Forest Supervisor's Office in Richfield, Utah. C* collected and currently undergoing analysis at the laboratory.

STATION	YEAR								
	88	**90**	**95**	**97**	**99**	**00**	**01**	**03**	**10**
Manning T	81	77/84	76	73	79	-	-	71	-
Manning 7.0	-	-	-	-	79	-	-	73	-
Manning L	-	-	66	65	63	-	-	-	-
Manning 3	-	-	-	70	-	-	-	-	-
Barney Cr	-	-	-	-	-	-	-	78	-
Koosharem 01	-	-	-	-	-	-	-	-	C*
Greenwich 01	-	-	-	-	-	-	-	-	C*
Box Cr 1	-	-	67	-	-	-	-	-	C*
SF Box Cr	-	-	-	-	53	-	-	-	-
NF Box 2	-	-	-	-	69	63	65	-	C*
NF Box 3	-	-	-	-	-	76	73/78	-	-
NF Box 4	-	-	-	-	--	73	73/76	-	-

3.4.8 Direct and Indirect Effects

3.4.8.1 Bonneville Cutthroat Trout (Sensitive) and Resident Trout (MIS)

Direct Effects

Direct effects are impacts that directly result in the death of a fish. One example would be a water quality impact such as a major chemical spill. Another example would be equipment in a creek that directly crush and kills trout eggs are incubating in the gravel. Given the required design features listed for the Monroe Mountain Aspen Ecosystems Restoration Project, direct effects to fisheries and aquatic biota are considered generally unlikely to occur, with the exception of a low but real risk to boreal toads of direct injury from vehicles or equipment.

Indirect Effects

Indirect effects are impacts that are not directly connected in space and time. One example would be the spread of an aquatic invasive species (AIS) that changes the ecology of an aquatic habitat, indirectly reducing the habitat quality for a native species. Another example would be

sediment from a disturbance that embeds gravels, reducing spawning success, and decreasing aquatic macroinvertebrate food production.

The stream and lake habitats in the project area provides suitable habitat for these trout and fish species. Aquatic habitat conditions range from good to poor on Monroe Mountain. The actual potential of these habitats in pristine condition is not known. Existing sedimentation impacts occur from grazing and low standard roads.

The activities associated with this project are relatively low risk for AIS transfer provided the required design features are followed.

There are several potential effects to aquatic habitats and associated species that can result from timber harvest. These include increased solar radiation, decreased supply of large woody debris, erosion of streambanks, addition of logging slash, altered streamflow regime, accelerated surface erosion, increased nutrient runoff, and inputs of fine inorganic and organic matter (Robertson 1997a).

Prescribed fire can affect aquatic habitat and biota. Direct effects include heating or abrupt changes in water chemistry. Indirect effects include changes to the hydrologic regime, erosion, debris flows, woody debris, and riparian cover. All of these effects are dependent on numerous factors including fire intensity, its extent and location within a watershed, the amount and type of fuel consumed and left, soil type, soil fire temperatures, fire severity, and the frequency, timing, and intensity of precipitation events (Robertson 1997b)

The primary potential for indirectly affecting fish, aquatic macroinvertebrates, or aquatic habitats would be from the introduction of fine sediment to the streams. Fine sediment can change the species composition, diversity, and abundance of macroinvertebrates as well as suffocating trout eggs and fry (Robertson 1997a). The use of design features, mitigation measures, best management practices, and following the soil and water conservation handbook reduces the amount of sediment reaching the stream.

Also of concern would be nutrients from this sediment and nutrients from treatments such as dissolved nutrients from ash and burned areas reaching fish supporting reservoirs, where they could further overload these lakes and lead to increased fish kills, algal blooms, and anoxic conditions.

Figure 68 through Figure 71 show alternatives 2 through 5 to give a general location of treatments. Appendix C of Whelan 2014 provides greater overlaying proposed treatments with aquatic species habitat including mapped boreal toad habitat.

Key comparison elements for evaluating how the alternatives affect sensitive and management indicator species are:

- **Bonneville cutthroat trout, resident trout,** and **aquatic macroinvertebrates** – measures: increase of sediment in streams (number of tons of sediment per acre added to streams), biomass of trout per acre, and aquatic macroinvertebrate BCI rating.

- **Boreal toad** – sedimentation of breeding sites, percent area disturbance within RHCAs, road increases within RHCAs.

Other aquatic resources –

- **Lake habitat** – sediment influx into the lake, nutrient levels (phosphorus and nitrogen).

The figures listed in Table 106 are listed as mechanical treatment acres, percent HUC mechanical treatment, fire acres, fire acres adjusted for a maximum 60 percent treatment level, percent HUC fire treatment (at 60 percent), total percent HUC treatment methods. Note: Table 106 shows slightly fewer treatments acres than some tables in the rest of this document, or other project file documents that use official NHD layer HUC6 boundaries, as 159 acres of proposed prescribed fire treatments in the NHD Monroe Creek HUC6 are excluded from the modified Monroe Creek boundary shown below, as they do not drain into aquatic supporting drainages. These acres outside of modified HUC boundaries are evident on Figure 68 through Figure 70.

3.4.8.2 General Fire and Mechanical Treatment Aquatic Effects Discussion

The following discussion points describe important general concepts regarding key aquatic habitat features, potential fire effects, and measures to protect those habitats:

Buffer Zones

Belt et al. (1992, 3:2) note that riparian buffer strips provide three basic roles: 1) they maintain the hydrologic, hydraulic, and ecological integrity of the stream channel, soil, and vegetation, 2) they filter and trap nutrients and sediments, and 3) they provide food, cover, and thermal protection to fish and wildlife. See Belt et al. (1992 5:6) for discussion on the role of buffer zones in managing cumulative effects to riparian areas.

Sediment

Duffield (no date) reviews the potential effects of sediment on fisheries. As summarized by Duffield (no date, page 1) fine sediment can suffocate trout eggs incubating in gravels, reduce macroinvertebrate biomass and diversity, and fill interstitial gravel spaces important for some life stages of trout and fill pools important for adult trout. Many studies have documented the reduced survival to emergence of trout eggs as fine sediment levels increase. At high enough levels (greater than 40 percent), fine sediment can even eliminate trout fisheries. Duffield (no date, page 3) notes that when evaluating sediment influx, channel morphology, historic sediment

Table 106. Proposed fire and mechanical vegetation treatments by subwatershed (modified HUC6 and HUC7s used for aquatic analysis) by alternative.

		No Action	Alternative 2						Alternative 3						Alternative 4						Alternative 5					
HUC 6	HUC 6 Total Acres	Acres Being Treated	Mechanical & Slash Burning (Acres)	Mechanical & Slash Burning Percent of HUC 6 Being Treated	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	Prescribed Fire Mixed Burn Severities Percent of HUC 6 Being Treated	All Treatments Combined Percent of HUC 6 Being Treated	Mechanical & Slash Burning (Acres)	Mechanical & Slash Burning Percent of HUC 6 Being Treated	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	Prescribed Fire Mixed Burn Severities Percent of HUC 6 Being Treated	All Treatments Combined Percent of HUC 6 Being Treated	Mechanical & Slash Burning (Acres)	Mechanical & Slash Burning Percent of HUC 6 Being Treated	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	Prescribed Fire Mixed Burn Severities Percent of HUC 6 Being Treated	All Treatments Combined Percent of HUC 6 Being Treated	Mechanical & Slash Burning (Acres)	Mechanical & Slash Burning Percent of HUC 6 Being Treated	Prescribed Fire Mixed Burn Severities (Acres)	Prescribed Fire Mixed Burn Severities Factoring 60% of Acres Get Treated	Prescribed Fire Mixed Burn Severities Percent of HUC 6 Being Treated	All Treatments Combined Percent of HUC 6 Being Treated
Box Creek - Above Reservoirs	8,470	0	686	8%	904	542	6%	15%	734	9%	896	538	6%	15%	737	9%	893	536	6%	15%	725	9%	796	478	6%	14%
Box Creek - Below Reservoirs	11,214	0	1,808	16%	445	267	2%	19%	2,098	19%	501		0%	19%	2,250	20%	501	301	3%	23%	1,974	18%	276	166	1%	19%
Browns Canyon-Otter Creek	17,857	0	2	0%	422	253	1%	1%	-	0%	424	254	1%	1%	-	0%	424	254	1%	1%	3	0%	420	252	1%	1%
Dry Canyon	59,521	0	72	0%	3,217	1,930	3%	3%	356	1%	3,031	1,819	3%	4%	754	1%	2,745	1,647	3%	4%	428	1%	2,959	1,775	3%	4%
Dry Canyon - Hunts Lake	241	0	-	0%	116	70	29%	29%	-	0%	116		0%	0%	-	0%	116	70	29%	29%	0	0%	116	70	29%	29%
Dry Creek - Lower	2,980	0	-	0%	209	125	4%	4%	-	0%	209	125	4%	4%	-	0%	209	125	4%	4%	0	0%	209	125	4%	4%
Dry Creek - Upper	9,510	0	417	4%	3,007	1,804	19%	23%	951	10%	3,153		0%	10%	1,254	13%	3,153	1,892	20%	33%	1,204	13%	2,213	1,328	14%	27%
Gold Creek-Sevier River	29,011	0	-	0%	830	498	2%	2%	-	0%	830	498	2%	2%	1	0%	829	497	2%	2%	0	0%	830	498	2%	2%
Greenwich Creek	11,922	0	1,721	14%	199	119	1%	15%	1,822	15%	195	117	1%	16%	1,864	16%	194	116	1%	17%	1,720	14%	195	117	1%	15%
Koosharem Creek-Otter Creek	3,715	0	43	1%	582	349	9%	11%	69	2%	585	351	9%	11%	238	6%	508	305	8%	15%	39	1%	585	351	9%	10%
Manning Creek - Barney Lake	283	0	-	0%	202	121	43%	43%	81	29%	121	73	26%	54%	130	46%	72	43	15%	61%	133	47%	70	42	15%	62%
Manning Creek - Lower	7,857	0	-	0%	191	115	1%	1%	-	0%	191	115	1%	1%	-	0%	191	115	1%	1%	4	0%	191	115	1%	2%
Manning Creek - Manning Reservoir	1,189	0	34	3%	367	220	19%	21%	190	16%	276	166	14%	30%	431	36%	41	25	2%	38%	281	24%	185	111	9%	33%
Manning Creek - Upper	14,855	0	364	2%	3,704	2,222	15%	17%	740	5%	3,795	2,277	15%	20%	1,298	9%	3,553	2,132	14%	23%	1,188	8%	2,878	1,727	12%	20%
Maple Creek-Sevier River	28,346	0	-	0%	316	190	1%	1%	-	0%	316	190	1%	1%	9	0%	308	185	1%	1%	0	0%	316	190	1%	1%
Mill Creek	11,800	0	225	2%	1,500	900	8%	10%	583	5%	1,255	753	6%	11%	869	7%	1,112	667	6%	13%	470	4%	1,255	753	6%	10%
Monroe Creek	23,532	0	997	4%	9,017	5,410	23%	27%	2,297	10%	8,680	5,208	22%	32%	4,363	19%	7,190	4,314	18%	37%	3,150	13%	7,041	4,225	18%	31%
Monroe Creek - Magleby	1,667	0	85	5%	413	248	15%	20%	330	20%	168	101	6%	26%	449	27%	49	29	2%	29%	330	20%	168	101	6%	26%
Peterson Creek	31,202	0	12	0%	499	299	1%	1%	118	0%	392	235	1%	1%	266	1%	244	146	0%	1%	118	0%	392	235	1%	1%
Pine Canyon-Otter Creek	18,464	0	-	0%	405	243	1%	1%	-	0%	405	243	1%	1%	-	0%	405	243	1%	1%	0	0%	405	243	1%	1%
Pole Canyon-Otter Creek	26,120	0	1	0%	18	11	0%	0%	16	0%	18	11	0%	0%	16	0%	18	11	0%	0%	2	0%	16	10	0%	0%
Swift Spring Creek	22,852	0	41	0%	738	443	2%	2%	40	0%	779	467	2%	2%	40	0%	779	467	2%	2%	113	0%	666	400	2%	2%
Thompson Creek-Sevier River	12,681	0	-	0%	2,276	1,366	11%	11%	8	0%	2,267	1,360	11%	11%	346	3%	1,930	1,158	9%	12%	8	0%	2,267	1,360	11%	11%
Thompson Creek-Sevier River - Annabella Reservoir	940	0	48	5%	626	376	40%	45%	217	23%	457	274	29%	52%	507	54%	167	100	11%	65%	223	24%	450	270	29%	52%
Water Creek	29,962	0	1,106	4%	1,903	1,142	4%	8%	2,250	8%	1,573	944	3%	11%	3,168	11%	1,175	705	2%	13%	1,802	6%	1,201	721	2%	8%
Water Creek - Big Lake	3,409	0	525	15%	726	436	13%	28%	743	22%	562	337	10%	32%	845	25%	470	282	8%	33%	1,159	34%	91	55	2%	36%
Grand Total	389,600		8,187		32,832	19,699			13,643		31,195	16,455			19,835		27,276	16,366			15,074		26,191	15,715		

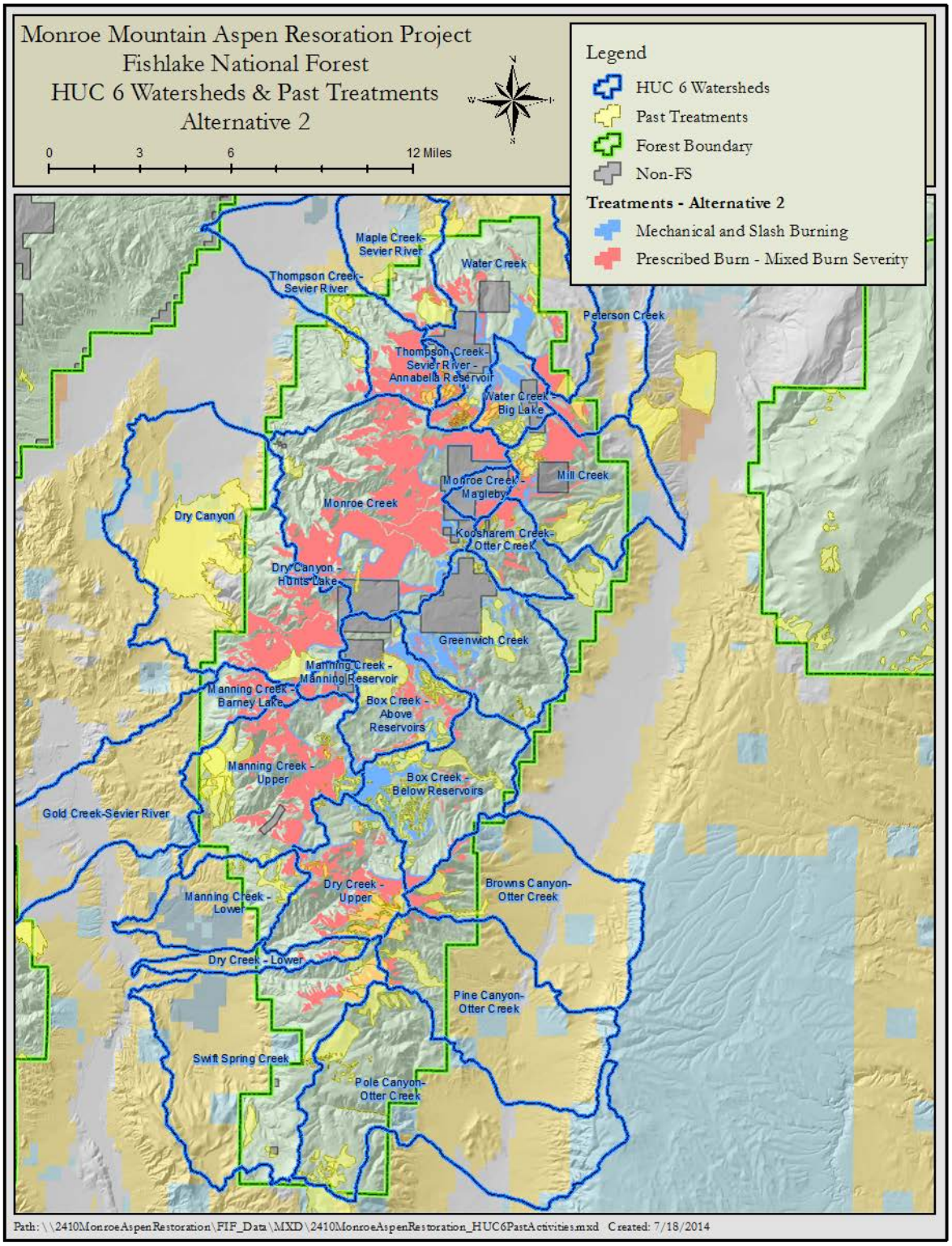


Figure 68. Map showing landscape scale view of Monroe Mountain watersheds, past treatments and fires, and proposed treatments in alternative 2

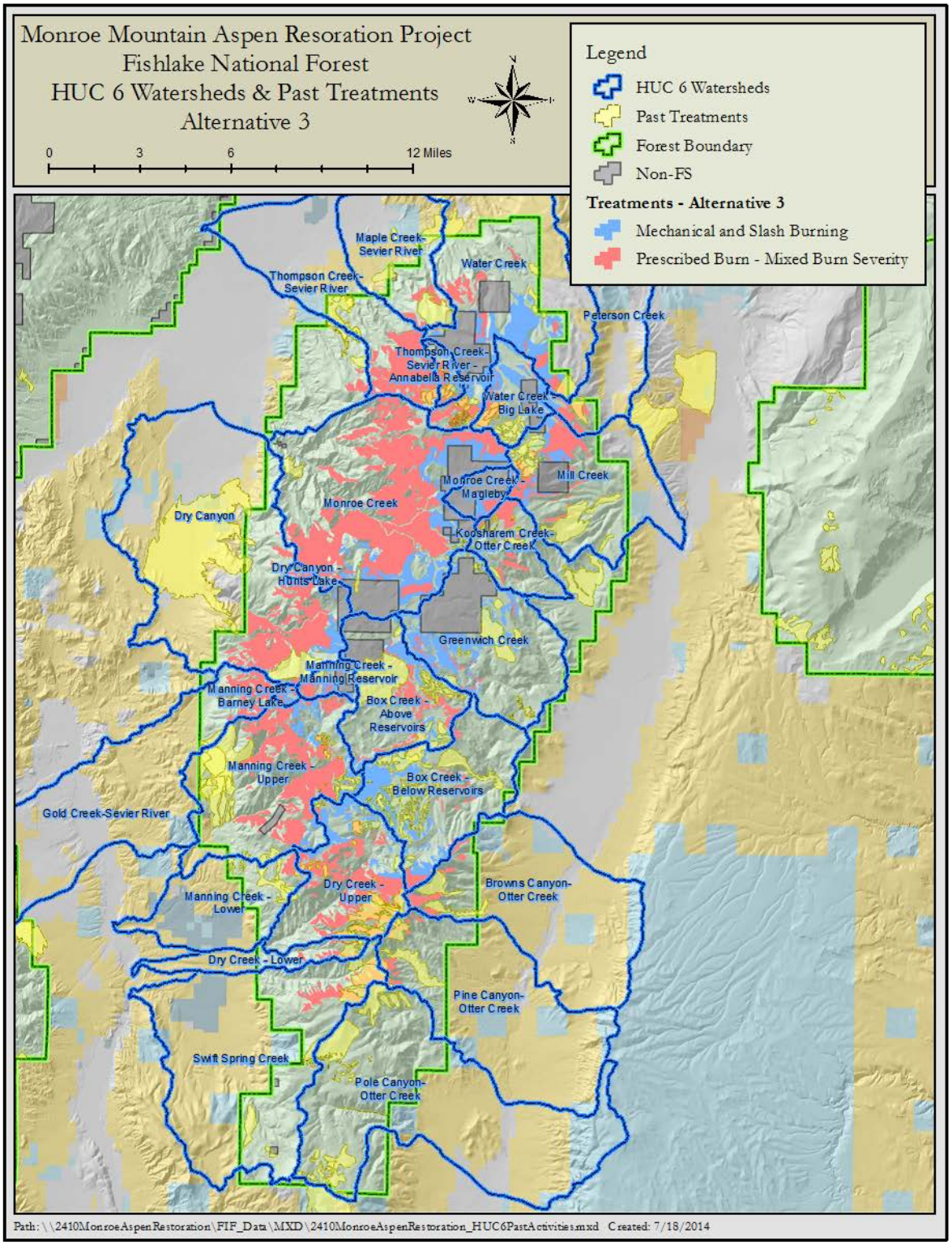


Figure 69. Map showing landscape scale view of Monroe Mountain watershed, past treatments and fires, and proposed treatments in alternative 3

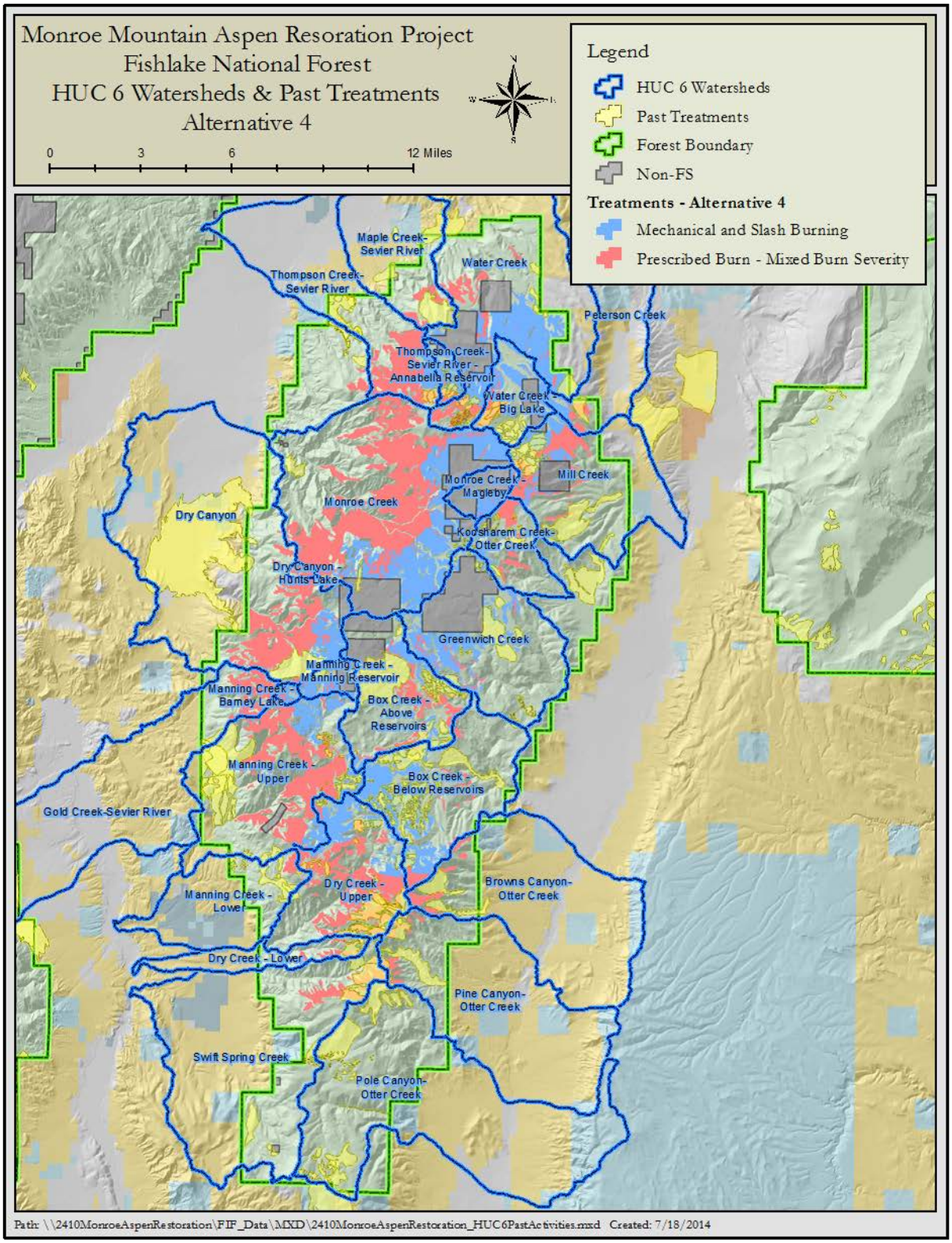


Figure 70. Map showing landscape scale view of Monroe Mountain watersheds, past treatments and fires, and proposed treatments in alternative 4

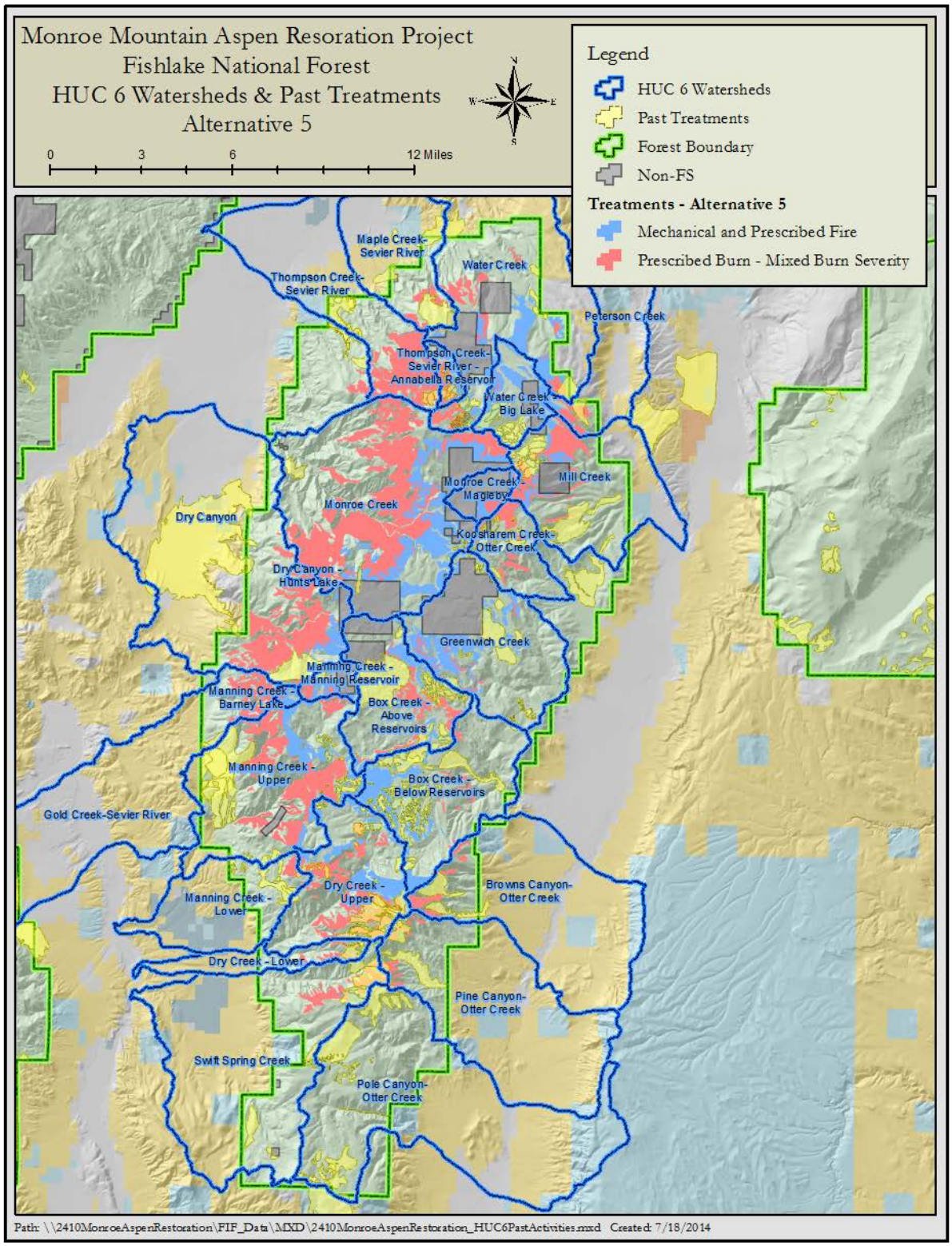


Figure 71. Map showing landscape scale view of Monroe Mountain watersheds, past treatments and fires, and proposed treatments in alternative 5

levels, and timing are important considerations, and even relatively low incremental sediment may have adverse impacts.

On the Monongahela National Forest, Duffield (no date, page 4 and 7) found a moderate inverse correlation between the percent fines in spawning gravels and biomass of fish in "B" channel types, and a highly significant inverse correlation between age 1 fish and sediment in "B" channel types, showing that in these moderate gradient stream channel types increasing sediment levels do have an effect on trout populations. Correlations were weaker in "A" and "G" channel types.

Belt et al. (1992, 2:3 and 5:3) note 4 factors to consider regarding buffer zone trapping of sediments: 1) buffer strips need to be wider on steeper slopes; 2) *buffer strips are not effective in stopping sediment moving in channels* (which can travel up to 1000 feet or more) [emphasis added the Forest's fisheries biologist]; 3) overland sediment flow can move up to 300 feet through buffer zones in worst case scenarios; and 4) removing natural obstructions including vegetation within the buffer increases the distance sediment can flow. Mitigation measures to control sediment such as windrows at the base of road fill slopes, treatment of fill slopes with plantings (grass) or mulch, and road surface treatments can considerably reduce sediment yields (Belt et al. 1992 5:2). Belt et al. (1992 5:2) summarize a number of studies, and while sediment travel distances varied, and were much less on low slopes, in general they note that filter strips of 200 to 300 feet are generally effective in controlling overland sediment transport.

Temperature

Stream temperatures are a factor of concern for salmonids, and not just in the relatively arid and warm environments of the Western United States. According to Teti (2003, page 1) stream temperature is of concern even in British Columbia, and sockeye salmon have been reported to lose weight above 17 degrees Celsius, indicating stress. Monitoring of stream temperatures on the Forest since 2001 has found peak summer temperatures to be of concern on several streams (unpublished Fishlake National Forest file data). Experience sampling trout on the Forest since 2001, particularly in the hotter and dryer summers of 2002 and 2003, has shown that trout in water 20 degrees Celsius, or higher are clearly stressed and much more vulnerable during electroshocking sampling work. These high peak water temperatures have been correlated with low fish numbers during sampling on Upper Manning Creek (Hepworth et al. 2010).

One interesting item noted in several years of monitoring temperature on the Forest is how rarely single point in time temperature readings document stream temperature problems when they do occur. Usually it requires data logging continuous sampling over the summer to identify the problem. In low elevation warmer areas and high elevation low flow streams it is highly likely that temperature would be a concern on these creeks if the currently canopy layer was removed. Therefore, to maintain the fisheries in the project area streams and prevent habitat quality degradation, maintaining a high proportion of streamside shade would be very important.

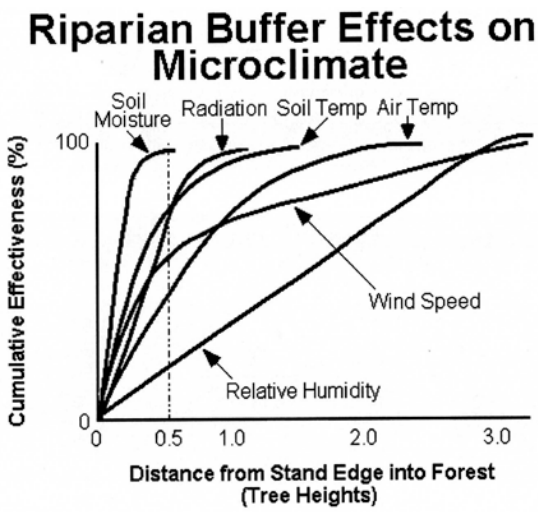


Figure 72. Riparian buffer effects on microclimate (from FEMAT 1993, Chapter 5)

Figure 72 shows the role riparian forests play in modifying the climate near streams. The graph shows the effect by distance based on tree heights. For the project area tree height potential is about 100 feet, so the 100-foot special management zone would be equal to the one (tree height) on the graph. This shows that the 100-foot buffer would be highly effective at reducing radiation to the stream and reducing air temperatures in the stream corridor.

Studies reviewed by Belt et al. (1992, 4:1 and 5:4) indicate that loss of riparian vegetation results in larger daily temperature variations and elevated monthly temperature during summer periods when stream flow is low and air temperature high. Removal of riparian vegetation can also reduce winter water temperature. Conversely, other studies reviewed by Belt et al. (1992, 5:4) showed that riparian buffer strips were effective in preventing stream temperature increases in clear-cut areas. Stream morphology can affect the streams sensitivity to changes; shallow streams will tend to heat and cool more rapidly (Teti 2003 page 4).

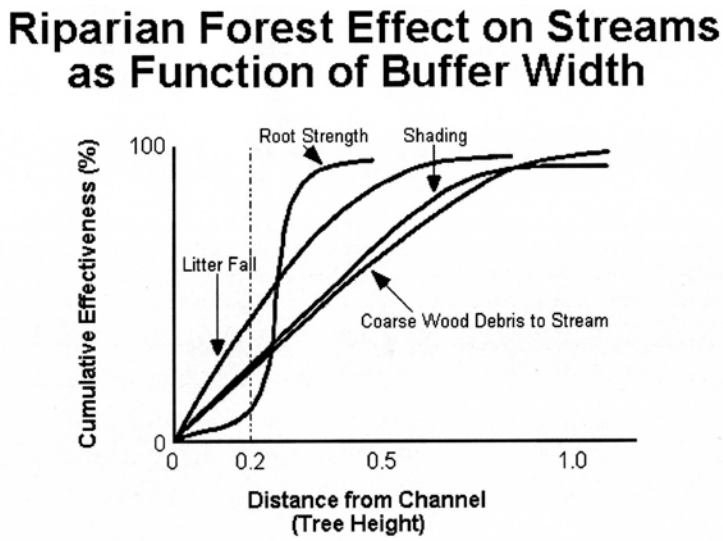


Figure 73. Riparian forest effects on streams (from FEMAT 1993 Chapter 5)

Figure 73 shows that a buffer width of about 1 tree height, or about 100 feet for this project area out from the stream on each side will provide nearly 100 percent effectiveness for shading and maintaining coarse woody debris to the stream.

Nutrients

According to Belt et al. (1992, 2:3), effectiveness of buffer strips as nutrient filters has not been examined extensively in scientific literature. Slash burning within a buffer strip can increase nutrients supplied to streams. Belt et al. (1992, 4:3) also reviewed one study that showed some effects of slash burning could be reduced by passage through the riparian buffer. Thus, the effects of slash burning could vary widely from beneficial to harmful depending on the background nutrient level in the soil and water, amount of material burned, buffer zone distance between the burned material and the creek, and weather. Belt et al. (1992, 5:4) note the studies they reviewed "suggest that where nutrient loading is a problem, burning slash within the buffer is likely to increase the loading and the problem". These studies on slash burning indicate buffer zones likely also reduce nutrient spikes from upland prescribed burning.

Water chemistry samples taken on North Fork of North Creek in October 2010 showed a considerable spike in phosphorus after the Oldroyd burn, despite the fact that that the sample was not timed in order to hit expected peak levels (Whelan 2003). This could indicate the prescribed burn treatments and wildfires could lead to large nutrient pulses moving down streams. These would likely be of small consequence in stream systems, but could be important if draining into the fish supporting water reservoirs on Monroe Mountain, which are already nutrient laden.

3.4.8.3 General Discussion on Proposed Mechanical Vegetation Treatment Effects

Mechanical treatments proposed under the Monroe Mountain Aspen Ecosystems Restoration Project range from low impact to high impact. One level of proposed treatment would remove all existing conifers from aspen stands with only minor aspen removal as necessary to reach conifers. In some cases, this work could even be done by hand. This work would have less benefit in stimulating aspen to sprout and my only "buy time" by setting back conifer invasion, but it also would not "bet the stand" where regeneration would have to be successful or the stand would be lost, such as those that happened in the Dry Creek and While Ledges area. It would also have minimal effects to watershed function. Outside of the risks of motorized use (which should mostly be mitigated by design features), these treatments would not have measurable effects to aquatic resources.

A variation of this proposal is to thin smaller conifers up to an 8-inch DBH size, leaving the larger trees. In areas where conifer invasion was just starting, it could increase habitat diversity. In areas where conifer invasion is well established, it may be much less effective due to leaving seed sources in the stand. It would have similar or even less effects than above.

The other proposal is thinning stands to a basal area of 90. This is more of a classical thinning timber harvest. As noted above, the timber stand provides important functions along streams for

nutrient and sediment trapping and microsite conditions. Design features should maintain most of these riparian values. The major risk of effects from this harvest to aquatic resources results from disturbances related to roads and mechanical skidding. Roads change delivery networks, increase disturbed ground, and increase sedimentation and peak flows to streams. Skidding effects can vary from relatively minor to greater due to implementation. At its best, it should disturb less than 15 percent of the ground surface (D. Deiter, former Fishlake National Forest hydrologist (currently the District Ranger on the Jackson Ranger District, Bridger-Teton National Forest, personal communication)), but can range much higher. Past watershed monitoring of Monroe Mountain timber harvests found much higher skidding ground disturbance (Deiter 2002) at levels that would likely contribute sediment to nearby streams.

3.4.8.4 General Discussion on Effects to Aquatic Macroinvertebrates

Under the no action alternative, there would be no mechanical vegetative or prescribed fire treatments, so no direct adverse effects would be expected to the streams aquatic macroinvertebrates. Potential indirect effects would come from natural succession as the areas further move to late seral communities with secondary effects to watershed health and increasing risks of catastrophic wildfire.

A wildfire may have a negative effect on stream water quality (depending when and where it burned), as it would likely occur in the summer months when control efforts are more difficult and the acreage burned would probably be greater. This would result in potentially more sediment moving into the streams following a precipitation event than from a planned prescribed burn. Wildfires also have the potential for larger size than the proposed treatments, which would increase the total amount of sediment potentially delivered to the streams. These high rates of sediment could cover gravels and may adversely affect localized populations or viability of aquatic macroinvertebrates.

Under the action alternatives, some impacts would likely occur to aquatic macroinvertebrates from proposed mechanical vegetation and prescribed fire treatments.

Several potential effects to aquatic habitats and associated aquatic macroinvertebrates can result from timber harvest. These include increased solar radiation, decreased supply of large woody debris, erosion of streambanks, addition of logging slash, altered streamflow regime, accelerated surface erosion, increased nutrient runoff, and inputs of fine inorganic and organic matter.

Wildfire and prescribed fire can affect aquatic macroinvertebrates. Direct effects include heating or abrupt changes in water chemistry. Indirect effects (impacts that are not directly connected in space and time) include changes to the hydrologic regime, erosion, debris flows, woody debris, and riparian cover. The primary potential for indirectly affecting aquatic macroinvertebrates would be from the introduction of fine sediment to the streams. Fine sediment can change the species composition, diversity, and abundance of macroinvertebrates (Robertson 1997a). All of these effects are dependent on numerous factors including fire intensity, its extent and location within a watershed, the amount and type of fuel consumed and left, soil type, soil fire temperatures, fire severities, and the frequency, timing, and intensity of precipitation events

(Robertson 1997b). The results would be include increased solar radiation, erosion of streambanks, altered streamflow regime, accelerated surface erosion, increased nutrient runoff, and inputs of fine inorganic and organic matter. The use of design features, mitigation measures, best management practices, and following the soil and water conservation handbook reduces the amount of sediment reaching the stream.

The activities associated with this project are relatively low risk for AIS transfer. Thus, the design feature of following Regional Operational and Technical guidelines for AIS (USFS 2014a and 2014d) would provide adequate protection.

Effects to aquatic macroinvertebrates are a compilation of the suite of factors mentioned above, including shading (probably mostly related to photosynthesis), organic debris (fine and course) for allochthonous food, sediment (which covers gravels and cobbles favored by clean water taxa important for fish food), and nutrients (both from sediment and ash from burning). It is likely that treatments of the units within trout supporting habitat will lead to localized to multi-reach scale delivery of sediment in the short to moderate-term. This would decrease habitat quality for clean water taxa macroinvertebrates in the short to moderate term.

Riparian vegetation is an important factor of aquatic biological productivity both by its input of terrestrial organic matter and by shading, which limits production by aquatic plants (Belt et al. 1992, 4:1). Belt et al. (1992, 2:4 and 5:6) found a fair number of studies that document effects on aquatic food webs between harvest with or without buffer strips, but limited information on predicting effects from differing types of buffer strips. These studies indicate that a 98-foot buffer strip is adequate to maintain macroinvertebrate diversity at pre-harvest levels, where a 33-foot buffer strip is inadequate (Belt et al. 1992, 2:4 and 5:6). Streams without buffer zones showed increased sediment and decreased benthic invertebrate fauna (both diversity and density). Diversity increased over a 6-year period following treatment, but had not fully recovered. While these studies were focused on effects of timber harvest, they indicate that riparian buffer strips will help limit impacts to aquatic macroinvertebrates from upland mechanical vegetation and prescribed fire treatments.

3.4.8.5 Specific Effect Predictions

There are many applicable methods to analyze and disclose the potential effects of the proposed actions under the various alternatives – mechanical vegetation treatments and prescribed fire - to aquatic resources. When looking at multiple aquatic species at a landscape level across a small mountain range, no one method is likely to capture all of the important considerations. Indeed, different methods may give different conclusions due to change in emphasis or perspective. For the purpose of this report, 9 different measures of potential effects were considered across 15 mapped HUCs (for some measures only 13 of the 15 are used), and 3 combined 6th field HUCs (that include 2 or more of the 15). In order to simplify this symphony of information, a synthesis of the results was developed. This synthesis ranks the relative effects of the various alternatives, and a summary ranking of the alternatives for each HUC is included. The nine specific areas looked at are: tiering to the hydrological/soils report which included a table of relative impacts based on professional opinion of the Forest hydrologist; comparison to fire effects from empirical data of other southern Utah fires; debris flow potential; mass wasting potential; a

watershed analysis tool called equivalent area modeling; a spatial review of the alternative actions in each HUC summarized by the professional opinion of the Forest fisheries biologist; consistency with Partners in Amphibian and Reptile Conservation (PARC) habitat management guidelines; percent area of mapped boreal toad habitat proposed for treatment; and percent increase in motorized route density in mapped boreal toad habitat.

Hydrologic and Sedimentation Modeling

Solt (2014) prepared the hydrology and soils report for the Monroe Mountain Aspen Ecosystems Restoration Project. Solt (2014) provides background information on the proposed action, design features, and background information on Monroe Mountain, much of which was incorporated into this report. He also provides information on aquatic resources (streams and lakes), riparian areas, groundwater, and water quality. As noted in Solt (2014), two Monroe Mountain water bodies are on the 2010 approved 303d list – Manning Meadow Reservoir (dissolved oxygen and total phosphorous for Cold Water Aquatic Use) and lower Box Creek Reservoir (pH for Cold Water Aquatic Use).

Solt (2014) has a good summary of soils and erosion processes (stream and upland) that this report tiers to for its effect analysis.

Solt (2014) conducted Water Erosion Prediction Project (WEPP) modeling for representative treatments in the Box Creek and Manning Creek drainages (see Table 103). This modeling found a relatively low probability of erosion for skid trails and mechanical treatments, a low to moderate probability of erosion from low intensity fire, and a 100 percent probability of erosion for high intensity fire. These results translated to a low probability of sediment delivery for mechanical treatments, low intensity fire, and a low to moderate probability of sediment delivery for high intensity fire.

Monitoring of past timber sales on Monroe Mountain identified implementation issues that likely resulted in actual sediment delivery much higher than the predictions for this project. Deiter (2002) documents monitoring of three Monroe Mountain timber sales in 2001. In the White Pine Creek area, Deiter (2002) documented a unit boundary only 75 feet from a perennial stream (this boundary was corrected by the forester before harvest after being made aware of the issue) and considerable surface erosion from overland flows. In the Annabella area, Deiter (2002) documented a very high level of surface disturbance from soil compaction, displacement, and rutting from skidding with no designated trail network, which was further increased by dozer slash piling. A skid trail was found on a slope greater than 40 percent. In the Mill Creek area Deiter (2002) documented heavy cutting under an intermediate harvest prescription that had subsequent blowdown, substantial overland erosion, no special protection in the harvest along intermittent and ephemeral channels - with harvest up to the channel, skidding of logs down an ephemeral channel, and removal of wood needed to stabilize elevations in intermittent channels [note that there is no protection built into the LRMP for intermittent channels]. There were numerous road issues in these three areas as well. Deiter (2002) recommended no harvest or skidding within the inner-gorge of perennial channels, some protection for all channels of the defined channel network including intermittent or ephemeral channels, limiting skidding to a designated network unless on a slash mat, 18 inches of snow, or frozen ground, grapple piling,

assessment of [salmon blade] scarification needs and better following of road best management practices. [Note that the Equivalent Roaded Area (ERA) model has a high coefficient for timber harvest that likely represents conditions generally found on typical timber sales. Solt's (2014) values likely represent a minimum level of erosion and sedimentation that could be obtained under ideal circumstances. Proper administration of all project actions (mechanical timber management and burning) is essential for obtaining predicted results.]

It is important to note that due to the many assumptions and uncertainties inherent in models absolute numbers should be treated with caution. Predicted model results may be plus or minus 50 percent of true values and erosion rates are highly variable. Erosion after fires can range from 0.4 to 2.6 tons per acre per year from prescribed fires up to 9 to 49 tons per acre per year after wildfires. Erosion rates and sedimentation normally decline for several years until returning to normal background rates.

In all cases, these effects would be considered higher than the background level of the no action alternative, but they would be smaller in magnitude then the effects from a large high intensity wildfire.

Solt (2014) notes several drainages of concern given the proposed action. Summarizing from Solt (2014) but in the HUC order discussed in this document they are:

- **Dry Creek** is a concern due to area proposed for treatment. Canyon bottom could be subject to flooding.

- **Manning Creek** should be treated over multiple entries, as channel conditions for the "uber-important" BVCT fishery, and preventing larger floods should be a factor of consideration for area treatment size for each entry. Treatment will help reduce long-term fire risk, so implementation is a "balancing act between water quality and watershed restoration".

- **Dry Canyon** is debris flow prone (values at risk below Forest) and should likely be treated over multiple entries.

- **Monroe Creek** – extensive areas proposed for treatment. High values at risk downstream. Maintaining channel access to floodplains and hydrologic function is very important.

- **Thompson Creek** – large areas proposed for treatment. Highly debris flow prone. "Great care should be taken to limit flooding and debris-flow events. Large storms are frequent. "…flooding and debris could go anywhere below or on the [alluvial] fan".

- **Water Creek** – potential to affect downstream diversions and irrigation water and add sediment to Big Lake.

- **Mill Creek** – high downstream values below the Forest that could be at risk.

- **Koosharem Creek** – diversions and high downstream values. Cumulative effects concern – "When this project is added to the Monument Peak Project then about 70 percent of the drainage will be treated and with values downstream…great care should be taken to prevent large floods downstream".

- **Greenwich Creek** – somewhat less concern but still greater than15 percent treatment and a diversion potentially at risk.

- **Box Creek** – Cumulative affects concern with areas proposed for treatment added to past treatments. "Cumulative effects wise this should be treated with care and potential over multiple entries."

Solt (2014) notes that the project design features will aid in the trapping of sediment and nutrients (see buffer discussion above) and are a factor in the relatively low probability of sediment reaching the stream from mechanical treatments and low intensity fire in his WEPP modeling.

Solt (2014) notes some concerns from overlap of currently approved but not yet implemented work in the Box Creek, Monument Peak, and Cove Mountain/North Clover projects. Since acreage figures for these projects by HUC were not provided in GIS data for the fisheries analysis, it is likely that the ERA modeling conducted below understates impacts to Big Lake, Koosharem Creek, and Box Creek. It is difficult to predict effects for two potential projects in the same area with different and unknown timelines. The potential for increased impacts in these drainages should be kept in mind.

One difficulty in assessing impacts of this project are that actual effects will depend on project administration and implementation, scale – how much is treated at one time, fire severities and relative ground disturbance during mechanical treatments, post-treatment weather, post-treatment land use. Overlaid on this is the potential over the project implementation timeline of 10 years the risk of wildfire, which could range from no impacts to impacts considerably outside the realm produced by the proposed actions. These items are probably factors that lead both the aquatics portion of this report and Solt (2014) to have somewhat varying interpretations. Solt (2014) notes in several areas that there will likely be negative effects to stream channels and floodplains from increased floods generated from fire activities. These effects would decrease as time passes, and may be less from prescribed fire activities than wildfires (Solt 2014 – see comment in empirical fire section below, however).

With regard to design features, Solt (2014) writes, "Riparian buffers, Mitigation Measures, BMPs will not likely protect all riparian functions during vegetation treatments. However, they will be aid in the protection of riparian areas and maintaining water quality." Solt (2014) describes that local impacts "might be dramatic" but at the "landscape level are not expected to lead to drastic loss of riparian vegetation or function". This is consistent with the fisheries biologist view that design features and BMPs minimize impacts but do not fully offset them. Interpreted the Forest's fisheries biologist, Solt (2014) implies that fairly large reach scale impacts are likely, while at the overall drainage level and across the mountain range, watershed function will only slightly or moderately be affected. This should maintain large scale resources

like fish populations in long streams, but could be important to key localized aquatic assets like important boreal toad breeding sites and hibernacula, trout broodstocks, and high value recreational lake fisheries.

Unfortunately, there are not any current fish modeling techniques to predict where aquatic biota thresholds are in relation to the predicted increases of sediment probability delivery modeled. In addition, the model does not account for potential of mass wasting events or delivery by small ephemeral drainage channels. Professional opinion of the Forest's fisheries biologist is that very short-lived (1 to 3 years) and localized reach scale effects would be likely at the level of low intensity fire modeling. With the high intensity fire modeling, burning of the proposed units would likely result in mid-term reach scale effects. In contrast, in a severe wildfire that had large areas of moderate to high burn severities, effects could be long-term (greater than 5 years) and affect multiple reaches or even overall population persistence. Similar effects could occur if burning triggered a debris flow (see below).

Solt (2014) developed a table ranking of alternative effects (Table 7 from Solt 2014). Based on his professional experience and WEPP modeling, Solt (2014) generally favored mechanical treatment over fire in his ranking. For this report, Table 7 from Solt 2014 has been reformatted to be consistent with other tables in this document and is shown as Table 107 below.

Table 107. Hydrological disturbance rating developed from Solt 2014. Note: Alternatives ranked 1 through 5 with 1 being least impacts, 5 greatest. Solt 2014 did not include the no action alternative in the table; it was added to Table 9 and Tables K-1 and K-2 in Whelen 2014 for the synthesis for consistence with other tables in the report.

HUC	No Act	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	1	3	4	5	2
Manning Creek – Upper	1	3	4	5	2
MC – Barney Lake	1	5	4	2	3
MC – Manning Reservoir	1	2	2	2	2
MC – HUC 6 combined					
Dry Canyon – Hunts Lake	1	2	2	2	2
Monroe Creek	1	3	4	5	2
Monroe Creek-Magleby	1	4	2	3	2
Monroe Creek-combined					
Thompson Creek	1	3	3	2	3
TC-Annabella Reservoir	1	4	3	2	3
Water Creek	1	5	4	3	2
WC – Big Lake	1	4	4	2	3
Koosharem Creek	1	3	5	4	2
Greenwich Creek	1	2	3	4	2
Box Creek ab. Reservoir.**	1	2	2	2	2
Box Creek below Reservoir.	1	3	4	2	5
Box Creek - combined					

Empirical Data from Past Southern Utah Fires

In the late 1990s, the Forest's fisheries biologist researched fire effects on isolated streams for an environmental analysis for managed wildfire on the Snake Range in eastern Nevada. Fire effects to Apache and Gila trout and non-native trout species in Arizona and New Mexico were reviewed. Where the fire (size and soil severities) descriptions were limited in the journal articles, the authors were contacted for further information. Ultimately, the districts and units where the fires occurred were contacted to discuss the percent of watershed burned and their burn severities. Effects from these fires were much more severe than those found in central Idaho with large connected stream networks and mobile fish populations. From this a general rule of thumb was developed for the environmental analysis project area based on these southwestern United States fires that burning over 15 percent of the watershed (uplands only, well dispersed) at moderate to high severities would likely result in population scale impacts to a trout population and burning over 50 percent of the watershed with moderate and high severities would likely result in extirpation of the trout population. These fires were in harsher fisheries conditions then typically found on the Forest, but are more likely applicable to south central Utah then the central Idaho fire research. Changes in long-term weather patterns also seem to be making Fishlake N.F. situations more like those experienced in the southwestern United States in the past.

Empirical data from wildfires and prescribed fires from southern Utah has provided an opportunity to check the above figures and provides another method to judge potential effects from this proposed project. The majority of fires on the Forest are located far enough from streams and are small enough that no deleterious effects are even noted to aquatic biota. For example, a wildfire burned the north side the canyon above lower Chalk Creek in the Pahvant Range in 2005, yet monitoring in 2006 showed the biomass at the lower station had increased (probably due to better stream water flow conditions in 2005). Some fires have had greater effects, however. The effects to trout of well documented/studied fires on the Fishlake and Dixie National Forests (excluding the Pine Valley mountains) from 2000 to 2010 are described below, in general order of increasing impacts.

Prescribed burning was conducted in Pine Creek above Sulphurdale in 2004. Approximately 12 percent of the watershed was burned in a spread out mosaic fashion. Most of the burning was away from the creek at low to moderate severities, although about 0.33 mile of creek was affected by moderate severity riparian burning. Overall, the fish biomass increased relative to the 2001 data when the seven fish population stations were re-monitored in 2005. Only the lower station directly below the burned riparian area decreased, and vegetation was resprouting vigorously in the burned stream bottom. Improved water flows in 2005 and resting the stream from livestock grazing apparently offset any negative effects from the burning, which were minimal (unpublished Fishlake National Forest files).

In contrast, a prescribed fire on Shingle Creek in 2002 burned about 0.5 mile of stream bottom in a high intensity burn resulting in high fire soil severities in the riparian area. Fish were absent from the burned area for several weeks following the fire, and monitoring found about 80 percent fewer fish in the burned area for 2 years following the fire (unpublished data in FNF SO files). Fish numbers returned to near normal levels 5 years following the burn, but a heavy infestation

of cheatgrass invaded upper streambanks and stream terraces, likely increasing future fire risk to the stream and sediment erosion from upper banks into the stream.

The 2002 Sanford fire caused fish kills in three tributary streams of the East Fork of the Sevier River and in one tributary stream of the upper Sevier River. The fish kill actually extended downstream into the East Fork of the Sevier River, resulting in the elimination of trout in 37 miles of streams by UDWR estimates. Sanford Creek, the tributary on the west side draining into the upper Sevier River, was least affected. It had only 3 percent of the watershed receiving high severity burn, with 27 percent of the watershed moderate severity, and 6 percent low severity. The fish in this drainage survived the initial fire and over the first winter, but were eliminated by flooding off the burned areas during the second summer. Sanford Creek was a naturally marginal stream due to low stream flows, but had beaver ponds, which provided good fish habitat in some stream reaches.

Deer Creek, one of the three tributaries on the East Fork of the Sevier River, had the next highest burn percentages. It had high severity fire on 10 percent of the sub-watershed, 27 percent moderate severity, and 3 percent low severity. The trout population was extirpated from Deer Creek, but it has been making good habitat recovery since the fire. Deer Creek was reinvaded by non-native trout from the East Fork of the Sevier River. Following construction of fish barriers, it was treated for reintroduction of native BVCT.

Cottonwood Creek, also on the East Fork of the Sevier River, had 6 percent high severity, 39 percent moderate severity, and 5 percent low severity burn within its sub-watershed. Trout were also extirpated in this watershed.

Deep Creek was the most severely burned of the three tributary creeks on the East Fork of the Sevier River. It had over 60 percent of the sub-watershed burned. The high severity burn covered 23 percent of the watershed, 33 percent was moderate severity, and 5 percent low severity. Sampling within a week of the fire found no fish surviving within the portion of the stream that was burned over. Estimates were that only about 350 pure native BVCT survived the fire, all on Bureau of Land Management administered lands below the fire. This was a unique genetic stock that had not been replicated in any other streams. Fortunately, one stream had been treated to remove non-native trout with the intent of moving fish from Deep Creek to it in the fall. About 225 BVCT were rescued and transplanted to this stream within a few weeks of the fire. The remaining few fish were extirpated when a storm and flood occurred just a few weeks later. Effects to Deep Creek habitat have been severe, with many areas of aggradation resulting in limited channel and subsurface flow, but also severe downcutting in places to bedrock and flash flood events with debris flows. The Deep Creek watershed has been slow to stabilize, and flooding in 2005 wiped out a small number of trout, which were reintroduced into the watershed in July 2005. By 2009, the stream has recovered enough to support and carry over trout and BVCT have been reintroduced into the watershed (Hadley et al. 2010).

In 2010 the Twitchell Canyon fire was allowed to burn for 119 days following a natural ignition by lightning in the Indian Creek watershed. Over this time, about 54,000 acres were burned in a nearly even mix of 0.33 percent low severity, 0.33 percent moderate severity, and 0.33 percent

high severity. Four HUC6 watersheds were burned over 30 percent of moderate to high severity, with even higher percentages in some tributaries.

Indian Creek had 38 percent burned at moderate to high severity but a large part of the upper watershed was moderate severity night underburns (human ignitions) in stands with an aspen component that actively sprouted, lessening fire effects. Late season lower watersheds were more severely burned. Thus fish survival was fairly good in the upper watershed with some habitat effects, while fish in the lower watershed were extirpated from events from tributary drainages, even as late as 2013 (Fishlake National Forest file data).

North Fork of North Creek had 38 percent burned in moderate to high severity, with the Pole Creek tributary burned 54 percent moderate (mostly) to high severity. Fish had survived in this drainage until treatment with rotenone in 2014, but fish were generally extirpated below the Pole Creek confluence by severe flooding out of this drainage. Initial flooding in lower north fork of North Creek was estimated at 300 cfs by the local Watermaster and 500 cfs by Forest personnel (Photo 7). Debris flows from small tributary face drainages in the upper watershed have had a pronounced effect on the pure remnant BVCT in the headwaters. Some were salvaged in 2013 and moved to South Fork of North Creek and low numbers persisted in 2014. (Fishlake National Forest file data).

Shingle Creek was burned at 42 percent moderate to high severity. Fire effects have been especially severe in this drainage. Flooding one year after the fire was sufficient to destroy a concrete block fish barrier and left most of the middle drainage completely turned over without a single living riparian plant for extensive distances (Photo 8 and Photo 9). These severe effects have continued 4 years post-fire, with extensive habitat turnover. Much of the middle drainage looks almost the same in late summer 2014 as it did immediately following the August 2011 flood. Extensive habitat work to incorporate wood back into the riparian zone was just completed in much of Shingle Creek in August 2014 using large trackhoes. Just weeks after completion of this work, the 2014 floods rearranged much of the wood placed into a series of small debris jams.

Fish Creek was burned at 47 percent moderate to high severity, with the tributaries Picnic, Line, and Trail Creek burned at even higher percentages. Upper Picnic Creek was not affected by the Twitchell Canyon fire, however, and East Fork of Fish Creek had a lower burn percentage and high areas of low to moderate fire severities. Fish survived in both of these areas. Downstream-burned areas have had extensive habitat damage from gravel bedload transport filling habitat features, but some fish have been found in sampling due to small numbers of fish moving in from unburned reaches (Hadley 2012).

These fires have been summarized in Table 108, below. The fires which led to trout populations being lost occurred in dry or hot summer and fall months (June through September excluding the wet monsoon season), and had at least 30 percent of the watershed burned OR were associated with debris flow prone sub-watersheds (see below). The streams in the table below have been arranged by increasing percentage of the watershed burned in moderate to high severity to show the generally increasing progression of effects to aquatics as fire percentage increases.

Photo 7. Fishlake hydrological personnel show magnitude of August 2011 flood in lower North Fork of North Creek from mark on far bank, over the height of the hand raised at stream edge to the toe of the person in the foreground. Flood was estimated at 500 cfs and killed all the fish in these stream reaches.

Photo 8. Middle Shingle Creek after the August 2011 flood. All traces of riparian vegetation were removed by the flood. Only nine trout survived this flood above constructed fish barriers on mainstem Clear Creek just below the Shingle confluence. The surviving trout were in the mainstem channel above the confluence. Design feature incorporated into this project to limit 6th field HUC treatments to 15 percent of the area at one time will prevent floods of this magnitude, but there still could be some impacts from high percentage treatments at the 7th field HUC level.

Photo 9. The August 2011 flood out of Shingle Creek was large enough to destroy this concrete block fish barrier located just below the confluence with upper Clear Creek. One concrete block (2x2x4 foot) was found over 500 feet downstream.

Table 108. Fire Effects to Fisheries – S. Utah 2000-2014 (excludes Pine Valley Mountains). This table shows the percentage burned at the HUC-6 level, although the pour point used for the table might be slightly modified from the HUC boundary to the point of diversion or lower extent of the fish population. Percentage burn is for the modified boundary.

Stream	Total Watershed % M-H Severity Burned	Fish Population Effects	Channel Effects	Fire/Year
Pine Creek (Sul)	2%	None known	None known	Twitchell/2010
Shingle Creek	2% (8% stream length)	Reach scale decline	Minimal	Pres. Burn/2002
SF North Creek	8%	Minimal – some below Pine Cr trib.	Minimal – some below Pine Cr trib.	Twitchell/2010
Oak Creek	12%	Extirpated[1]	1 to 2 foot downcutting[1]	Devils Den/2006
Pine Creek (Sul)	12%	Minimal	None	Pres. burn/2004
Mill Creek	19%	Reach scale	Minimal	Twitchell/2010
Sanford Creek	30% (Majority at moderate)	Extirpated - year 2	Minor	Sanford/2002
Deer Creek	37%	Extirpated	Moderate	Sanford/2002
Indian Creek	38% (upper watershed mostly moderate)	Upper - declines, extirpated lower	Upper minimal but inc. bedload, lower major	Twitchell/2010
NF North Creek	38%	Nearly extirpated lower, large declines middle, nearly extirpated upper remnant.	Major – particularly below Pole Creek and upper headwaters due	Twitchell/2010

		Population continuing to decline 4 years post-fire	to bedload increase issues	
Shingle Creek	41%	Extirpated[2]	Severe – with new major channel changing events even 4 years post-fire	Twitchell/2010
Cottonwood Creek	45%	Extirpated	Major	Sanford/2002
Fish Creek avg. (inc. Tributaries)	47%	Extirpated except in less burned East Fork headwaters	Major esp. bedload issues	Twitchell/2010
Trail Canyon (Fish Cr. Trib.)	53%	Marginal fishery, Extirpated	Major	Twitchell/2010
Pole Creek (N. Fork North Cr. Trib.)	54%[3]	Marginal fishery, Extirpated	Major – bedload issues	Twitchell/2010
Deep Creek	56%	Extirpated	Extensive	Sanford/2002
Picnic Creek (Fish Cr. Trib.)	59%	Extirpated lower, good survival in unburned headwaters	Major	Twitchell/2010
Line Canyon (Fish Cr. Trib.)	83%	Extirpated	Major – extensive downcutting	Twitchell/2010

[1]A debris flow prone subwatershed with about 90 percent moderate to high severity burn was located at the head of the Oak Creek fishery. A 25-year storm event in October following the fire generated a 100-year plus flood event with extensive sediment from the burned subwatershed, accounting for the serious effects despite a relatively low overall watershed percentage burned.
[2]Limited survival (9 trout) occurred in upper Clear Creek above its confluence with Shingle Creek below the fire.
[3]Majority of this figure (86 percent) is moderate severity.

The proposed action was analyzed by comparing the percentage of land proposed for treatment in each sub-watershed for each alternative to the past fire data shown in Table 108. The areas proposed for treatment are shown in Table 109 below. In addition to the HUC6 level, as looked at in Table 108, the percentages proposed for treatment were also looked at for several smaller HUC7 level subwatersheds. HUC scale is shown by the second column in Table 109. Note that actual on-the-ground impacts *may* be less than indicated by calculated percentage analysis shown in Table 109. This is because not all of the area may be treated at one time. Some treatment may be deferred at the HUC6 level as part of the design feature. If a unit contains both mechanical harvest and burning, they may occur in differing years. Treatment units within the subwatershed may be broken up for implementation and treated in different years. It is likely that most of the upland treatments will occur in a relatively compressed timeframe, however.

Table 109. Proposed treatment percentages by subwatershed summarized from Table 106.

			Fire % / Mechanical % / Total %			
HUC Name	HUC scale	NoAct	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	Mod6	0 / 0 / 0	19 / 4 / 23	0 / 10 / 10	20 / 13 / 33	14 / 13 / 27
Manning Cr – Upper	Mod6-	0 / 0 / 0	15 / 2 / 17	15 / 5 / 20	14 / 9 / 23	12 / 8 /20
MC – Barney Lake	7	0 / 0 / 0	43 / 0 / 43	26 / 29 / 54	15 / 46 / 61	15 / 47 / 62
MC – Manning Res	7	0 / 0 / 0	19 / 3 / 21	14 / 16 / 30	2 / 36 / 38	9 / 24 / 33
MC – HUC 6 combined	Mod6	0 / 0 / 0	16/2/18	15/6/22	14/11/25	12/10/21
Dry Can – Hunts Lk	8	0 / 0 / 0	29 / 0 / 29	29 / 0 / 29	29 / 0 / 29	29 / 0 / 29
Monroe Creek	Mod6-	0 / 0 / 0	23 / 4 / 27	22 / 10 / 32	18 / 19 / 37	18 / 13 / 31
MonroeCr-Magleby	7	0 / 0 / 0	15 / 5 / 20	6 / 20 / 26	2 / 27 / 29	6 / 20 / 26
MonroeCr-combined	Mod6	0 / 0 / 0	23/4/27	21/10/32	17/19/36	17/14/31
Thompson Creek	6	0 / 0 / 0	Not used due to HUC configuration			
TC-Annabella Res	7	0 / 0 / 0	40 / 5 / 45	29 / 23 / 52	11 / 54 / 65	29 / 24 / 52
Water Creek	6	0 / 0 / 0	Not used due to HUC configuration			
WC – Big Lake	7	0 / 0 / 0	13 / 15 / 28	10 / 22 / 32	8 / 25 / 33	2 / 34 / 36
Koosharem Creek	Mod6	0 / 0 / 0	9 / 1 / 11	9 / 2 / 11	8 / 6 / 15	9 / 1 / 10
Greenwich Creek	Mod6	0 / 0 / 0	1 / 14 / 15	1 / 15 / 16	1 / 16 / 17	1 / 14 / 15
Box Cr ab. Res.**	7	0 / 0 / 0	6 / 8 / 15	6 / 9 / 15	6 / 9 / 15	6 / 9 / 14
Box Cr below Res.	Mod6-	0 / 0 / 0	2 / 16 / 19	0 / 19 / 19	3 / 20 / 23	1 / 18 / 19
Box Cr - combined	Mod6	0 / 0 / 0	4/13/17	4/15/19	4/15/19	3/14/17

***Small rounding errors evident in Table 106 and Table 109.**
****Large areas already burned and treated. See ERA modeling and cumulative effects section for cumulative watershed impacts.**

In previous use of these figures (treatment greater than 15 percent reach scale short-impacts, treatment between 15 to 30 percent population scale/moderate-term impacts, treatment greater than 30 percent potential population extirpation and long-term impacts) only burning was proposed. This is the first use to look at both burning and mechanical treatments. For this report, they were considered equivalent with the understanding that the predicted effects would be on the high end, since some of the mechanical treatments are relatively low effect [since type of mechanical treatments were not mapped at the HUC scale, a more detailed analysis could not be one].

Empirical fire data effects have not been well looked at in southern Utah for 7th field HUCs, although they have been documented to be the source of damaging debris flows in steeper basins, which are well documented in two Cannon et al. papers (2010 and 2003) and Cannon and DeGraff (2009) [see next section]. Treatment at this level is complicated by a couple of factors. The smaller size makes it more efficient and economical to treat a larger percentage of the subwatershed in one entry. Due to topography and continuous fuels, it is often difficult to limit fire treatments to only a certain percentage of the subwatershed. It is not well established what an appropriate treatment level for 7th field HUCs are, generally speaking, for southern Utah. Discussion with professional hydrologists indicate that it is a scaling problem, however, and that if a treatment of a certain percentage is problematic at the 6th field level (i.e. 30 percent), than it is also likely to generally be an issue at that same percentage in the smaller 7th field subwatersheds.

The IRE stream surveys conducted provided streambank stability ratings, which can be adjusted for channel type. This streambank stability level provides an idea of the resilience of the stream to moderately increased sized watershed events. Petty's (2004) Pfankuch data shows that Manning Creek and its tributaries are generally in good condition, which will help lessen effects of project work to this drainage. The Manning Creek drainage has a moderate level of treatments proposed (17 to 23 percent or 18 to 25 percent when combined with Barney Lake and Manning Reservoir), which is in between levels observed where reach scale impacts occur and populations are typically lost. The 6th field design feature would limit treatments at one time to 15 percent of the HUC. This would indicate that moderate-term population scale impacts could occur at the HUC6 scale. Manning Reservoir's subwatershed is proposed for treatments ranging from 21 to 38 percent, which due to topography and location at the head of the drainage are not likely to generate events or debris flows, but which are indicative of likely increases in sedimentation to the broodstock reservoir. Barney Lake's subwatershed is proposed for treatments ranging from 43 to 62 percent. Again, topography and location at the head of the drainage are not likely to generate events or debris flows, but these very high treatment percentages are indicative of likely major increases in sedimentation to the reservoir.

Monroe Creek drainage has a high levels of treatments proposed (27 to 37 percent or 27 to 36 percent when combined). There is no IRE data to indicate stream stability to buffer impacts. The 6th field design feature would limit treatments at one time to 15 percent of the HUC. This would indicate that moderate-term population scale impacts could occur at the HUC6 scale. [Many of the steeper subwatersheds, which are planned for fire treatment, are debris flow prone and could have major effects below their confluences - see next section].

Annabelle Reservoir 7th field subwatershed is proposed for treatments ranging from 45 to 65 percent. Again, topography and location at the head of the drainage are not likely to generate events or debris flows, but these very high treatment percentages are indicative of likely major increases in sedimentation to the reservoir.

Big Lake's 7th field subwatershed is proposed for treatments ranging from 28 to 36 percent. Again, topography and location at the head of the drainage are not likely to generate events or debris flows, but these high treatment percentages are indicative of likely increases in

sedimentation to the reservoir. These predictions are potentially low due to interaction with approved but not yet carried out treatments in this subwatershed.

On Koosharem Creek, proposed treatments are generally in the range where reach scale effects have been seen (less than 15 percent treatment area). Petty's (2006b) Pfankuch data showed Koosharem Creek to be mostly in good condition, furthering limiting impacts. While Koosharem Creek impacts would likely be mostly localized and short-term, these predictions are potentially low due to interaction with approved but not yet carried out treatments in this subwatershed.

On Greenwich Creek, proposed treatments are generally just over the level where reach scale effects have been seen (less than 15 percent treatment area). Petty (2006b) however, found that a large percentage of Greenwich Creek is in poor condition, which will exacerbate impacts to this watershed. The stream is well dispersed across the landscape in several tributary drainages. Thus, impacts in this watershed will most likely be at the reach scale but moderate-term in duration.

On Box Creek proposed treatments are generally just over the range where reach scale effects have been seen (17 to 19 percent combined HUC). Petty's (2006a) Pfankuch data showed Box Creek at its upper tributaries to be a mix of good (54 percent), fair (24 percent) and poor (22 percent) condition, which reduces its ability to buffer impacts. Predictions based on the above percentages are potentially low due to interaction with approved but not yet carried out treatments in this subwatershed. Therefore, overall, Box Creek impacts will likely be moderate-term extensive reach scale or smaller population scale affects at the HUC6 scale.

Debris Flow Risk

In areas of steep stream gradient and hill slopes, debris torrents from debris flow prone sub-watersheds represent an additional concern for fisheries. After reviewing Cannon et al. (2003) Dale Deiter, the previous Forest hydrologist, observed that characteristics of many Forest sub-watersheds make them highly prone to debris flow events given disturbances. Burning over 40 percent of these small, steep face side drainages at a moderate or higher intensity can place the treated area at high risk for a debris flow event. These risks were confirmed after the Devils Den wildfire in 2006, which burned the majority (mostly moderate to high severities) of two debris flow prone tributaries to Oak Creek: Devils Den and Limekiln Canyon. Storm events two months following the fire caused severe flooding and borderline debris flows out of these canyons, effectively extirpating the recreational fishery despite the fact that only a small percent of the total watershed was burned (see Table 108 for summary information). Thus, even small ephemeral tributaries can be of concern if they connect near the head of a trout population.

Two important considerations of debris flows are that they can cause considerable damage downstream of the fire boundary and that relatively small or common storms can trigger them (Cannon and DeGraff 2009). Western weather patterns since the mid-1980s have trended toward reduced snowfall, warmer spring seasons, earlier snowpack melt, and longer drier summers, which have altered fire regimes to more frequent, longer lasting large fires that pose greater debris flow risks (Cannon and DeGraff 2009).

The hydrological report (Solt 2014) looked at ten partial HUC6 level watersheds using the Cannon et al. (2003) model and found that eight of the ten are debris flow prone. If greater than 50 percent of these drainages were burned at moderate severity, they would all be prone to debris flows under the right precipitation events. Discussed in the same order as other sections of the report, these drainages were Dry Creek, Manning Creek, Dry Canyon (limited aquatic resources), Monroe Creek, Thompson Basin (most aquatic resources in very upper end), Koosharem Creek, and Greenwich Creek. The two basins not debris flow prone – South and North Fork of Box Creek- were actually close to thresholds and could produce debris flows under the right conditions.

Potential for debris flows actually decreases as the watershed size looked at increases. These are generally issues with small steep subwatersheds at the HUC7 or HUC8 level. Floods from these small subwatersheds can have major effects downstream throughout HUC6 drainages; however, if they occur near the headwaters (see above discussion on Oak Creek, and Hadley et al. 2011b). Given this, the Forest fisheries biologist ran the Cannon 2003 model on several HUC7 and HUC8 tributary subwatersheds to Monroe Creek. All were debris flow prone.

This does not necessarily mean that treatment will result in a debris flow. It is highly dependent on the area treated, the fire severity affecting the soils, and precipitation received by the subwatershed after the fire. At the 7th and 8th field level this can be challenging for implementers, as the same factors that make the drainage debris flow prone make it difficult to control fire (i.e., these are frequently natural "chimneys" and their steepness and rugged nature often precludes work that could break up fuels to allow treatment of only part of the drainage at a time). Given the knowledge and concern, it is likely that implementers will be careful, and make choices that result in treatments that have lower probabilities of creating debris flows. What can be said, however, is that there are no design features currently in place to require these factors be considered at the 7th or 8th field level.

Since no detailed GIS analysis was conducted using later Cannon developed models by HUC, there are no ranking tables for this measure. *This section serves as information to the deciding official and readers that debris flow prone subwatersheds are common in the project area, and with sufficient treatment levels, debris flows would be likely.* The new models (Cannon et al. 2010 and Cannon and DeGraff 2009) factor in soil characteristics along with basin geography. With these new models, specific subwatersheds could be modeled; with an assumed rainfall intensity modeling could look at changes in area treated to potentially identify thresholds where debris flows would become much more likely. It is highly recommended that this modeling be conducted before treatments in any subwatersheds containing, or upstream of, high value aquatic resources and human property.

A recommended implementation action was added at the end of the report to run newer Cannon debris flow prediction models (Cannon et al. 2010, Models A, B, or C depending on what soil information is available or Cannon and DeGraff. 2009, page 186 - equations 9.6 and 9.7) for each debris flow prone HUC7 or HUC8 (identified as being debris flow prone using the Cannon et al. (2003) model) prior to actual implementation to determine if potential threshold points can

be identified. These could help determine the appropriate sized treatment area to achieve desired results while greatly lessening the probability of severe downstream consequences.

Soil Suitability/Mass Wasting Risk

Mass wasting and other soil erosion processes, such as areas prone to slope failure or other high volume movements and hydrophobic conditions after fire are important to aquatic resources, as they have potential to introduce large volumes of sediment into stream channels where they can have major indirect effects to aquatic biota. Mike Smith, former Fishlake National Forest soil scientist, prepared maps showing soil suitability for various treatments by typical calendar dates (Fishlake National forest file data). These maps help identify areas that may respond poorly to prescribed burning, for example. In the experience of the Forest fisheries biologist, the volcanic derived soils of Monroe are not likely as serious a concern for mass wasting and severe erosion as the shale derived soils in the Salina Creek drainage. The hydrological report notes, "Mass wasting is not a dominant process in the project area. However, rock fall, shallow landslides, deep-seated landslides, and debris flows may be potential hazards…in the hill and mountain portions of the project area…Special methods and erosion control best management practices may be needed to prevent or limit soil loss in the hill and mountain areas" (Solt 2014, page 25). This section serves as information to the deciding official and readers that soil wasting processes are not considered highly likely events that would affect aquatic biota, but could occur. Erosion events and processes, particularly rill, sheet, and gully erosion could occur off of steep slopes, some of which, based on the Smith soil maps, would be unsuitable for burning under some conditions. It is recommended that these soil maps be consulted when planning individual burn treatments, but overall general soils concerns are considered secondary to debris flow risk.

Equivalent Roaded Area Analysis

Analysis of a landscape scale restoration project such as this is complex, as it covers multiple watersheds, and occurs alongside many past and ongoing land management actions, so cumulative effects are a major concern. In an attempt to incorporate these past impacts and actions – wildfires, prescribed fires, managed wildfires, timber sales, Dixie harrow treatments – and ongoing activities - particularly grazing and motorized transport – Equivalent Roaded Area modeling was used. The cumulative effect area of delineated subwatersheds was used as the base area. Geographic Information System figures were developed for the year of occurrence and acres of affected habitat within each subwatershed. Geographic Information Systems were also used to develop figures for road miles (including proposed temporary road for each action alternative), and riparian grazing (developed by overlaying the stream layer, and HUC boundaries).

The figures for acres of the various types of proposed mechanical treatment by HUC have not been calculated, so for this and other analysis methods an assumption had to be made to treat all mechanical treatments as harvest for modeling purposes. This likely overstates the effects of the proposed vegetation treatments. In the smaller 7th and 8th field HUCs where harvest levels are of most concern to aquatic resources (Barney, Manning, Annabella Reservoir, and Big Lake) the majority of mechanical treatments are likely timber harvest (thinning to BA 90), so modeling results in these HUCs is likely correct.

In all, 90 Excel spreadsheet sheets were used to model 13 delineated subwatersheds at the modified 6th field HUC (somewhat reduced in area to a pour point at major diversion, fish population end, or mouth of canyon), or smaller 7th or 8th field HUC containing important lakes and reservoirs. Two 6th field HUCs that were not modified and included large areas of low elevation land off Forest were not modeled. In three modified 6th field HUCS where smaller subwatersheds had been split out, the subwatersheds were also combined to show figures for the entire modified HUC6. Appendix H of Whelan 2014 has additional information on the methods used and assumptions made for this modeling exercise. Eighty spreadsheet sheets are summarized into Table 110 below that ranks the no action and action alternatives for each of the modeled HUC.

Table 110. ERA percentage by sub-watersheds by alternative. TOC = Threshold of Concern

HUC Name	HUCtype	TOC	No Action	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	Mod6	12	3.1	9.8	12.1	13.2	11.4
Manning Cr – Upper	Mod6-	10	4.6	9.6	10.6	11.7	10.6
MC – Barney Lake	7	<10	.2	12.1	17.3	21.1	21.3
MC – Manning Res	7	<10	2.9	10.4	13.4	16.3	14.5
MC – HUC 6 combined	Mod6	10	4.3	9.5	10.7	12.1	10.9
Dry Can – Hunts Lk	8	12	3.3	11.3	11.3	11.3	11.3
Monroe Creek	Mod6-	12	1.3	9.1	10.8	12.9	11.0
MonroeCr-Magleby	7	10	.2	6.1	8.8	10.1	8.8
MonroeCr-combined	Mod6	11	1.3	8.9	11.1	12.7	10.8
Thompson Creek	6	14	Not modeled due to HUC configuration/lower elevations				
TC-Annabella Res	7	10	1.4	7.2	12.4	21.3	12.6
Water Creek	6	10	Not modeled due to HUC configuration/lower elevations				
WC – Big Lake	7	10	2.6	11.6	13.0	13.6	15.0
Koosharem Creek	Mod6	10	4.1	7.1	7.3	9.0	7.0
Greenwich Creek	Mod6	10	5.9	11.2	11.5	11.6	11.2
Box Cr above Res.	7	10	9.1	13.8	13.9	13.9	13.7
Box Cr below Res.	Mod6-	14	6.0	12.4	15.2	13.8	12.6
Box Cr - combined	Mod6	12	7.3	12.9	13.6	13.9	13.0

Since Table 110 found that many of the modeled subwatershed exceeded the suggested Threshold-of-Concern (as developed by the Forest's fisheries biologist), 10 spreadsheet sheets were developed and summarized into Table 111. This table shows how application of the design feature of only treating 15 percent of a HUC6 would affect the modeled ERA at the HUC6 level.

This change was only applied to the alternative with the maximum ERA as determined in Table 110, which were alternative 4 in all cases.

Table 111. Change in ERA level due to application of treatment of only 15 percent of a HUC6

Mod HUC6	Area - Acres	15 % Level - Acres	Max ERA Impact Alternative	Original Modeled ERA – Max Alt.	15% treatment DF ERA	2nd Entry 15% (or remaining) Retreat ERA
Up Dry Creek	9510	1427	Alt 4	13.2	7.6	11.0
Manning (combined)	16327	2449	Alt 4	12.1	9.0	11.0
Monroe (combined)	25199	3780	Alt 4	12.7	6.0	9.5
Koosharem*	3715	557	Alt 4	9.0	8.7*	7.8
Box Cr (combined)	19684	2953	Alt 4	13.9	12.4	11.4

***Proposed treatment is close to the 15 percent level already. Decline by second treatment is due to recovery over the 5 years assumed between treatments.**

As described in greater detail in Appendix H in Whelan 2014, actual levels of impacts that occur during implementation are likely to be somewhat lower (due to implementation being spread over time, achieving design objectives of low to moderate fire severities, and including low fire severities as part of the 60 percent treatment area*) if the project is implemented as designed*. In some cases, impacts could be moderately lower than modeled. While the modeled results are likely the upper end of what could occur, since all factors were consistent between alternatives, the relative ranking of the alternatives can be used to help differentiate between them for decision-making purposes.

Solt (2014) notes some concerns from overlap of currently approved but not yet implemented work in the Box Creek, Monument Peak, and Cove Mountain/North Clover projects. *Since acreage figures for these projects by HUC were not provided in GIS data for the fisheries analysis, it is likely that the ERA modeling conducted understates impacts to the Big Lake, Koosharem Creek, and Box Creek.* It is also difficult to predict effects for two potential projects in the same area with different and unknown timelines. The potential for increased impacts in these drainages should be kept in mind. *A recommended implementation action was added at the end of the report to re-run ERA modeling for each HUC prior to actual implementation to get the most accurate value to compare to the suggested Threshold of Concern (TOC) for that HUC. This would capture new watershed disturbance while accounting for additional recovery time from past projects and the more accurate results could then be used to guide the appropriate treatment size for that entry.*

In general, the ERA modeling shows that under the current conditions (No Action alternative), the western and northern modeled HUCs have relatively low ERAs, Koosharem and Greenwich HUCs have moderate ERAs, and Box Creek already has a relatively high ERA. Alternative 2 generally raises the ERA to near the suggested TOC in watersheds that had relatively low

existing ERA. The remaining action alternatives – Alternatives 3 through 5 – generally raise the ERA to at or above TOC levels.

Applying the 15 percent design feature at the HUC6 level reduces the initial treatment ERA to below TOC in the three west Monroe HUCs. The ERA level rises considerably for the second treatment in Dry Creek but remains below the suggested TOC (found in Table 110) due to the higher TOC for this subwatershed. In second treatment, ERA also remains below TOC for the Monroe subwatershed. In the Manning Creek subwatershed, however, ERA rises above TOC. In the Koosharem subwatershed, applying the 15 percent design feature only slightly reduces ERA, as the proposed treatment level was already near 15 percent. By the time the small amount of remaining acres were treated in the second entry, modeled ERA declines further due to recovery from past treatments. In Box Creek, the design feature reduces total ERA slightly to just above TOC for the initial treatment and just below TOC for the second entry, due to the large area of existing and proposed disturbance.

At the ERA, levels calculated at the modified 6th field level one would expect moderate level impacts to aquatic biota that would occur over the short-moderate time frame.

At the smaller 7th and 8th field, ERA modeling shows much higher figures due to cumulative disturbance in some subwatersheds. Calculated ERA levels ranged from a low of 7.8 up to a high of 21.3, which could be considered very high (and well above TOC) based the Haraden (2013) calculated ERA for Shingle Creek and observed effects to fisheries there. For Barney Lake the ERA was very high for alternatives 3, 4, and 5; for Manning Reservoir the ERA was moderately high for alternative 3 and high for alternatives 4 and 5, for TC-Annabelle Reservoir the ERA was very high for alternative 4, for WC-Big Lake the ERA was moderately high for Alternatives 3 and 4 and high for Alternative 5, and for Box Creek above Reservoirs moderately high for alternatives 2 through 5.

This does not mean that these very high levels of cumulative watershed disturbance calculated in the ERA modeling ***will*** occur. In the Manning Meadow Reservoir and Barney Lake areas, the proposed fencing (Figure 21) would allow for spread-out implementation over several years due to the protection for regenerating aspen shoots. At the very high ERA levels calculated for some of the 7th and 8th field subwatersheds, however, *moderate to high impact levels to aquatic biota would be likely if implementation was carried out in a short time frame, and these impacts would likely be of moderate to long-term duration*. If implementation were spread out across multiple entries over a reasonable period in these basins, impacts would be considerably less.

Visual/Spatial Review of Action Alternative Maps by HUC

Quantitative tools for habitat effects analysis for boreal toads, BVCT, and other aquatic species are limited. When looked at across the landscape scale the juxtaposition of proposed actions (Figure 68 through Figure 71) and aquatic resources (Figure 64 through Figure 65) can be visually overwhelming. To get a better understanding of the spatial overlap of the project proposed actions with aquatic resources at the subwatershed scale, a series of maps showing each action alternative were prepared. Each printout showed from one to three subwatersheds. These maps are included in their entirety in Appendix C of Whelan 2014. The professional experience

and opinion of the Forest's fisheries biologist was then used to interpret the potential effects at the scale of each watershed and discuss any relative differences between them. This information is summarized into Table 112 below. Finally, for the alternative synthesis section the information in Table 112 was simplified into a ranking system and incorporated into Table K-1, Appendix K of Whelan 2014.

Table 112. Summary of visual spatial review of proposed actions in relation to aquatic resources (see appendix C from Whelan 2014 for maps used in this review)

HUC Name	HUC type	No Action	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	Mod6	No treatments	Extensive burning in watershed but mostly below BT habitat. Minor timber harvest and burning within BT habitat.	Extensive burning in watershed but mostly below BT habitat. Addition of much more timber harvest in upper watershed in. BT habitat.	Similar to alternative 2 with even more harvest in upper watershed. Considerable portion of BT habitat treated.	Similar to alternative 2 but with some middle elevation areas switched from prescribed burning to mechanical harvest.
Manning Cr – Upper	Mod6-	No treatments	Considerable portion of HUC treated. Prescribed fire proposed along most of fish bearing stream.	Similar to alternative 2 w/ additional mechanical harvest between Collins Creek and Barney Cr.	Similar to alternative 3 w/almost all of upper HUC now w mech. treatment. Considerable risk for BT and BVCT resources.	Similar to alternative 2 but with some upper elevation areas switched from prescribed burning to mechanical harvest.
MC – Barney Lake	7	No treatments	Very high % of HUC above reservoir w/ prescribed burning. High risk to reservoir, BT, high value fishery.	Similar to alternative 2 but w about 1/2 of treatment switched to harvest. High risk to reservoir, BT, high value fishery.	Similar to alternative 3 but w/ addition of road around entire basin above reservoir. Very high risk to reservoir, BT, high value fishery.	Similar to alternative 4 but w/ slight additional change of burning to harvest. Very high risk to reservoir, BT, high value fishery.
MC – Manning Res	7	No treatments	High % of HUC above reservoir w/ prescribed burning. Mod-high risk to critical BVCT broodstock, reservoir, high value fishery.	Similar to alternative 2 w additional harvest along private, some burning S of lake switched to harvest. Mod-high risk to critical BVCT broodstock, reservoir, high value fishery.	Majority of basin above reservoir harvested. High risk to critical BVCT broodstock, reservoir, high value fishery.	Majority of basin above reservoir treated w/ areas close to reservoir harvested, further away burned. High risk to critical BVCT broodstock, reservoir, high value fishery.
MC – HUC 6 combined	Mod6					
Dry Can – Hunts Lake	8	No treatments	Moderate percentage of basin above lake proposed for burning. Mod risk to BT and other aquatic	Same as alternative 2.	Same as alternative 2.	Same as alternative 2.

			res.			
Monroe Creek	Mod6-	No treatments	High percentage of watershed proposed for burning. High debris flow prone risk for non-native fishery and property downstream. Minor treatments in headwater BT habitat.	Similar to alternative 2 but with majority of headwater BT habitat treated, mostly mechanical harvest.	Similar area of treatment of alternative 3 but with higher percentage of mechanical harvest in upper watershed.	Similar area of treatment of alternative 3 but with highest percentage of mechanical harvest in upper watershed.
Monroe Creek-Magleby	7	No treatments	Most Forest admin. land in HUC treated w/ fire including BT habitat.	Similar area of treatment as alternative 2, but about half of fire switched to mechanical veg treatment.	Similar area treated as others but almost all mechanical vegetation treatment.	Similar to alternative 3.
Monroe Creek-combined	Mod6					
Thompson Creek	6	No treatments	Considerable area of headwaters treated w/ prescribed fire, including majority of BT habitat.	Similar to alternative 2.	Similar area treated as other alternatives, but w eastern edge of HUC mechanical vegetation treatment.	Similar to alternative 2.
TC-Annabella Res	7	No treatments	Nearly half the basin above reservoir and nearly half BT habitat proposed for treatment by fire. Mod-high risk to BT, fishery reservoir.	Slightly more area treated as alternative 2 but about half replaced w/ mechanical veg treatments. Mod-high risk to BT, fishery reservoir.	Similar area treated as alternative but with majority being mechanical veg treatments. Mod-high risk to BT, fishery reservoir.	Similar to alternative 3
Water Creek	6	No treatments	Moderate amount of fire and mechanical vegetation treatment w/ temporary roads.	Moderate to high amount of fire and mechanical vegetation treatment w/ temporary roads.	High amount of fire and mechanical vegetation treatment w/ temporary roads.	Moderate amount of fire and mechanical vegetation treatment *with no* temporary roads.
WC – Big Lake	7	No treatments	Moderate amount of treatments in HUC, about ½ fire and ½ mechanical veg. Mostly avoids BT habitat. One problematic temp road.	Similar to alternative 2 with slightly high percentage of timber harvest.	Similar to alternative 3.	Similar treatment zone as alternatives 2-4, but almost all mechanical veg treatment but with no temporary roads.
Koosharem Creek	Mod6	No treatments	Moderate amount of treatment, mostly fire. Mostly avoids BT habitat and streamside zones.	Similar to alternative 2.	Slightly increased treatment area compared to alt. 2 and 3, more mechanical, slightly more	Similar to alternative 2.

					BT and stream zone work.	
Greenwich Creek	Mod6	No treatments	Moderate amount of HUC treated, mostly mechanical vegetation. Moderate amount of BT habitat and upper streamside zone treated.	Similar to alternative 2.	Similar to alternative 2.	Similar to alternative 2.
Box Creek above Res.	7	No treatments	Small to mod amount of HUC treated due to extensive past fire/treatments. Majority fire with some mechanical vegetation treat. Small to moderate amount of BT habitat and upper streamside zone treated.	Similar to alternative 2.	Similar to alternative 2.	Similar to alternative 2.
Box Creek below Res.	Mod6-	No treatments	Moderate amount of mechanical vegetation treatment in headwaters, mostly away from streams.	Similar to alternative 2 with slightly more mechanical treatment.	Similar to alternative 3 with slightly more mechanical treatment.	Similar to alternative 2 with one area of fire replaced with mechanical and no temporary roads.
Box Creek-combined	Mod6					

Boreal Toad PARC Habitat Management Guideline Consistency

During project development, boreal toad experts within the Forest Service, UDWR, other agencies, non-government organizations, and academia were consulted to develop design features. Input was limited, but several responses did indicate that the PARC habitat management guidelines were the best available science. As covered in Appendix F of Whelan 2014, the publication for the southwest, which includes Utah, is in press, so the Northwest document was used (Pilliod and Wind 2008). All PARC habitat management guidelines applicable to public wildlands were summarized into Table 113, which also included the pertinent habitat measures from the Utah Boreal Toad Conservation Plan (Hogrefe et al. 2005).

The habitat measures outlined in these plans are quite general. In addition, as noted above, aspen regeneration efficacy, impacts to goshawks, and impact to roadless (IRAs) were the primary drivers in Alternative development. Thus, when compared to the habitat management guidelines table, most alternatives are either fully consistent or inconsistent (i.e. there was not a lot of gradation or ranges of varying degrees of consistency). There were limited differences between the alternatives, and these differences were primarily driven by roads and levels of treatment of boreal toad habitat and proximity of treatments to boreal toad habitat. Note that the PARC

habitat management guidelines do indicate that allowing natural processes to function, or treatments to mimic these processes, are desirable from a long-term standpoint.

Given these considerations, for the synthesis section (Appendix K, Tables K-1 and K-2 from Whelan 2014) Table 113 was summarized using the following convention. Fully consistent (which no alternatives met) – 1, Mostly consistent – 2, Moderately consistent -3, Areas of consistency concern – 4, Areas of high consistency concern -5. The no action alternative was rated 2 as the lack of treatments could be considered a concern. Most action alternatives were rated 3, due to some issues with closeness of treatments and season of work. A few specific HUCs with greater levels of concern were rated as 4 or 5; these were primarily based on roads and to a lesser extent large percentages of area proposed for treatment.

Table 113. Partners for Amphibian and Reptile Conservation (PARC) and Utah Conservation Partnership (UCP) habitat management guideline consistency with Monroe Mountain Aspen Restoration project alternatives

		Alternatives				
PARC No.	PARC Habitat Management Guidelines	No Action	Alt 2	Alt 3	Alt 4	Alt 5
	Habitat/Linkages					
P1	Ensure availability and protection of all essential and critical habitat types	No impact	Design features include measures for this HMG			
P2 UCP3.2.1	Maintain un-fragmented habitat. Minimize activities in corridors - PARC - 50-330 feet buffer on each side of streams	No impact	Mapped boreal toad habitat is 100m on streams and 300m on breeding sites, but some project activities are allowed within this.			
P3	Manage for a variety of stand ages and types at stand and landscape level	No change from current conditions	Part of purpose and need of project.			
P4	Identify and appropriately manage key and sensitive habitat features - Breeding sites and hibernacula are key sites	No impact	Breeding sites generally mapped but hibernacula have generally not been identified. Boreal toads could use localized small new/unknown breeding sites (they have been known to use flooded tire ruts in primitive roads), thus not all individual features located.			
P5	Reduce or prevent disturbance in headwaters. Create headwater reserves - Since headwaters are relatively low gradient plateau top they generally have human disturbance. Creating reserves is beyond the scope of this project.	No change from current conditions	Project will generally increase disturbance in headwater areas (also see ERA modeling section).			
P6	Retain cool moist microhabitats for forest associated amphibians	No change from current conditions	Design features include measures for this HMG			
P8	Maintain/restore native vegetation structure- Grazing is likely affecting riparian and aspen structure in some stream reaches. Restoring structure requires multi-age stands.	No change from current conditions	Project will primarily address a one-time regeneration, but the project aspen browse thresholds and adaptive management will help long-term with aspen regeneration (regeneration before stand loss also preserves long-term options for future management actions).			
P9	Consider a mix of protective measures, such as differing buffer widths, limited and no-entry	No change from current conditions	Design features include measures for this HMG			
P10	Maintain natural wetland habitats and nearby uplands through the use of buffers	No change from current conditions	Design features include measures for this HMG			
P11	Retain a representative proportion of aspen stands within the landscape	No change from current conditions	Part of the purpose and need of the project			
	Streams					
P13	Focus management actions on achieving desired stream conditions (i.e. water temperatures,	No impact	Design features are generally configured to meet habitat needs			

	no/minimal sedimentation, long-term input woody debris					
P14	Identify and specially manage stream reaches in natural and minimally disturbed watersheds	No impact	Project generally increases management and disturbance in Monroe Mt. watersheds			
P15	Retain large wood in riparian and streams/rivers	No impact	Design features include measures for this HMG			
P16	Maintain rocky substrates in streams	No impact	FNF Plan has S&G for % fines to maintain substrate size			
P18	Manage activities and ground disturbance in and near riparian areas	No impact	Actions other than fire and mechanical veg treatments are beyond the scope of this project. Project activities are managed through design features.			
	Water/Hydrology/Springs					
P24	Maintain/restore natural hydrology of wetlands	No change from current conditions	Vegetation treatments under this project may help maintain natural hydrology if negative impacts are managed.			
P26	Buffer permanent and seasonal wetlands. Min 30-50 feet for seasonal wetlands	No impact	Design features include measures for this HMG for permanent wetlands			
P27	Map all wetland habitat for project planning	No impact	Small perennial seeps need better mapping to ensure they are protected. Currently this is identified for the implementation phase.			
P28	Maintain seasonal wetlands by retaining native vegetation around them – PARC 540-900 feet (100-275m)	No impact	Vegetation treatments under this project may help maintain natural hydrology if negative impacts are managed.			
	Mechanical harvest/veg management					
P30	In timber management areas, buffer wetlands. Leave some surrounding upland areas undisturbed	No impact	Design features include measures for this HMG			
UCP3.8.1	Protect habitats in forest stands adjacent to and within 2.5 miles (4km) of breeding sites	No change from current conditions	Not consistent	Not consistent	Not consistent	Not consistent
P31 UCP3.8.2	When feasible harvest timber during amphibian inactive seasons	No change from current conditions	Not consistent	Not consistent	Not consistent	Not consistent
P32	Schedule log-hauling adjacent to amphibian habitat in dry months or fall/winter	No change from current conditions	Not consistent	Not consistent	Not consistent	Not consistent
P33	During timber harvest, leave woody debris on site to decompose	No change from current conditions	Design features include measures for this HMG - 15 tons/acre			
P34	Retain large trees and snags for future downed wood recruitment	No change from current conditions	Design features include measures for this HMG			
P35	Minimize logging on steep slopes [Note: GIS averages slope, can allow harvest on local slopes > 40%. Most N. Forests limit harvest to slopes <35%]	No change from current conditions	Harvest limited to 40% slopes or less.			
P36	Avoid dragging logging materials across streams and seeps	No change from current conditions	Some areas of skidding across streams may occur but would not likely be common. Since project level implementation has not yet been developed in this programmatic document, this HMG is hard to fully analyze.			
P37	Replant disturbed areas with native species to reduce erosion, esp. skidding and landing zones	No change from current conditions	LRMP guidance on			
P39	In timber management areas, plan for connectivity between stands	No change from current conditions	Connectivity will be maintained by treatment mosaic and stand regeneration			
	Fire/Prescribed Fire and Vegetation treatments					

P40	Restore historic disturbance regimes – fire	No change from current conditions	Part of the purpose and need of the proposed project			
P41	Use prescribed fire to restore natural fire regimes - Fire should mirror historic fire intervals and seasons. Avoid key amphibian times	No change from current conditions	Part of the purpose and need of the proposed project but seasons of burning and fire severities (due to fuel buildups) may be outside of historic conditions			
P42 UCP3.1.2	Conduct prescribed burns in late fall after first frost (through early spring)	No impact	Project design features describes this as desirable but not mandatory			
P43	In fuel/veg treatments retain some untreated areas as refugia	No impact	Fuels – 60% treatment target will leave some areas untreated as refugia. For mechanical hand treatment in boreal toad buffers 80% limit will also leave some areas as refugia.			
UCP3.1.1	Protect habitats in forest stands [from fire] adjacent to and within 2.5 miles (4km) of breeding sites	No impact	Not consistent	Not consistent	Not consistent	Not consistent
UCP3.1.3	Determine impacts of fire through monitoring of known breeding sites	No change from current conditions	Project monitoring of boreal toads is required for all design alternatives			
	Transportation Networks					
P47	Avoid roads in riparian areas. Avoid orienting roads parallel to riparian areas - UCP-Close motorized routes within 50 meters of breeding sites where feasible (3.5.2.c)	No change from current conditions. Existing roads do occur within or along riparian areas. Beyond the scope of this project				
P49	Close unneeded roads, avoid construction of new roads	No impact	Some impacts Water Creek and Big Lake subwatersheds	Some impacts Water Creek and Big Lake subwatersheds	Not consistent in Barney Reservoir subwatershed. Some impacts Water Creek and Big Lake subwatersheds	Not consistent in Barney Reservoir subwatershed
P50	Install arch culverts and tunnels in roadways. Replace old/failed culverts with passage friendly structures - UCP – Install culverts and bridges to allow for natural riparian zones and stream flows (3.7.1.a)	No impact	Required as design feature on any new roads in BT habitat			
UCP3.7.1	Minimize dispersal barriers posed by roads - UCP – Avoid developing new roads that bisect toad habitat (3.7.1.b)	No impact	Some impacts Water Creek and Big Lake subwatersheds	Some impacts Water Creek and Big Lake subwatersheds	Not consistent in Barney Reservoir subwatershed. Some impacts Water Creek and Big Lake subwatersheds	Not consistent in Barney Reservoir subwatershed
UCP3.7.2	Minimize habitat impacts due to roads - UCP – Buffer 150m between new dirt road and breeding sites (3.7.2.b)	No impact	Not consistent in Big Lake subwatershed	Not consistent in Big Lake subwatershed	Not consistent in Barney Reservoir subwatershed. Not consistent in Big Lake subwatershed	Not consistent in Barney Reservoir subwatershed
	Livestock Management					
	Recreation Management					
	Fisheries Management					
	Chemical Use					
	General/Miscellaneous					
P61	Avoid practices that result in sedimentation and slumping.	No impact	Mass wasting considered low risk with hillslope processes dominating. These are	Mass wasting considered low risk with hillslope processes dominating. These are	Mass wasting considered low risk with hillslope processes dominating. These are	Mass wasting considered low risk with hillslope processes dominating. These are

			relatively low risk in boreal toad habitat areas.	relatively low risk in boreal toad habitat areas.	relatively low risk in boreal toad habitat areas.	relatively low risk in boreal toad habitat areas.
P62	Avoid construction and habitat altering during months when amphibians are concentrated and vulnerable.	No impact	No timing restrictions but habitat areas are avoided (see p63)			
P63	Minimize soil disturbance when using heavy equipment near amphibian and reptile habitat	No impact	All action alternatives have a design feature with no mechanized equipment near streams and breeding sites			
P64	Reduce/remove impermeable surfaces near wetlands	No change from current conditions	Design features include measures for this HMG for timber harvest.			

Boreal Toad Habitat Impacts (Treatments/Roads within BT habitat)

To help provide context for discussions of specific impacts to boreal toad habitat and risks to boreal toad individuals, additional information on life history, response to disturbance, and research needs is presented in this section.

Much of the information on habitat use and life history of boreal toads was developed through radio-tagging and tracking studies (Browne and Paszkowski 2010; Guscio et al. 2008; Goates el al. 2007; Goates 2006; and Bull 2006). Finding boreal toads can be very difficult away from breeding sites where they congregate. Their small size and propensity to hide in refugia, under banks, or in thick grass can make them difficult to locate. Personal experience of the Forest's fisheries biologist during the 2003 to 2004 Monroe study (described in Goates 2006) was that often when one re-located a radio-tagged boreal toad, one would find another untagged toad nearby. Without the radio, both would have been missed. Studies of wildlife that involve handling of animals do introduce an element of risk to the animal being studied. The risk to the animal needs to be balanced against the need for information *and* the risk to the animal from other causes. In other words, not understanding life history and habitat use in relation to ongoing activities and land uses, new proposed land uses, and existing and potential threats also carries a risk to the population. Vandewege et al. (2013) describes the need for information and resulting radio-tracking study of the endangered Houston toad to obtain information necessary for conservation of that species.

Bull (2006) had high mortality and loss rates associated with her radio tracking study of 100 toads in five study areas in Oregon. Survival was 32 percent, predation 30 percent, 16 percent of the toads and radios were at some point not relocated, 13 percent had radios found without the toad (possible "slipping the radio" or predation), and 6 percent were believed to be lost from chytrid infections. While these losses seem high, Bull (2006) identified several important potential sources of predation - including ravens at one of the breeding reservoirs, red-tailed hawks, and common garter snakes, identified hibernacula sites, and answered key habitat use questions. Guscio et al. (2008) radio-tagged 22 boreal toads at three study sites. In their study, 64 percent survived and contributed data, 23 percent either disappeared or dropped the radio after tagging, and 13.6 percent died after tagging. While no data is given on survival or radio loss rates, in three summers Browne and Paszkowski (2010) radio-tracked 116 toads at three study sites. In working with an endangered toad in Texas, Vandewege et al. (2013) radio-tagged 21 toads using 3 different attachment techniques. Three toads lost radios during study

relocations but there were no reported mortalities. They also utilized breeding site surveys and drift fences in their study and PIT tags and toe clips to mark individuals.

Bull (2006) found boreal toads in her study to be primarily terrestrial (81 percent) with the majority of terrestrial locations (81 percent) associated with refugia (in decreasing order of use) such as rocks, burrows, logs, depressions, and stumps/root wads. In terms of habitat use, Bull (2006) found toads to use habitat in direct proportion of its occurrence in her study area in Oregon, which included wildfire burned habitat and timber harvests. Toads preferred more open habitat and south facing slopes, generally with more rocks, water, and forbs than occurred in random comparison plots (Bull 2006).

Bull (2006) found large movements between breeding sites and summer habitat, with the largest movement of a boreal toad 6.2 kilometers, and average movements of 2.5 kilometers for females and 1 kilometer for males. Browne and Paszkowski (2010) found boreal toads moved 0.15 to 1.9 kilometers between breeding sites and hibernacula. Interestingly, Bull (2006) found toads moved shorter distances in burned forests than unburned forests (she hypothesized that it could be due to better habitat conditions or travel conditions that are more difficult). The fastest daily movement she found was 241 meters per day. Bull (2006) also found some toads moved across rough terrain, including down areas with steep cliffs and up steep-sloped rocky hillsides, while others used streams. In contrast, most toads in the 2003-2004 radio tracking study work on Monroe Mountain appeared to generally use streams for movement, except for some cross-country movement between Manning and Barney Creeks.

Bull (2006) found that 95 percent of the diet of toads in her study were ants (primarily) and beetles, which is generally similar to other studies.

Bull (2006) found hibernacula at five sites in Oregon to be in rodent burrows, under large rocks, logs, root wads, and banks of streams and rivers, with only 27 percent associated (less than 1 meter) with water. Browne and Paszkowski (2010) radio-tracked boreal toads to hibernacula in three study sites in Canada, finding toads using peat hummocks, red squirrel middens, cavities under spruce trees, root tunnels, natural crevices, and abandoned beaver lodges. In two of the three areas, the majority of toads hibernated in [black] spruce-dominated tree stands. In the 2003 to 2004 radio tracking study on Monroe Mountain determining hibernacula location was not a primary goal (we attempted to remove radios before toads moved into hibernacula so that toads would not carry the radios into inaccessible areas before the batteries died) but enough areas of use were found in late season to find that small perennial and unmapped seeps (i.e. not on the Forest GIS data layers) that upwelled from root chambers under spruce/fir appeared to be important for hibernacula (Photo 11 and Photo 12). Other areas identified as hibernacula in the Monroe study were burrows and root chambers under riparian and even transitional zone shrubs (Photo 10) and old beaver dams. Several toads would often be found together in these situations, which is similar to the finding by Browne and Paszkowski (2010) that 68 percent of the hibernacula in their study were communal. This would increase the effect to the local population if hibernacula were impacted by management activities.

Guscio et al. (2008) found that in the northern forests of Glacier National Park (lodgepole pine, western larch, western red cedar, and western hemlock) boreal toads preferentially used severely burned habitat over partially burned habitat (unburned habitat was not a major component in their study area). They noted that boreal toad's ability to move/disperse and their preference for open habitats facilitated their use of recently disturbed habitats but that presence of refugia in open habitats for protection against predation and maintaining water balance was crucial for their use of the habitat. Hossack and Corn (2007) documented short-term positive breeding responses of boreal toads to stand replacing fires in Glacier National Park. After the 2001 Moose Fire, nine burned wetlands were used for breeding the two years following the fire where reproduction had not been documented before. They also found increased reproduction after another fire in 2003 with 20 wetlands used for reproduction the year after the fire where only three breeding sites had previously been documented. Reproduction after the Moose Lake fire returned to pre-fire levels in year three. Bull (2006) found that wildfires did not appear detrimental to toads in her study as burned stands (that were not salvage logged) were used in proportion to their occurrence on the landscape (6 to 10 years post-fire).

Bull (2006) did voice concern, however, that fuel reduction treatments that reduce course woody debris, clear-cutting, and other harvest activities may limit toad movements and habitat use (by removing predation/thermal/moisture refugia), affect food availability (ants), and affect squirrels (that create burrows used by toads) noting additional research was needed. Guscio et al. (2008) also noted that more information was needed on the effects of direct habitat treatments, including timber harvest and fuel reductions.

In relation to buffers, Browne and Paszkowski (2010) found that at one of their three study sites, all hibernacula were within a 100m buffer from perennial water. At the other two study sites, the buffers ranged from 30 meters on small perennial streams, 60 meters on large (greater than 5 meters) streams, and 100 meters on lakes. Despite these relatively large buffer sizes, 84 percent of the hibernacula were outside of buffers at the second study site, and 90 percent were outside on the third.

Rittenhouse and Semlitsch (2007) used a univariate kernel density estimate to determine the probability of an amphibian being present at a given distance from a breeding site for salamanders, frogs, and toads. Their work was based on 13 studies, 2 of which were included boreal toads. The 99 percent isopleth (i.e. contour line of similar use levels) was less than 1 km from breeding wetlands in all cases, with 95 percent of amphibians within 664 meters and 50 percent within 93 meters of the wetland edge (Rittenhouse and Semlitsch 2007, page 155; Figure 64). Frogs and salamanders had similar distributions but frogs generally ranged about twice as far from breeding sites as salamanders. Boreal toads did not follow the same pattern, however, with less of a peak near breeding sites that implied they travel to specific resources not adjacent to the breeding site and not evenly distributed on the landscape (likely key feeding areas, refugia, and hibernacula). Their analysis of the Bartelt boreal toad data showed a distribution peak at about 300 meters from the breeding site, with the 50 percent isopleth at 375 meters and 95 percent isopleth at 980 meters (Rittenhouse and Semlitsch 2007, page 155 - Table 1 and page 156 – Figure 2E). Rittenhouse and Semlitsch (2007) note, however, that the area immediately adjacent to the breeding site may be essential for both breeding and recently metamorphosed juveniles. In summary, they note that amphibians may regularly use areas beyond buffers

established for water quality protection (typically 100 feet), and that habitat loss at moderate distances from wetlands could affect a large proportion of the adult population of amphibians.

In contrast, Goates et al. (2007) found that many small streams and seeps that were not mapped on the Fishlake National Forest. Geographic Information Systems layer and buffered constituted the majority of relocations that were not within existing 30.5 meter (100 feet) streamside buffers. At Manning Meadow Reservoir, one of the key breeding areas studied, a 274.3 meter (900 feet) breeding site buffer [on just the area of the reservoir where breeding typically occurred] did less to protect areas of boreal toad use than a 30.5 meter buffer on *all* flowing streams, seeps, and water sources (see Figure 64). Thus Goates et al. (2007) found that ground truthing to locate, digitize, and buffer all of these small water sources was a critical factor to ensure protection of boreal toads. Goates et al. (2007) also documented use of adjacent upland habitat up to, and in lower numbers beyond, 100 meters from streams (see Figure 74).

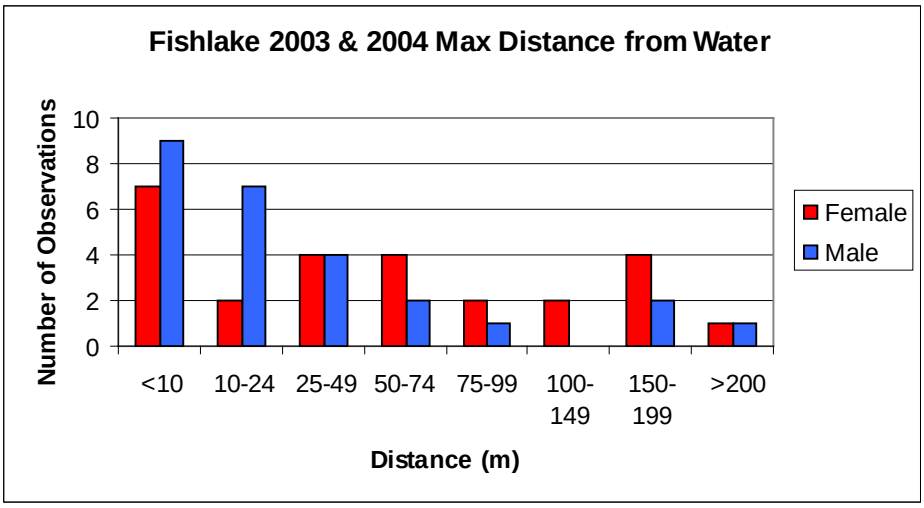


Figure 74. Radio marked toad distance to flowing or standing water during summer 2003 and 2004 on the Forest (from Goates 2004).

The Forest's fisheries biologist developed the study proposal and worked with seasonal employees in implementing the 2003 to 2004 Monroe Mountain boreal toad habitat use study in response to the earlier Monroe Mountain aspen restoration EIS that was further analyzed and described by Goates et al. (2007) and Goates (2006). Monroe Mountain has considerable open habitat available, so open habitat is not likely a limiting factor as it appears to be for boreal toads in the Northern Rocky Mountain areas, and that toads on Monroe used a variety of habitat types, mostly along or near water. At times during the summer, Monroe Mountain can be quite dry and warm given its lower mountainous elevation and southern Utah location. It is the professional opinion of this writer given his experience in working on this study and the above factors that 1) most within-drainage boreal toad movement during summer likely occurs along the streams within the drainage; and 2) boreal toad response to habitat projects would *likely* be similar to Bull's (2006) findings that burned habitats are used by toads in about the same ratio as its availability in the mid to long-term.

All of these factors were considered when developing the project specific design features for this project. The Rittenhouse and Semlitsch (2007, Figure 2E) information was key in extending the

buffer around breeding sites from 200 meters (UDWR recommendation) to 300 meters – to at least extend it to the distribution peak for density (i.e. toad density declines from this distance outwards). While the 50 percent isopleth was beyond this 300 meter distance, work by Goates et al. (2007) supports the premise that protection will be provided by buffering travel corridors and non-breeding site streams and wetland areas. Goates et al. (2007) documentation of boreal toad use up to 100 meters from streams supports the streamside buffer distance recommended by UDWR and used for general mapped stream drainages for this project. Finally, ensuring all unmapped streams and seeps have at least a 100-foot (30.5 meter) buffer incorporates the lessons learned from Goates et al. (2007) for buffering these unmapped waterways.

While design features have been incorporated into the Monroe Mountain Aspen Ecosystems Restoration Project to reduce the impact of treating boreal toad habitat, one can infer from the above information that both vegetation treatments and the lack of treatments in boreal toad habitat can have positive or negative effects to habitat suitability and individual toads depending on scale, timing, and location. Logically, it was felt that no treatment of boreal toad habitat could be negative, in having a progression towards domination of late seral habitat, too much conifer/woody cover, and increased fire risk (of particular concern bring the secondary detrimental effects of a large high severity fire to riparian, stream, and lake habitats). While treatment of some habitat could entail short-term risks to individual toads, it would reduce fire risk and ensure a variety of habitats and stand ages. Treatment of extensive areas could result in larger impacts to individuals and toad burrows/habitats due to much more physical disturbance within boreal toad habitat, however. These large areas of disturbance could result in loss of large wood and other features across large areas that are associated with hiding/thermal/moisture refugia, and hibernacula (often associated with spruce trees). They could also have effects to squirrels and other small mammals that affect toad habitat quality, and toad food supplies.

Therefore, Table 114 was summarized for synthesis under the following convention or rule set. Treatment of 1 to 20 percent of the mapped boreal toad habitat in the HUC – 1 (smallest overall impact – a reasonable level over a 10-year timeframe and likely beneficial), treatment of no mapped boreal toad habitat – 2 (no short-term impacts, but no creation of earlier seral habitat stages leading to less habitat variety in the long-term), treatment of 21 to 40 percent of the mapped habitat – 3, treatment of 41 to 60 percent of the mapped habitat – 4, and treatment of 61 percent or more of the habitat in the next 10 years – 5 (at this level much higher impacts to individuals would be expected, and habitat may shift to excessively open with too dry of microsites for boreal toad use on Monroe Mountain). It was felt that areas outside of the mapped boreal toad RHCAs were accounted for in the percent watershed treated and ERA modeling sections.

Based on that convention, the No Action alternative rated as 2 for all HUCs. Action alternatives generally ranged from 1 to 3, with some HUCs - primarily smaller mapped 7th fields - having levels of 4 or 5.

Treatment disturbance was particularly high for the Barney Lake HUC in alternatives 4 and 5, and the Thompson Creek HUC in alternative 4. Treatment disturbance was very high for Barney Lake in alternatives 2 and 3, the Thompson Creek HUC in alternatives 2, 3, and 5 and Anabella Reservoir HUC in alternative 4. These high levels noted in this paragraph are likely to have

much higher short-term impacts to boreal toads, with also a greater risk of creating unforeseen habitat impacts in the moderate term.

Photo 10. Unusual hibernacula used in North Fork of Box Creek in a burrow system under a shrub above the riparian zone. Note aspen in background. The shrub was located in a gentle swale bottom and may have had some groundwater influence.

Table 114. Percentage of boreal toad habitat proposed for treatment by subwatershed (created by using GIS to overlay project areas (summarized in Error! Reference source not found.**) and mapped boreal toad habitat).**

HUC Name	Subwatershed Size - Acres	BT Habitat Acres	Acres and Percent proposed for treatment Acres mechanical/Acres fire (60% factored in) Total acres/% of BT habitat			
			Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	9,510	901	49/46 95 – 10.5%	174/53 227 – 25.2%	265/53 318 – 35.3%	77/27 104 – 11.5%
Manning Cr – Upper	14,855	1,044	68/209 277 – 26.5%	124/235 359 – 34.4%	212/205 417 – 39.9%	207/125 332 – 31.8%
MC – Barney Lake	283	174	0/72 72 – 41.4%	61/35 96 – 55.2%	95/15 110- 63.2%	102/11 113 – 64.9%
MC – Manning Res	1,189	539	3/85 88 – 16.3%	71/55 126 – 23.4%	145/11 156 – 28.9%	135/17 152 – 28.2%
MC – HUC 6 combined	16,327	1757				
Dry Can – Hunts Lake	241	107	0/18 18 – 16.8%	0/18 18 – 16.8%	0/18 18 – 16.8%	0/18 18 – 16.8%
Monroe Creek	23,532	2,023	152/235 387 – 19.1%	428/193 621 – 30.7%	567/128 695 – 34.4%	337/124 461 – 22.8%
Monroe Cr-Magleby	1,667	506	5/0 5 - 0.1%	25/20 45 – 8.9%	54/2 56 – 11.1%	25/20 45 – 8.9%
Monroe Cr-combined	25,199	2,529				
Thompson Creek	N/A (inc. off Forest)	355	0/178 178 – 50.1%	1/177 178 – 50.1%	109/112 221 – 62.3%	1/177 178 – 50.1%
TC-Annabella Res	940	427	37/118 155 – 36.3%	135/58 193 – 45.2%	207/16 223 – 52.2%	136/58 194 – 45.4%

Water Creek	N/A (inc. off Forest)	420	38/13 51 – 12.1%	55/10 65 – 15.5%	55/10 65 – 15.5%	48/7 55 – 13.1%
WC – Big Lake	3,409	700	102/14 116 – 16.6%	113/10 123 – 17.6%	122/5 127 – 18.1%	122/2 124 – 17.7%
Koosharem Creek	3,715	475	7/17 24 – 5.1%	7/20 27 – 5.7%	43/18 61 – 12.8%	3/20 23 – 4.8%
Greenwich Creek	11,922	1,322	296/40 336 – 25.4%	299/40 339 – 25.6%	299/40 339 – 25.6%	296/40 336 – 25.4%
Box Cr above Res.*	8,470	2,089	76/130 206 – 9.9%	87/132 219-10.5%	87/132 219 – 10.5%	77/132 209 – 10.0%
Box Cr below Res.	11,214	5	0/0 0 – 0.0%	0/0 0 – 0.0%	0/0 0 – 0.0%	0/0 0 – 0.0%
Box Cr - combined	19,684	2,094				

***Note: Box Creek cumulative effects are higher from past fires/treatments. Due to all of the past activities, the acres proposed for treatment in the Box Creek above reservoirs HUC under this project are lower. See ERA model for cumulative effects.**

PARC HMGs (Pilliod and Wind 2008; see Appendix F of Whelan 2014) and the Utah Boreal Toad Conservation Plan (Hogrefe 2005) both provide indications that placement of new roads and increasing road network density in and near boreal toad habitat could be considered very negative to their habitat suitability. Fridell et al. (2000) documents a dead boreal toad from road mortality along the main road in the Manning Creek drainage in 1997, and Petty (2004) documented their own survey vehicle killing several recently metamorphosized toadlets near Barney Lake and noted that similar mortality by other road users was likely [during metamorphosis there is a short duration of very high toadlet density near the breeding pond, which disperse over several days – this was literally a case of "poor timing"] (note - road and vehicle crushing mortality is one case of a direct impact that can occur from project actions). Overall increase of roads ***near*** boreal toad habitat is considered in the ERA modeling section and the spatial analysis section. For this section, it was determined that increases in road length within actual mapped boreal toad habitat would be the most negative impact and should be considered separately. Since watershed area and toad mapped habitat varies by HUC, the increase was listed as a percentage increase.

For the purpose of the summary spreadsheet, Table 115 was simplified based on the following convention. The HUCs with no increase in road mileage ranked 1, an increase of 1 to 10 percent ranked as a 2, an increase of 11 to 20 percent ranked as 3, an increase of 21 to 30 percent ranked as 4, and an increase of 31 percent or greater ranked as 5. As can be seen in Table 115, most HUCs have little or no increase, but several key 7th field HUCs for boreal toads do have small increases, and one key boreal toad HUC, Barney Lake, has a major increase.

It is also evident in Table 115 that many of the HUCs have a very high existing road network density. Big Lake is exceptionally high at 9.03 miles per mile squared, dropping to 5.66 miles per mile squared in Dry Creek. All remaining HUCs are under 4 miles per mile squared, descending in the following order – Hunts Lake, Water Creek, Greenwich Creek, Box Creek above Reservoirs, Barney Lake, Koosharem Creek, and Manning Reservoir, which are all above 2.5 miles per mile squared. When the temporary road is factored in, Big Lake and Dry Creek remain as number 1 and 2 in the rankings, but Barney Lake rises to 3 and Water Creek to 4. At

this level of road density in mapped boreal toad habitat, clearly impacts to boreal toad habitat suitability and survival from roads would be a factor.

Table 115. Boreal toad habitat road density with temporary roads proposed by subwatershed (summarized from GIS subwatershed, boreal toad habitat, and motorized routs within boreal toad habitat tables).

HUC Name	Sub-watersh. Size - Acres	BT Habitat Acres/Sq miles	Road miles in BT Habitat/ Density	Motorized Trail Miles BT Hab/ Den	Temp Road	Density Existing/ w/ Temp Roads	percent Increase	Alter. w Temp Rds.
Dry Creek – Upper	9,510	901 (1.408)	7.4 (5.26)	.57 (.40)	0	5.66/5.66	0%	
Manning Cr – Upper	14,855	1,044 (1.631)	2.59 (1.59)	.64 (.39)	.11 (.07)	1.98/2.05	3.5%	4
MC – Barney Lake	283	174 (.272)	.12 (.44)	.67 (2.46)	.56 (2.06)	2.9/4.96	71%	4,5
MC – Manning Res	1,189	539 (.842)	2.02 (2.40)	.12 (.14)	.04 (.05)	2.54/2.59	2.0%	4
MC – HUC 6 combined	16,327	1757	-	-	-	-	-	
Dry Can – Hunts Lake	241	107 (.167)	.19 (1.14)	.46 (2.74)	0	3.88/3.88	0%	
Monroe Creek	23,532	2,023 (3.161)	3.18 (1.01)	.78 (.25)	.03 (.01)	1.26/1.27	1%	2,3,4
Monroe Cr-Magleby	1,667	506	0	0	0	0/0	0%	
Monroe Cr-combined	25,199	2,529	-	-	-	-	-	
Thompson Creek	N/A	355	0	0	0	0/0	0%	
TC-Annabella Res	940	427 (.667)	1.3 (1.95)	.21 (.31)	0	2.26/2.26	0%	
Water Creek	N/A	420 (.656)	2.21 (3.37)	.26 (.40)	.32 (.49)	3.77/4.26	13%	2,3,4
WC – Big Lake	3,409	700 (1.094)	8.19 (7.49)	1.68 (1.54)	.25 (.23)	9.03/9.26	2.5%	2,3,4
Koosharem Creek	3,715	475 (.742)	2.02 (2.72)	0	0	2.72/2.72	0%	
Greenwich Creek	11,922	1,322 (2.066)	6.61 (3.20)	.14 (.07)	.10 (.05)	3.27/3.32	1.5%	2,3,4
Box Cr above Res.	8,470	2,089 (3.264)	6.17 (1.89)	4.2 (1.29)	0	3.18/3.18	0%	
Box Cr below Res.	11,214	5*	0	0	0	0/0	0%	
Box Cr - combined	19,684	2,094	-	-	-	-	-	

*Small area makes GIS numbers and density estimate unreliable for this HUC6

The simplified summary rankings of Table 114 and Table 115 can be found by looking at Tables K-1 and K-2 in Appendix K of Whelan 2014.

3.4.8.6 Alternative Synthesis

This analysis used 7 methods to help quantify the potential impacts of the no action alternative relative to the 4 action alternatives to aquatic resources. These methods were tiering to the hydrological/soils report, watershed treatment area percentage, equivalent roaded area, spatial review with aquatic biologist professional opinion, amphibian management guideline consistency, key boreal toad habitat proposed for treatment, and key boreal toad habitat proposed road increases. Each of these methods tells a slightly different story as effects vary by alternative, area, and the resource of concern (stream fishery, lake water quality, boreal toad viability, etc.). To help assimilate each of these analysis methods to a common frame of reference a synthesis table was developed (see Appendix K of Whelan 2014).

First, a master table was established with rankings and/or scores for each of the alternatives for each of the HUCs for each method. A summary was tallied of all the rankings/scores. A higher ranking is indicative of more potential negative impacts to aquatic resources. Table 116, below, is derived from Table K-1 in Whelan 2014. The overall rankings are shown below to give the reader an idea of the relative level of impacts from each alternative. This score is then simplified to a simple ranking to show the order of potential impacts from least to worst. These overall ranking shows that of the action alternatives, 2 has the least impacts, followed by alternative 5, then alternative 3. Alternative 4 has the most impacts to aquatic resources.

Table 116. Overall synthesis score/ranking

HUC Name	No Action	Alt 2	Alt 3	Alt 4	Alt 5
Overall Score	116	245	293	330	273
Overall Ranking	1	2	4	5	3

The overall ranking washes out some important differences by HUCs (i.e., overall alternative 4 may be most impactful, but in a specific HUC another alternative might have the most impacts – such as Barney Lake where alternative 5 has the most impacts). This information could be useful for the deciding officer to modify the decision by making HUC specific selections. So the information in Table K-2, Appendix 2 in Whelan 2014 was summarized into Table 117 below. This gives the actual score, to show the relative level of impacts. Then Table 117 was simplified to the simple ranking shown in Table 118.

Table 117. Synthesis score by HUC

HUC Name	HUC type	No Action	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	Mod6	8	14	20	26	16
Manning Cr – Upper	Mod6-	8	16	20	25	17
MC – Barney Lake	7	8	23	24	31	34
MC – Manning Res	7	8	13	18	24	20

MC – HUC 6 combined	Mod6					
Dry Can – Hunts Lk	8	8	16	16	16	16
Monroe Creek	Mod6-	8	16	23	27	19
MonroeCr-Magleby	7	8	17	17	19	17
MonroeCr-combined	Mod6					
Thompson Creek	6	7	14	14	16	14
TC-Annabella Res	7	8	20	23	26	24
Water Creek	6	7	16	16	15	9
WC – Big Lake	7	8	18	20	20	21
Koosharem Creek	Mod6	8	14	18	17	12
Greenwich Creek	Mod6	8	14	18	20	14
Box Cr above Res.	7	8	13	15	15	12
Box Cr below Res.	Mod6-	3	8	13	11	11
Box Cr - combined	Mod6					

Table 118. Relative ranking (1 least impact-5 most impact) determined by synthesis score by HUC

HUC Name	HUC type	No Action	Alt 2	Alt 3	Alt 4	Alt 5
Dry Creek – Upper	Mod6	1	2	4	5	3
Manning Cr – Upper	Mod6-	1	2	4	5	3
MC – Barney Lake	7	1	2	3	4	5
MC – Manning Res	7	1	2	3	5	4
MC – HUC 6 combined	Mod6					
Dry Can – Hunts Lk	8	1	2	2	2	2
Monroe Creek	Mod6-	1	2	4	5	3
MonroeCr-Magleby	7	1	2	2	3	2
MonroeCr-combined	Mod6					
Thompson Creek	6	1	2	2	3	2
TC-Annabella	7	1	2	3	5	4

Res						
Water Creek	6	1	3	3	4	2
WC – Big Lake	7	1	2	3	3	4
Koosharem Creek	Mod6	1	3	5	4	2
Greenwich Creek	Mod6	1	3	4	5	2
Box Cr above Res.	7	1	3	4	4	2
Box Cr below Res.	Mod6-	1	2	4	3	3
Box Cr - combined	Mod6					

General Miscellaneous Effects Discussion

Under all of the alternatives, one of the "wild cards" of the analysis discussion is wildfire. This analysis and other specialist's reports make the case that long-term the action alternatives (alternatives 2 through 5) would reduce the long-term risk of large catastrophic fires by reducing conifer domination/fuel loading and breaking up large contiguous blocks of fuels. Some apply the counter argument that therefore the no action implies a much larger risk of wildfire. This is true in the long-term but in terms of the proposed project timeline (1 to 10 years) it may or may not be true, depending on weather patterns, ignition sources, management response to fire, etc. Since all of the action alternatives are very similar in the area treated, varying mainly in how they are treated (mechanical verses fire), for the purpose of this analysis, ***the benefit from the reduction of fire risk is presumed to be primarily long-term and constant across all action alternatives.*** It has not been well developed in this analysis due to the unknowns (a typical approach that could be used would to model a range of fire sizes/severities for comparison to the action alternatives, but this would still not incorporate the relative risk). Given the benefits should be similar across the alternatives, for this analysis of aquatic resources this benefit was considered constant and the action alternatives were rated by their risk to aquatics from implementation effects (i.e. the positive is constant, so the decision criteria for aquatic resources can be the changes in negative effects from implementation).

It is often stated that managed fire is generally cooler and less destructive than wildfire. This may be true in the case of many fires looked at individually. Coming at it from the side of conservation biology of sensitive native aquatic fish and the loss or near loss of remnant populations and genetic diversity, however, it is not necessarily true. Over the last 20 years in southern Utah, there have been three large fire events that have had major consequences to native BVCT populations. Remnant stocks and unique genes would have been lost (and may yet still be lost for one) if it were not for the dedicated actions of fisheries professionals from multiple agencies. These three major fires were a wildfire actively suppressed from initial management onwards, a prescribed fire that escaped prescription, and a managed wildfire allowed to burn for "resource benefits". *Thus, the empirical data from southern Utah over the last 2 decades show that wildfire, prescribed fire, and managed fire have all had about equal risk to important and irreplaceable native fish stocks.* (As an aside, fisheries professionals are aware of the risks and are attempting to reduce them by dispersing stocks across the landscape, utilize areas where fire treatments have occurred for reintroductions, and conduct proactive fuels treatments to provide

fire breaks within watersheds and reduce riparian fire risk/severities. However, these projects are long and time consuming to plan and implement).

Water quality is known to be an issue for Monroe Mountain lakes and reservoirs. This is in part due to parent geology as volcanic soils are high in nutrients, but human actions in the watersheds also play a role (Solt 2014 and Deiter 2002). The design features incorporated into this project will reduce the incorporation of sediment derived nutrients into these water bodies (particularly helpful are no treatments within 100 feet of streams and 328 feet of breeding ponds/lakes, no direct ignitions within 100 feet of streams and lakes, and any rest from livestock grazing). Due to the scale of areas proposed for treatments, however, (Table 109 and Table 110), some sedimentation, and nutrient addition is still likely to occur. Fish kills have been noted on Big Lake, Manning Meadow Reservoir is known to be largely anoxic during parts of the year, and cyanobacteria (blue-green algae) blooms were observed on two Monroe Mountain lakes by Forest personnel in 2013 through 2014. These blooms can even reach toxic levels to animals, as was evidenced after a dog died from ingesting material from Utah Lake that was later shown to be 70 times the health advisory level (KSL.com, Toxicity levels in parts of Utah Lake 70 times the 'healthy' limit, October 21, 2014). Careful project administration and monitoring (shown below) and potentially additional mitigation actions (also below) would likely be needed to prevent major exacerbation of the lake nutrient problems.

The design feature of fencing treated areas near and alongside Barney Lake and Manning Meadow Reservoir will aid in the restoration of aspen shoots within the fenced area. During the initial year after treatment, and during the growing season of the second year, the area will be rested from livestock grazing (under project design features, livestock rest could be extended into a third grazing season). During this time, the fence will primarily protect the new shoots from wildlife use. After livestock use is returned, this fence will generally eliminate both livestock and wild ungulate use on the young shoots until the reach a height where they are released from grazing pressure. This will have the effect of hastening the recovery of the burned area and reducing sedimentation to the reservoirs. In addition, the fence will also allow for treatment within the fenced area to be spread out over a longer timeframe to reduce watershed impacts to these two lakes.

Looking at Figure 21 showing the fencing proposal it is evident, however, that after livestock grazing resumes, the proposed fence may actually act to increase livestock grazing pressure along the shorelines of the two lakes, since the fence follows the wooded area boundary and leaves herbaceous areas along the lake unprotected. This is particularly the case along the north shore of Barney Lake, where livestock and wildlife use would be funneled into herbaceous areas with wet soils where boreal toads were commonly found in surveys. This increases the chance of exceeding livestock use standards and guidelines, which if they were exceeded, would increase sedimentation of the lakes from grazing. It also raises the risk of mortality to toads from crushing by livestock hooves (a crushing mortality in the Strawberry Basin was reported at the 2013 Utah boreal toad conservation meeting). Proper livestock management (and addressing of wildlife issues) will be critical in these areas post-treatment. Closing the fence gap and temporarily completely fencing off Barney Lake should also be considered.

3.4.8.7 Aquatic Sensitive and Management Indicator Species Summary:

General discussion for All Species

Effects of the No Action Alternative

Under alternative 1, there would be no vegetative treatments and no direct adverse effects would be expected to the streams BVCT, boreal toads, resident trout, and aquatic macroinvertebrates.

Potential indirect effects would come from natural succession as the areas move from early/mid seral species to late seral communities. This change in vegetation communities could potentially affect fire risk, fire behavior, fire severity and recovery times, and watershed function.

A wildfire may have a negative effect on stream or lake water quality (depending when and where it burned), as it would likely occur in the summer months when control efforts are more difficult and the acreage burned area may be greater than the proposed project area. This would result in potentially more sediment moving into the streams and/or lakes following a post-fire precipitation event than from a planned prescribed burn. These high rates of sediment could cover gravels and spawning habitat and may adversely affect localized populations resulting in long-term negative effects to aquatic species.

Direct Effects of the Action Alternatives

Direct effects to BVCT, boreal toads, resident trout, and aquatic macroinvertebrates would ***generally*** be minimal and not of major consequence due to the required project design features. The one direct effect that is considered to be of higher probability is vehicle crushing of boreal toads in or near key boreal toad habitat. Design features have been incorporated to minimize this risk to boreal toads.

Indirect Effects of the Action Alternatives (Broken Out by Species/MIS)

<u>Bonneville cutthroat trout</u>

The proposed action may impact individual BVCT due to indirect effects. Part of the project planning area is important habitat for BVCT:

- Manning Meadow Reservoir has been managed as a southern UDWR BVCT broodstock operation since 1992. This source of pure BVCT has been instrumental in preventing BVCT listing to date, has helped refound several new conservation populations on the Forest, is important for native cutthroat for sport-fishing stocking (to eliminate the need to stock non-native cutthroat trout), and currently provides over 500,000 eggs annually to meet UDWR needs.
- Manning Creek has been managed as a UDWR core conservation population since 1996. For many years, it was one of the larger populations on the Forest, functions as a partial metapopulation, and provides high quality habitat for BVCT.

- The Manning Creek watershed contains the only BVCT core conservation population lake habitat on the Forest. Manning Meadow Reservoir provides a high quality sport fishery after the lake opens for fishing following broodstock operations. Barney Lake, where BVCT co-occur with sterile hybrid tiger trout, provides a high quality fishery.

The following factors make impacts to BVCT highly likely to occur from the proposed actions.

- A considerable portion of the Manning Creek drainage is planned for treatment under all action alternatives.
    - Treatment is proposed for 17 to 23 percent of the land area in the upper Manning Creek subwatershed excluding the upper reservoirs. Above Manning Meadow Reservoir 21 to 38 percent of the area is proposed for treatment. Above Barney Lake 43 to 62 percent of the area is proposed for treatment. When all areas are considered together, 18 to 25 percent of the land area in the mapped Upper Manning Creek HUC (see Figure 63) is planned for treatment.
        i. These treatments at the 6th field HUC are at levels where population scale effects have been experienced by other fish populations based on effects of past fires in the UDWR region.
        ii. The Forest does not have experience at modeling at the 7th field HUC level, but communication with professional hydrologists indicate reasons for concern at high treatment percentages at the 7th field level.
    - Equivalent Roaded Area modeling found ERAs for the action alternatives to be near, at, or above the suggested (TOC 10). The ERA values ranged from 9.6 to 11.7 in the upper Manning Creek subwatershed excluding the upper reservoirs. Above Manning Meadow Reservoir ERA ranged from 12.1 to 21.3 for the action alternatives. Above Barney Lake ERA ranged from 10.4 to 16.3 for the action alternative. When all areas are considered together, the ERA ranged from 9.5 to 12.1.
        i. These treatments at the 6th field HUC are at ERA levels where population scale effects have been experienced by other fish populations on the Forest based on observed fisheries effects and calculated ERA values by Haraden (2013) on the Twitchell Canyon fire.
            1. Calculated ERAs for North Fork of North Creek and Indian Creek were 9 and 10.3 (Haraden 2013). These fish populations suffered population scale declines.
            2. Calculated ERAs for Fish Creek and Shingle Creek were 14.4 and 15.5 (Haraden 2013). These fish populations were effectively lost.
        ii. The Forest does not have experience at predicting effects at the 7th field HUC level based on ERA calculations and monitoring for results, but the high levels calculated for Manning Meadow Reservoir and Barney Lake would seem to indicate need for *extreme caution and multiple entries*. As this project is currently designed, there is no design requirement for multiple entries over time at the 7th field level to spread project effects over time.

The following factors and project design features reduce the effects expected from the above modeling and make it likely that while population scale effects could occur, they would not likely be at a scale of a trend towards federal listing.

- Since BVCT in Manning Creek overlap boreal toad habitat above 8,000 feet, in this zone above 8,000 feet there is a 100-foot stream buffer and 328-foot breeding site buffer with no harvest. There is also a zone from 100 feet to 328 foot from streams and 328 feet to 984 feet from breeding sites where no mechanized equipment can be used for harvest.
    - This buffer distance will filter out the vast majority of overland sediment flow [not channelized] before it can reach the creeks or lakes. This design feature is consistent with guidance found in the Forest LRMP (FP IV-33) that states: "Special protection and management will be given to floodplains, wetlands, and all land and vegetation for a minimum of 100 feet from the edges of all perennial streams, lakes, and other bodies of water or to the outer margin of the riparian ecosystem if wider than 100 feet" (IV-33).
- Treated areas would be rested from livestock grazing for two growing seasons (i.e. usually grazed late the 2nd year) and possibly three if needed. This reduces cumulative effects from livestock grazing.
- Aquatic Invasive Species control measures are included as a design feature, which should effectively eliminate the risk of bringing in new AIS or spreading AIS currently on the mountain. Drafting will include screens to prevent intake of fish or amphibians.
- Upland areas would be treated first and separately from riparian areas.
- No more than 15 percent of the upland area at the modified HUC6 area would be treated at one time. The area would then be allowed to recover [comparable to pre-treatment] watershed function, after which an additional 15 percent could be treated, or the remaining area if less than 15 percent.
- Empirical data from past fires in southern Utah show that trout populations are likely to survive at this level and habitat suffer only minor short-term negative impacts.
- No more than 5 to 10 percent of the riparian area within a modified HUC6 subwatershed would be treated at one time. The area would then be allowed to recover [comparable to pre-treatment] riparian function, after which an additional 5 to 10 percent could be treated.
- Post-treatment visual monitoring would be conducted to determine potential for increased sediment into streams. Localized treatments of straw mulch, wood chips, slash placement, seeding, and silt fencing could be installed as needed to control, prevent, or minimize effects from soil erosion.
- Snags (200 to 300 per 100 acres) and downed logs (50 per 10 acres) would be left which will help provide large wood for habitat formation/diversity.
- Ground based treatments would occur only on slopes less than 40 percent.
- Equipment use within riparian areas would occur only when soils were dry, frozen, or covered with snow to prevent wheel or track damage. Low ground pressure equipment would be used when possible.
- Temporary roads would be reclaimed upon completion of the mechanical treatments.
- No skid trails or landings would be constructed in riparian areas.
- No direct ignitions would occur in riparian areas on slopes greater than 40 percent. Prescribed burning would be ignited when low to moderate fire severities would be

expected in riparian areas and spruce/fir or conifer stands with very low aspen component (less than 15 recruits per acre). Since BVCT in Manning Creek overlap boreal toad habitat above 8,000 feet, in this zone above 8,000 feet there is a 100 foot no direct ignition zone along streams (fire could back in).

- The 100 foot no ignition zone along streams would trap the majority of overland sediment [not channelized] flow from shallower slopes along treated/burned areas and capture a portion of the sediment from steeper slopes. This will reduce sediment delivery to the streams. The 100-foot no ignition zone will likely maintain stream shading and stream temperature at levels nearly the same as for the no action alternative. A 100-foot no ignition zone will also likely maintain large woody debris levels very close to the no action alternative. This design feature is consistent with guidance found in the Fishlake LRMP for vegetation treated by burning (LRMP IV-49) that apply to wildlife, which states: "Limit use of prescribed fires on areas adjacent to riparian areas to protect riparian and aquatic values".
- Nutrient loading effects from the burning will be reduced by passage of overland water flow and sediment through the riparian buffer (Belt et al. 1992, 4:3).

- Other boreal toad design features will provide additional protection.
- The soils and hydrology report suggests very little additional risk of sediment delivery from areas burned at low intensity/severity.
- The prescribed burning as proposed (with a mix of fire severities primarily planned to have low to moderate severities) would likely have less negative effects then a wildfire.
- The proposed treatments would reduce the risk of a large high severity wildfire in the drainages treated.
- The fish populations at the stations within the project area sampled appeared relatively robust. The majority of Manning Creek and its tributaries had good streambank stability as determined by Pfankuch adjusted for stream channel type (Petty 2004, Appendix I).
- There are no adverse cumulative effects of this project on BVCT (see cumulative effects section).
- Fencing of Manning Meadow Reservoir and Barney Reservoir treatment areas would ensure good protection of sprouts and likely increase the amount and rate of aspen recovery within the treated area, reducing sedimentation to the reservoir. It also would allow for multiple entries, which could spread the treatment effects over time. (Multiple entries are not currently required by project design features, however. There are concerns the fencing could negatively affect riparian areas along the lake shorelines).

The conclusion of all of the above factors in combination is that while there will be impacts to BVCT, their population will be maintained in the aquatic CEA.

<u>Boreal Toad</u>

The situation for the boreal toad is similar to the one above for BVCT (since they both occur in the Manning Creek drainage) with the following additional considerations project area wide:

- The entire upper elevation zone of Monroe Mountain can be considered crucial habitat for boreal toads. This mountain acts as a large conservation metapopulation for boreal

toads. While monitoring to date has limited power to determine trends (K.Wheeler, UDWR native aquatics biologist, personal communication), professional opinion is that populations have been stable, at least until around 2012. Mountain-wide, over 11,000 acres has been mapped as important boreal toad habitat

The following factors make impacts to boreal toad highly likely to occur from the proposed actions.

- A considerable portion of the watersheds containing boreal toad habitat on Monroe Mountain are planned for treatment under all action alternatives.
    - Treatment is proposed for 18 to 25 percent of the land area in the upper Manning Creek subwatershed. Above Manning Meadow Reservoir, 21 to 38 percent of the area is proposed for treatment. Above Barney Lake, 43 to 62 percent of the area is proposed for treatment. Above Hunts Lake 29 percent of the area is proposed for treatment. Treatment is proposed for 27 to 36 percent of the Monroe Creek subwatershed. Above Magleby Reservoir, 20 to 29 percent of the area is proposed for treatment. Above Annabella Reservoir, 45 to 65 percent of the area is proposed for treatment. Above Big Lake, 28 to 36 percent of the area is proposed for treatment and this does not include some approved but not yet implemented or completed treatments. Treatment is proposed for 11 to 15 percent of the Koosharem Creek subwatershed and this does not include some approved but not yet implemented or completed treatments. Treatment is proposed for 15 to 17 percent of the Greenwich Creek subwatershed. Treatment is proposed for 17 to 19 percent of the Box Creek subwatershed and this does not include some approved but not yet implemented or completed treatments.
        i. The Forest does not have experience at modeling boreal toad effects at the 6th field HUC but professional opinion would indicate reasons for concern at levels over 15 percent due to potential watershed effects to breeding sites and riparian use areas (i.e. flooding may cause sediment deposition on breeding sites and downcutting that dewaters riparian areas and makes them unsuitable for future toad use).
        ii. The Forest does not have experience at modeling boreal toad impacts vs. watershed area treated at the 7th field HUC level, but professional opinion would indicate reasons for concern at the high treatment percentages at the 7th field level in some boreal toad used HUCS.
    - The ERA modeling found ERAs for the action alternatives to be near, at, or above the suggested (TOC 10). Equivalent Roaded Area values ranged from 9.5 to 12.1 in the upper Manning Creek subwatershed (TOC 10). Above Manning Meadow Reservoir ERA ranged from 12.1 to 21.3 for the action alternatives. Above Barney Lake, ERA ranged from 10.4 to 16.3 for the action alternatives. Above Hunts Lake, the ERA was 11.3 (under the TOC of 12). The ERA values ranged from 8.9 to 12.7 in the Monroe Creek subwatershed (TOC 11). Above Magleby Lake, ERA ranged from 6.1 to 10.1 (TOC 10). Above Annabella Reservoir the ERA ranged from 7.2 to 21.3 (TOC 10). Above Big Lake, the ERA ranged from 11.6 to 15.0 (TOC 10) and this does not include some approved but not yet implemented or completed treatments. The ERA values ranged from 7.1 to 9.0 in

the Koosharem Creek subwatershed (TOC 10) and this does not include some approved but not yet implemented or completed treatments. The ERA values ranged from 11.2 to 11.6 in the Greenwich Creek subwatershed (TOC 10). The ERA values ranged from 12.9 to 13.9 in the Box Creek subwatershed (TOC 12) and this does not include some approved but not yet implemented or completed treatments.

i. The Forest does not have experience at modeling boreal toad effects at the 6th field HUC at various ERA levels but professional opinion would indicate reasons for concern at levels over suggested TOCs.
ii. The Forest does not have experience at predicting boreal toad effects at the 7th field HUC level based on ERA calculations and monitoring results, but professional opinion would indicate reasons for concern at high treatment percentages at the 7th field level. As currently designed, there is no design requirement for multiple entries over time at the 7th field level to spread project effects over time.

- A considerable portion of the boreal toad mapped habitat (RHCAs) are planned for treatment.
- In several subwatersheds, a considerable portion of mapped boreal toad habitat (RHCAs) already contains very high existing road densities, and planned temporary roads will increase this density further.

Various factors and project design features reduce the effects expected from the above modeling/considerations and make it likely that while population scale effects could occur to boreal toads, they would not likely be at a scale of a trend towards federal listing. For boreal toads, this includes all of the factors listed under BVCT, which will not be repeated here, and the following additional factors:

- Project implementation would utilize boreal toad RHCAs of 328 feet from each side of streams as buffers for vegetation treatments. Utilize RHCAs of 984 feet from known boreal toad breeding ponds (see Figure 65 for mapped RHCAs).
- In order to protect Boreal toads and hibernacula[31] from being crushed, no ground-based mechanized harvesting equipment would be permitted within the RHCAs.
- Within the RHCAs, treatments would be limited to hand-thinning, horse, or helicopter thinning up to 100 feet from the stream or up to 328 feet from the known boreal toad breading ponds.
- No treatments (hand treatment, horse, or helicopter thinning) would be allowed within 100 feet of perennial streams or within 328 feet of breeding ponds unless such treatments are coordinated with and approved by the Forest's fisheries biologist.
    - This will filter out the majority of overland sediment flow [not channelized] before they reach the creeks. This design feature is consistent with guidance found in the Fishlake LRMP (IV-33) that states: "Special protection and management will be given to floodplains, wetlands, and all land and vegetation for a minimum of 100 feet from the edges of all perennial streams, lakes, and

[31] An opening where Boreal toads can go underground.

other bodies of water or to the outer margin of the riparian ecosystem if wider than 100 feet" (IV-33).

- Within the RHCAs, no pile/slash burning would occur within 100 feet from the stream or breeding sites edge. Within the remainder of the RHCAs, pile or slash burning would occur during the Boreal toad dormant season (October 1 thru April 15) unless coordinated with and approved by the Forest's fisheries biologist.
- Within the RHCAs, snags (200 per 100 acres in aspen, 300 per 100 acres in mixed conifer spruce/fir, and large downed logs (50 per 10 acres; a minimum of 15 tons per acre) would be retained as cover for toads. This is the same criteria as general project criteria for snags and downed logs.
- Within the RHCAs, thinning treatments (hand treatment, horse, or helicopter thinning) would target less than or equal to 60 percent of the stands if treated for complete conifer removal (aspen cover type) or thinning to BA 90 (spruce/fir and mixed conifer cover types); or would target less than or equal to 80 percent of aspen, spruce/fir, or mixed conifer stands if treated by thinning conifer from below up to 8 inch DBH.
- If any unmapped perennial streams or water sources in Boreal toad supporting habitat were encountered during project implementation, these areas would be protected by a 100-foot buffer. No treatments (hand treatment, horse, or helicopter thinning) would be allowed within this buffer unless treatments are coordinated with and approved by the Forest's fisheries biologist.
- If any Boreal toad hibernacula were encountered during project implementation, these areas would be protected by a 328-foot buffer. No treatments (hand treatment, horse, or helicopter thinning) would be allowed within this buffer unless treatments are coordinated with and approved by the Forest's fisheries biologist.
- Temporary roads within the RHCAs would have toad passage friendly culverts installed where culverts are needed (buried culverts or bottomless arched structures) for the duration of the project.
- Dipping or drafting water for fire activities from smaller boreal toad breeding sites that may show a change in water levels from the use would be avoided, except for emergencies.
- Required monitoring of boreal toad populations and habitat use would occur (in addition to current levels by the UDWR), to document project effects and to help plan future vegetation management projects in boreal toad habitat. This would include breeding site monitoring to document use and relative densities of populations.
- Within the RHCAs, prescribed burning would occur when generally low to moderate fire intensity and severities would be expected. Prescribed fire personnel would attempt to implement prescribed burning during the Boreal toad dormant season (October 1 thru April 15).
- No direct fire ignitions would occur within 100 feet from the streams and 328 feet from Boreal toad breeding ponds unless coordinated with and approved by the Forest's fisheries biologist. Fire ignitions could occur outside these buffers and allowed to back into these areas.
    - The 100 foot no ignition zone along streams will trap the majority of overland sediment [not channelized] flow from shallower slopes along treated/burned areas and capture a portion of the sediment from steeper slopes. This will reduce sediment delivery to the streams. The 100-foot no ignition zone will likely

maintain stream shading and stream temperature at levels nearly the same as for the no action alternative. A 100-foot no ignition zone will also likely maintain large woody debris levels very close to the no action alternative. This design feature is consistent with guidance found in the Fishlake LRMP for vegetation treated by burning (IV-49) that apply to wildlife, which states: "Limit use of prescribed fires on areas adjacent to riparian areas to protect riparian and aquatic values".

- There are no adverse cumulative effects of this project on boreal toads (see cumulative effects section).

The conclusion of all of the above factors in combination is that while there will be impacts to boreal toads, their populations will be maintained in the aquatic CEA.

Resident Trout

The situation for resident trout is similar to the ones above for BVCT and boreal toad (since they occur together in most of the drainages) with the following additional considerations project area wide:

- Resident trout occur in Monroe Creek and its tributaries (including Magleby Lake on private land), Thompson Creek HUC (including Deep Lake and Annabella Reservoir), Water Canyon HUC (including Big Lake), Koosharem Creek, Greenwich Creek and its tributaries, and Box Creek and its tributaries (including upper and lower Box Creek Reservoir). The streams, lakes, and reservoirs listed above provide high local value as recreational fisheries.

The following additional factors make impacts to resident trout highly likely to occur from the proposed actions.

- A considerable portion of the fish supporting drainages are planned for treatment under all action alternatives as discussed above in the BVCT and boreal toad sections above.
- Two of the streams in the project area not yet discussed above have only marginal stream stability (as measured by Pfankuch), which makes them more susceptible to project impacts.
    - Greenwich Creek stability was 57 percent good stability, 6 percent fair stability, and 37 percent poor stability. These streambanks will not be resistant to erosive energy from floods and high flows with considerable suspended sediment and bedload.
    - Box Creek stability was 54 percent good stability, 24 percent fair stability, and 22 percent poor stability. These streambanks will not be resistant to erosive energy from floods and high flows with considerable suspended sediment and bedload.

The following factors and project design features reduce the effects expected from the above modeling and make it likely that while population scale effects could occur, they would not likely be at a scale of losing these resident fish populations.

- In areas where resident trout overlap boreal toad mapped RHCAs, boreal toad buffers will provide protection of resident trout habitat for mechanical treatments and prescribed fire treatments (see discussion in boreal toad section above).
- One of the streams not yet discussed above has decent stream stability (as measured by Pfankuch), which makes it more resistant to project impacts.
    - Koosharem Creek stability was 86 percent good stability, 8 percent fair stability, and 6 percent poor stability.
- There are no adverse cumulative effects of this project on resident trout (see cumulative effects section).

The conclusion of all of the above factors in combination is that while there will be impacts to resident trout, their populations will be maintained in the aquatic CEA.

Aquatic Macroinvertebrates

The situations for aquatic macroinvertebrates are similar to the ones above for BVCT, boreal toad, and resident trout (since aquatic macroinvertebrates (as used in a MIS) occur in trout supporting streams throughout the planning area) with the following additional considerations project area wide:

- Aquatic macroinvertebrates occur in all trout supporting streams on Monroe Mountain. The factors described above for BVCT, boreal toads, and resident trout, make impacts to aquatic macroinvertebrates highly likely to occur from the proposed actions.

The following factors and project design features, in addition to all of the ones listed above for BVCT, boreal toads, and resident trout, reduce the effects expected and make it likely that while short to moderate-term effects could occur, they would not likely result in a long-term reduction of habitat quality for clean water aquatic macroinvertebrate taxa.

- Belt et al. (1992, 2:4 and 5:6) indicates that a 98 foot buffer strip is adequate to maintain macroinvertebrate diversity at pre-harvest levels in clear-cut areas, where a 33 foot buffer strip was inadequate, which indicates the 100-foot (plus – depending on zone and treatment) buffer minimum within boreal toad occupied habitat will also help trap sediments from mechanical vegetation treatments and prescribed burning.
- The soils and hydrology report suggests very little additional risk of sediment delivery from areas burned at low intensity/severity.
- The is a project design feature of limiting 6th field HUC treatments to less than 15 percent of the sub-watersheds [moderate to high severities] at one time; empirical data from past fires in southern Utah show that at this level stream habitat is likely to suffer only minor or short-term negative impacts.
- There are no adverse cumulative effects of this project on aquatic macroinvertebrates (see cumulative effects section).

All of the above factors in combination will help protect the aquatic macroinvertebrate community structure, diversity, and BCI ratings in the aquatic CEA.

3.4.9 Cumulative Effects

This cumulative effects section considers the effects to the aquatic species previously discussed. The cumulative effects analysis area (CEA) for aquatic resources is shown in Figure 63. This area was selected because of continuity of aquatic habitat and watershed areas found in the project area.

The cumulative effects being described include past, present, and reasonably foreseeable future actions. This area includes known or predicted habitat use areas of the aquatic species analyzed in this document.

In terms of fisheries, the project area streams and watersheds are changed from their pre-settlement condition. Water reservoirs, diversions, and canals alter the natural movement and timing of water in this watershed. The native cutthroat trout have been affected by new human land uses in the watershed, as well as the introduction of non-native trout species since pioneer settlement.

The cumulative effects discussed in detail below include:

Cattle Grazing
Vegetation Treatment Projects
Wildfires
Recreational Activities
Travel Management
Special Uses
Water Management

3.4.9.1 Cattle Grazing

Cattle grazing has occurred for over 100 years within the CEA. Standards and guidelines for livestock grazing have been established in specific plans and are administered by rangeland specialists. Generally these plans permit moderate grazing utilization levels and incorporate a deferred or rest rotation system to allow for improved plant vigor and residual biomass on part of the allotment each year. Historic grazing typically removed more vegetation and was permitted for longer grazing seasons; this reduced vegetation that provided forage for some species, and nesting habitat with cover for other wildlife species. Currently through better rangeland management these effects are generally being reduced and improvement is occurring range wide as amount of vegetation and grazing seasons are more closely monitored and enforced. Grazing management decisions such as the forest utilization standards and guidelines (2001) provide direction for the management of livestock on National Forest System lands within the CEA on District.

Implementation of an action alternative may increase forage on upland areas. This may disperse grazing pressure more evenly throughout the area, and reduce grazing pressure in riparian areas and along creeks.

3.4.9.2 Vegetation Treatment Projects

Vegetation treatment projects include: prescribed burns, mechanical vegetation treatments, fuel reduction projects, firewood gathering, and noxious weed spraying. Previous mechanical fuels/vegetation treatments that are likely still affecting watershed function are included in the watershed ERA modeling in Appendix H of Whelan 2014.

Noxious weed spraying occurs in an effort to control or eliminate noxious weeds. Noxious weeds are more likely to gain footholds in disturbed areas such as along roads, dispersed campsites, grazed areas, and timber sales. Noxious weed control is an important management tool to prevent the spread and establishment these ecological pests. Spraying is done in accordance with an environmental assessment prepared for the Forest and has little cumulative effect to aquatic resources. Preventing the further spread of noxious weeds is a beneficial action.

3.4.9.3 Wildfires

The vegetation communities on Monroe Mountain form a fire-adapted ecosystem, and there have been numerous wildfires historically. In the previous 15 years (2000 through 2009) there have been large wildfires, prescribed fires, and a prescribed fire that escaped prescription. Wildfires will likely continue to occur within the analysis area. Previous wildfires, managed wildfires, and prescribed fires that are likely still affecting watershed function are included in the watershed ERA modeling in Appendix H of Whelan 2014. Selection of the no action Alternative may increase the probability of a large wildfire with more detrimental impacts to aquatic species due to fuel buildup and high fuel loadings.

Fire suppression, especially when coupled with changes in land use such as grazing, has affected fire ecology in some portions of the CEA. In general, low intensity, low severity ground fires have become less common in some fuel/vegetation types since Eurpoean settlement. Fire suppression activities, such as drafting water from streams or lakes, has the potential to spread AIS.

3.4.9.4 Recreational Activities

Recreational activities occur across the cumulative effects analysis area such as: camping, hunting, fishing, day use activities, and off-road vehicle riding, summer cabins/homes.

Dispersed camping is an ongoing activity that occurs mainly in the summer and early fall months. These camping areas have disturbed small parcels of land potentially increasing sedimentation of aquatic habitat.

Fishing occurs on perennial streams and water bodies within the CEA. The UDWR regulates the fishing limits. Activities associated with fishing can cause sedimentation due to disturbance of stream banks and reservoir shorelines. Historic stocking of non-native fish into CEA waters is one change from pre-settlement conditions. Typical harvest levels do not generally limit stream

trout populations at this time and wild self-sustaining populations occur in the streams capable of supporting trout.

Hunting is permitted across the CEA area during specified hunting seasons; the UDWR manages hunting. Mule deer and elk are hunted in three separate seasons (archery, muzzleloader, and general rifle). Herds are managed in accordance to established herd unit objectives. Hunting would have minimal effects on aquatic resources and would not be detrimental to species viability.

Many day use activities occur throughout the CEA area, such as picnicking, sightseeing, antler shed hunting, firewood gathering, horseback riding, etc. Shed hunting has increased significantly during the last 10 years. This activity is generally at lower elevations and generally occurs during late winter and early spring. These activities are short duration by definition and the impacts of such to aquatic biota are minimal. The primary effect of this day use activity and hunting would be off-road use that might occur near streams, lakes, and riparian habitat, especially on poorly maintained, designed, or user created routes.

Off-road vehicle riding is a popular activity by many local residents and others that come from all over the United States to experience trails open to off-road vehicles. A national all-terrain vehicle (ATV) jamboree occurs annually in September in Sevier County and in the Fillmore area in late June. Both attract 600 to 800 ATV riders to central Utah. There are various ATV trails and non-motorized trails within the CEA. Use statistics show that the amount of ATV use has been increasing over the last 15 years. A few individual companies have special use permits to take people on ATV rides on approved trails. The impacts to aquatics are minimal except where trails are located in riparian areas, near streams or lakes, or actually ford streams.

3.4.9.5 Travel Management

The Forest Travel Management Plan (USFS 2012) was updated in an intensive public participation process in association with an environmental impact statement and analysis of alternatives. The travel plan is now in the process of being implemented with signing of routes and closure of unautorized user created routes that were creating resource conflicts. The plan also closed the Forest to cross-country travel off of designated routes. The net effect of implementation of the new plan is reduce the current impacts to aquatic resources form off-road vehicles as well as reducing the potential for future resource degradation from off-road vehicles.

3.4.9.6 Special Uses

Special uses occur throughout the CEA area such as: firewood and post cutting, outfitter and guide operations, municipal water developments, small mining claims, irrigation diversions, roads, water lines, etc. Special uses such as these are authorized by Special Use Permits; usually these permits require a separate environmental assessment, which discloses the impacts from these activities. The permits have requirements and are generally managed to have minimal environmental impacts.

3.4.9.7 Water Management

Water management structures, canals, and other improvements are permitted as Special Uses and mentioned above. The primary effect has been to alter the amount and timing of water flows in natural channels. The effects to aquatic biota are discussed in the summary below.

3.4.9.8 Summary of Cumulative Effects

Bonneville Cutthroat Trout and Resident Trout

The introduction of non-native fish, stocking of hatchery fish, grazing, fires, fire management activities, timber/thinning operations, irrigation diversion, and water manipulation has altered riparian and upland vegetation composition and densities and riparian environments, which has reduced habitat for BVCT and resident trout species in some cases and created habitat in others. In general, stream habitats have generally been reduced in quantity and quality, while large (verses small beaver pond) lake quantity has increased. In addition, across their historic range, BVCT have generally been displaced by non-native trout species. Bonneville cutthroat trout only occur on Monroe Mountain where they have been reintroduced into the Manning Creek drainage. Despite these cumulative effects and concerns, these streams remain an important fisheries resource in the state of Utah, although the true potential biomass for these streams is not known.

As described above, the direct and indirect effects from the proposed action to BVCT and resident trout are expected to be of a short to mid-term duration provided that the required design features are properly implemented and the project properly administered. Thus the effects of the activities listed above in the cumulative effects section, in combination with either the no action alternative or one of the action alternatives, are not expected to cause ***long-term*** measurable adverse changes to the species discussed in this report or extrapolated to other aquatic species with similar habitats. None of the alternatives would add cumulative effects that would adversely affect population numbers or viability of BVCT and resident trout in the long term. Any adverse effects to trout species or trout habitat for future projects can be avoided or minimized on the National Forest through the use of project design features. The activities listed above in the cumulative effects section are not expected to increase as a result of the action alternative. (Note - As currently designed, there is risk that 7th field HUC impacts and - of particular concern - debris flows from a debris flow prone subwatersheds could occur following treatment of a high percentage of these particular subwathersheds. It is likely that if these did occur, the trout population would persist in other locations within the 6th field HUC upstream of the confuence with the 7th field subwatershed or in other 7th field HUCs not directly connected to them. These impacts could be considerable where they do occur, however, thus considerable caution has been recommended when conducting these treatments).

Boreal Toad

The introduction of non-native fish, stocking of hatchery fish, grazing, fires, fire management activities, vegetation management, irrigation diversion, and water manipulation has altered riparian and upland vegetation composition, densities, and riparian environments, which has

reduced habitat quality for boreal toads in some cases and created habitat or improved habitat quality in other cases. In general, stream habitats have generally been reduced in quantity and quality, and beaver density reduced from pre-European settlement conditions. Despite these cumulative effects and concerns, Monroe Mountain remains a very important area for boreal toad conservation in the state of Utah, although the true historic population size and distribution of boreal toads on Monroe Mountain is not known.

As described above, the direct and indirect effects from the proposed action to boreal toads are expected to be of a short-term duration provided that the required design features are properly implemented and the project properly administered. Thus, the effects of the activities listed above in the cumulative effects section, in combination with either the no action alternative or the action alternatives, are not expected to cause ***long-term*** measurable changes to boreal toads. None of the alternatives would add cumulative effects that would adversely affect population numbers or viability of boreal toads in the long term. Any adverse effects to aquatic species or aquatic habitat for future projects can be avoided or minimized on the National Forest through the use of project design features. The activities listed above in the cumulative effects section are not expected to increase as a result of the action alternative. (Note - As currently designed, there is risk that 7th field HUC impacts and - of particular concern - debris flows from a debris flow prone subwatersheds could occur following treatment of a high percentage of these particular subwathersheds. It is likely that if these did occur, the boreal toad population would persist in other locations within the 6th field HUC upstream of the confuence with the 7th field subwatershed or in other 7th field HUCs not directly connected to them. These impacts could be considerable where they do occur, however, thus considerable caution has been recommended when conducting these treatments).

Aquatic Macroinvertebrates

The introduction of non-native fish, stocking of hatchery fish, grazing, fires, fire management activities, timber/thinning operations, irrigation diversion, and water manipulation has altered riparian and upland vegetation composition and densities and riparian environments, which has affected macroinvertebrates in the cumulative effects area (CEA). Erosion, water manipulation (stream flows), and increased sediment are major factors affecting potentially suitable habitats for aquatic macroinvertebrates.

This has reduced habitat for clean water macroinvertebrate taxa, decreasing their populations and extent, which has an effect of reducing the BCI in most cases. In some cases, it may have improved habitat, raising the BCI. Often an effect of moderate increases in sedimentation and organic enrichment will be an increase in macroinvertebrate biomass and species richness as tolerant taxa become established, although at the expense of the cleanest water taxa which are lost (thus BCI scores will decrease slightly). As enrichment continues, however, biomass and species richness will begin to decline as sediments cover stream substrates and the majority of clean water taxa are eliminated, greatly reducing BCI scores.

As described above, the direct and indirect effects from the proposed action to aquatic macroinvertebrates are expected to be of a short-term duration if the required design features are properly implemented and the project properly administered. Thus the effects of the activities

listed above in the cumulative effects section, in combination with either the no action alternative or one of the action alternatives, are not expected to cause ***long-term*** measurable changes to the aquatic macroinvertebrate community. None of the alternatives would add cumulative effects that would adversely affect the aquatic macroinvertebrate community structure in the long term. Thus, the monitoring stations sampled would not be expected to decline after the mid-term recovery period in terms of the BCI index rating. Any adverse effects to aquatic species or aquatic habitat for future projects can be avoided or minimized on the National Forest using project design features. The activities listed above in the cumulative effects section are not expected to increase because of one of the action alternatives. (Note - As currently designed, there is risk that 7th field HUC impacts and - of particular concern - debris flows from a debris flow prone subwatersheds could occur following treatment of a high percentage of these particular subwathersheds. It is likely that if these did occur, aquatic macroinvertebrates would persist in other locations within the 6th field HUC upstream of the confuence with the 7th field subwatershed or in other 7th field HUCs not directly connected to them. These impacts could be considerable where they do occur, however, thus considerable caution has been recommended when conducting these treatments).

3.4.10 Determination and Rationale

As a result of this evaluation, it is the determination of the Forest's fisheries biologist that implementation of the proposed project may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species for the species considered in this document (Table 119, Table 120, and Table 121).

Table 119. Determination of impact on the affected sensitive species

➢ SPECIES	DETERMINATION
Bonneville cutthroat trout	MIIH
Boreal toad	MIIH

NI = No Impact

MIIH = May Impact Individuals Or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species.

WIFV = Will Impact Individuals Or Habitat With A Consequence That The Act ion Will Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species.

BI = Beneficial Impact

Table 120. Determination of impact on affected aquatic sensitive species.

Species	No Impact	May Impact Individuals Or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or	Will Impact Individuals Or Habitat With A Consequence That The Act ion Will Contribute To A Trend Towards Federal Listing Or	Beneficial Impact

		Species.	Cause A Loss Of Viability To The Population Or Species	
Bonneville cutthroat trout	**1**	**2 3 4 5**		
Southern Leatherside	**1 2 3 4 5**			
Boreal Toad	**1**	**2 3 4 5**		

Table 121. Summary of effects for aquatic management indicator species

Wildlife Species	Beneficial Effect	No Effect	May Affect individuals or habitat, but would not adversely affect long-term population numbers or viability	May Affect individuals or habitat, and may adversely affect long-term population numbers or viability
Resident Trout		**1**	**2 3 4 5**	
Aquatic Macroinvertebrates		**1**	**2 3 4 5**	

Bonneville cutthroat trout

A determination of **May Impact Individuals or Habitat** is made for BVCT. See Aquatic Sensitive/MIS Summary for determination rationale.

Boreal toad

A determination of **May Impact Individuals or Habitat** is made for boreal toad. See Aquatic Sensitive/MIS Summary for determination rationale.

3.4.11 Additional Mitigation Measures

3.4.11.1 Required Monitoring

Due to the nature of the project - which treats habitat across the majority of the mountain within, adjacent to, and upslope of boreal toad habitat that may affect boreal toad habitat through downstream effects, the recent introduction of chytrid fungus to Monroe Mountain and the likely concurrent population decline, and the fact that boreal toads have been petitioned for listing as a threatened species with a status review scheduled for completion by 2017, ***active monitoring of boreal toads before, during, and after project implementation is required to meet the MIIH determination*** by ensuring that project design features are implemented as designed, work as intended and are effective, and that site specific findings of toad use areas, timing, etc. can be incorporated into implementation actions. This monitoring will ensure that boreal toad impacts are minimized and of a scale that ensures the project will not lead towards federal listing.

Current monitoring is not adequate to determine trend (K. Wheeler, UDWR Native Aquatics biologist, email communication July 28, 2014), not to mention survival rates, movements, habitat use, or identification of key habitat features needing protection. The UDWR design feature recommendations to the Forest included the recommendation that "Monitoring of boreal toad populations (in addition to current levels by UDWR) should be implemented to document potential effects of proposed vegetation management. This should include breeding site monitoring to document use and relative densities of populations." (Appendix D of Whelan 2014).

While the exact nature of the monitoring program has not yet been designed, and needs future interagency coordination and cooperation to determine funding sources, personnel, and responsibilities before it can be finalized, Appendix J of Whelan 2014 provides an example monitoring plan that would be sufficient to meet this need. It includes project objectives of determining changes in toad use areas, chytrid fungus infection rates/changes, finding key concentration areas such as breeding sites and hibernacula that should be buffered/protected, determine boreal toad use of areas planned for treatment, comparing toad use of treated vs. untreated habitat, and (to the extent possible) determining population size and survival data. The AIS control measures and annual reporting requirements are included.

Photo 11. These boreal toad hibernacula would not have been found and identified without the 2003-2004 radio tracking study. Typical hibernacula along small perennial seep that leads to underground root chamber under spruce/fir just behind the aspen.

Photo 12. Deep buried root chamber under spruce along a flowing small perennial tributary in spruce/fir conifer habitat. M. Goates in photo. Other identified hibernacula included old beaver dams and burrows under riparian and transitional zone shrubs (see Photo 10).

3.4.11.2 Recommended Monitoring

The following monitoring actions are recommended to provide baseline information before project implementation and effect determination monitoring from project implementation. This data will help validate design features and lead to better future project design, validate the effects analysis, and generally provide feedback to improve project planning and implementation to reduce aquatic biota impacts on other areas where landscape scale treatments are undertaken.

- Monitor fish population transects and aquatic macroinvertebrate sample stations one time before large-scale treatments are implemented if they have not been monitored in the last 5 years.
- Monitor fish population transects and aquatic macroinvertebrate sample stations one time immediately following project implementation and one final time 3 to 5 years following project implementation.
- Lake water quality monitoring (basic water chemistry, nutrient levels, and secchi disk depths) should be collected from fish supporting lakes in the project area before project implementation in that watershed, during project implementation, and 3 to 5 years following project implementation. Monitoring should be conducted monthly during the summer season with easy access from May/June through September/October (difficult access in winter and particularly transitional periods leading into and out of winter make sampling difficult, more dangerous, and not recommended).
- Repeat hydrological channel monitoring stations (cross-sections, longitudinal profiles, and photo points) that were established in or about 2001 on Manning Creek, Barney Creek, Dry Canyon, and Koosharem Creek. These stations should be resampled one time before large scale treatments are implemented, immediately following project implementation, and a final time 3 to 5 years following project implementation
- Project monitoring should be conducted to determine how well required project design features were implemented.

3.4.11.3 Recommended Additional Implementation Actions

Prior to beginning large scale implementation within a HUC6 watershed, the ERA modeling should be repeated for that HUC to incorporate the recovery period (i.e. years from this analysis to the implementation start date) for past projects, allow inclusion of new projects that were previously permitted but not yet carried out or completed during this planning process, and the proposed work. This will help incorporate effects from of currently approved but not yet implemented or completed work in the Box Creek, Monument Peak, and Cove Mountain/North Clover projects. If accurate fire modeling has been done, actual burn severity percentages should be used. If the new Equivalent Roaded Area modeling shows the proposed work would push the HUC over the suggested TOC, multiple entries should be considered to reduce cumulative effects to the subwatershed.

Consider subwatershed debris flow prone risk (and secondarily mass wasting and other soil erosion factors) when planning the implementation of specific burning treatments in watersheds with fish bearing streams and/or boreal toad habitat.

Prior to be beginning large scale prescribed burning within HUC7 or HUC8 subwatersheds that have been identified as being debris flow prone using the Cannon et al. (2003) model, additional modeling should be conducted using more extensive debris flow prediction techniques such as those in Cannon et al. (2010, Models A, B, or C depending on what soil information is available) or Cannon and DeGraff (2009, page 186 - equations 9.6 and 9.7). These could help determine any potential threshold points and/or appropriate sized treatment areas to achieve desired results while lessening the probability of serious downstream consequences.

3.4.11.4 Recommended Additional Mitigation Measures

The following mitigation measures, in addition to the already described design features, are recommended to further reduce impacts to aquatic biota and/or provide monitoring data for adaptive management changes to improve future project design.

- Rest degraded riparian areas adjacent to or below treatment sites prior to the actual treatments to increase riparian plant vigor and mass to help trap and hold sediment.
- Disperse treatments across watersheds and time to reduce impacts to aquatic biota. While large treatments are desirable to reduce ungulate browsing to aspen shoots, treating the same total area as a series of smaller areas in several watersheds over several years will likely result in fewer impacts to aquatics then treating a large block in one watershed within one year.
- If high erosion potential areas are found in post-implementation inspections, consider silt fence and/or straw-bale check dams within 300 feet of streams or ephemeral delivery channels as needed (similar to existing design feature but focused on streams/channels).
- Coordinate project treatments in watersheds containing BVCT with the UDWR southern region fisheries personnel (and vice versa).
- As closely as possible follow recommendation of the former Fishlake's soil scientist for soil water percentages that soil moisture sould be at least 8 to 10 percent water by weight

regardless of the season when a unit is burned to protect soil and plant root crowns that can resprout following fire.

- Past fire effects studies have often had limited description of fire severities. It is difficult to make quantitiative links between cause and effect without this data. Accurate mapping of the actual treatment areas burned, soil moistures, and associated fire severities in conjunction with the recommended aquatic monitoring listed above will provide data to further develop Forest specific relationships of treatment area/size, location within watersheds, proximity to streams, and fire severity to aquatic biota effects. Such data will aid in planning future vegetation treatment projects in high value aquatic resource watersheds on the Forest.

3.4.12 Compliance with Management Direction/Irreversible or Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitment of habitat associated with selection and implementation of the proposed action that affects threatened, endangered, or candidate aquatic biota.

This process has served to review the effects of implementing the Monroe Mountain Aspen Ecosystems Restoration Project on aquatic sensitive and management indicator species of the Fishlake National Forest. Adverse impacts that could affect the long-term viability of these aquatic sensitive and MIS species should be avoided provided the required design features listed above are implemented; thus, the proposed project would meet LRMP standards and guidelines. See Appendix A of the Biological Evaluation//MIS Report for Sensitive and MIS Aquatic species (Whelan 2014) for more information.

3.5 Issue 5 – Browsing by domestic and wild ungulates on new aspen shoots post-treatment and/or the continued high levels of aspen browsing in the stable aspen areas may result in complete loss of aspen stands; and Issue 6 – Project activities may result in livestock permittees not having a place to graze their livestock while vegetation is reestablishing on Monroe Mountain (two, or more, growing seasons)

3.5.1 Rocky Mountain Elk (*Cervus elaphus*)

This discussion is extrapolated directly from the Wildlife Specialist Report (Rasmussen 2014).

3.5.1.1 Direct and Indirect Effects

Elk habitat occurs across the entire Fishlake National Forest and the project area. There are approximately 1,458,049 acres of potentially suitable habitat on the Fishlake National Forest. Within the Fishlake LRMP II-29, Table II-8B (USFS 1986), the estimated population size of elk on the Fishlake National Forest was 2,000 head in 1986 when the LRMP was signed. Now the estimated population on Monroe according to UDWR as of winter 2013 is 1,300 (Table 122). Helicopter counts are collected on a three-year basis. Due to habitat improvement projects across the Forest, these data show an increase since 1986 when the plan was signed.

The UDWR collects population data and monitors harvest levels and trends of all big game populations, such as elk.

Big game is an economically important species; hunting demands are high and expected to continue. This area is managed as a trophy bull elk hunt with some variation of spike bull hunts being tried over the past 5 years. Numerous cow tags have been issued in recent years to keep the herd within the respective Herd Management Plan.

Elk can be found throughout the analysis area in spring, summer, and fall periods of the year. The area provides ideal habitat for elk during all important life cycle periods except for winter. The lower elevation portions of the proposed project area are transitional range, which is when big game animals spend time post winter and post summer.

Hiding cover is defined as vegetated areas where brush and trees are tall or dense enough to hide 90 percent of a deer or elk at 200 feet. Foraging habitat is defined as areas that provide an

adequate level of browse and non-woody plants for food. Areas of conifer/aspen and solitary aspen communities are especially important for elk calving habitat. These areas can be found throughout the analysis area. Elk prefer habitats where they are least disturbed. Studies have shown that big game avoid areas up to half a mile on each side of a road. This distance depends on topography, vegetation, and vehicle use near the road. Avoidance of these roaded areas decreases the habitat effectiveness in providing for big game needs.

The proposed project area is located at higher elevations that support a majority of summer range conditions for elk. A good balance of forage to cover ratios mixed with randomly dispersed water sources make the area ideal habitat for elk calving and rearing, breeding, and foraging in preparation for winter months. A large portion of the proposed treatment area is in a 4B management stategy according to the LRMP a management concern for MIS. Elk use the entire proposed treatment area. Some areas within the project area are utilized more based on specific habitat components unique to the life cycle of elk. Elk are an economically important species in most all states that have established elk herds. The Monroe elk herd has an important economic value to the local communities. Non-consumptive use provides non hunters or non-permit holders the opportunity to travel to the mountain to view, photograph, listen to, and enjoy elk in a natural wild environment. The number of people that enjoy non-consumptive elk opportunites is greater than the consumptive user. Monroe Mountain Elk Unit is designated as a trophy bull unit where a person has to apply for a chance to draw one of approximatley 30 to 40 tags offered each year for a mature bull elk. In each case a tremendouse amount of money is spent in the local communities for gas, optical equipment, camera equipment, hunting equipment, camping equipment and all associated vehicle costs as well as many other associated costs. For this reason local public support is high to keep an abundant elk herd on the mountain. This support for elk by the public could be counter productive to the project if elk numbers need to be reduced to facilitate the success of aspen recruitment after treatments. It is well documented that elk are attracted to areas that have been burned or mechanically treated and aspen regeneration and recruitment is part of the management objective. Camera trap studies on Monroe Mountain verify elk, deer, cattle and sheep are attracted to aspen regeneration. Elk are new to the mountain in recent decades. They were not introduced to Monroe Mountain but established from neighboring units that had elk re-introduction in the early 1900s. The first elk sightings were in the early 1970s. The UDWR manages the population by limited entry bull hunts, spike only bull hunts, and cow hunts to keep the population within the elk plan level. Changes in hunt timing, location, and permit numbers per elk sex are recommened by the UDWR, presented through the public Regional Advisory Council Process and then made law on an annual basis through the Utah Wildlife Board. This process demonstrates that the Forest Service does not control hunted game species in the State of Utah.

Based on UDWR data current elk populations on Monroe Mountain have trended in the following way:

Table 122. Estimated elk populations on Monroe Mountain Management Unit (UDWR)

YEAR	POPULATION ESTIMATE

1970's	Few elk sighted, 50 or less
1980's	Roughly 500 animals by end of 1980's
1982 (first hunt-10 permits)	---
1994 (first helicopter survey)	1,000
1997	809
2000	1,775
2003	1,300
2006	900
2009	1050
2013	1,300 (Modeled Population)

Current Monroe Elk Plan Objective = 1,800

In summary, elk are a MIS supported by the LRMP, a locally important ecological species, a economically important species, a protected hunted population managed by the UDWR through a public process and through a cooperatively signed management plan.

The Monroe Mountain Working Group has developed a "Thresholds Document" that has been included in this document (appendix C). It is designed to provide quantifiable browse thresholds and response options that could occur if browse thresholds are exceeded in treatment areas or if stable aspen stands do not show improvement. This would provide protection of aspen regeneration from ungulate browsing and trigger mechanisms that could come into play if aspen browsing is occurring at unacceptable levels. Opportunities to monitor and manage successful aspen regeneration through the direction of the Thresholds Document would range from livestock use modification, big game hunts targeted at population reductions in target areas, wildlife hazing, wildlife fencing, and others (MMWG 2014). This document has received support from the local Regional Advisory Council and the State Wildlife Board

Direct effects to elk may occur during the implementation period when burning operations may cause some individuals to be burned over. They would also be driven from their cover areas and need to re-located to adjacent areas. Indirectly, elk would compound use on other adjacent areas for cover and forage with other elk. This could cause an over use of forage when compounded by livestock.

Cumulative effects for elk will be considered on National Forest System Lands (excluding Bureau of Land Management administered lands, State, or private) across the entire Monroe

Mountain Unit since elk are migratory leaving summer range, transition range, and end up on winter range from November through April (depending length of winter condition).

Effects of Alternative 1 - No Action

If the no action alternative were selected, there would be no direct adverse impacts to habitat for late serial species, or improved habitat effectiveness on population numbers or viability of this species.

Since there would be no vegetation treatments under alternative 1, no decrease in immediate habitat effectiveness for elk would occur. Potential indirect effects may come from natural succession events as the areas move from early to mid-seral species to late seral communities. This may create decreases in habitat effectiveness on the quality of elk habitat over time as the variety of vegetation species is reduced as conifer continues to expand into aspen communities resulting in a lack of habitat diversity.

The area would likely remain suitable until an uncharacteristic event occurs. The area would likely remain susceptible to wildfire. A wildfire would likely occur during the summer months when the area impacted could be larger, without a broken mosaic pattern. In addition, the severity could be high and plant recovery and re-establishment may take longer. This type of wildfire could be stand replacing on a large scale that it would create areas of even age forest succession and be different than the type of forest that exist today. The balance of forage to cover ratios would likely affect usable elk habitat across the landscape of Monroe Mountain. This would cause elk to concentrate (on a short-term basis 2 to 4 years) on other parts of the range, which would compound effects to forage, and space where other elk traditionally occupy.

This type of uncharacteristic wildfire could be stand replacing on such a large scale that it would create an even age forest succession and alter the type of forest that exist today providing optimum elk habitat across the landscape of Monroe Mountain. However, if this type of change occurred and the landscape had time to recover for a few years, elk would find the burned area attractive for forage consumption. A lack of cover for elk could be an issue.

Effects of Alternatives 2 through 5 - Mechanical treatments and/or prescribed burning

Alternatives 2, 3, 4, and 5 all consist of a combination of mechanical forestry practices and prescribed fire. Mechanical treatments and/or prescribed burning proposed range from 27,981 to 36,300 acres. The total number of acres of conifer bearing acres is 18,877. Of these acres a mix of spruce and firs are combined. In alternative 2, 30 percent of spruce-fir is proposed for treatment, in alternative 3, 37 percent of spruce-fir is proposed for treatment, in alternative 4, 44 percent for treatment. Of mixed-conifer acres in the proposed area 30 to 44 percent treatment is proposed through the action alternatives (2 through 5) (Table 123).

Seral and stable aspen are found within their spring, summer and fall life cycle areas. In alternative 2, 39 percent of seral aspen is proposed for treatment, in alternative 3, 48 percent of seral aspen is proposed for treatment , in alternative 4, 55 percent of seral aspen is proposed for treatment and in alternative 5, 44 percent of seral aspen is proposed for treatment. As for stable

aspen, in alternative 2, 51 percent of stable aspen is proposed for treatment, in alternative 3, 56 percent of stable aspen is proposed for treatment, in alternative 4, 60 percent of stable aspen is proposed for treatment and in alternative 5, 55 percent of stable aspen is proposed for treatment (Table 123).

Elk will calve in an aspen dominated forest type, but will soon train their offspring to use the mixed-conifer and spruce-fir forest types as thermal and hiding cover. A balance of open meadows associated with cover (forested types) is an important combination for elk on the mountain.

Direct impacts for elk will occur when treatments occur. They will be displaced from their traditional summer ranges and have to combine with other elk in other summer range areas on the mountain. This could compress elk use in other areas; however, this would be short-term (less than 5 years) as the sudden response from treatments would improve and increase the summer forage for elk. Hiding cover would be affected to some extent, but with the percentages designed to be left for goshawk foraging areas (40 percent), ample cover should be maintained. Elk depend on a balance of forage to cover ratios to fulfill a balanced life cycle. As stated, as large acres of treatment occur, elk would be displaced to other areas where they would combine use with other elk. This would compound the forage use in the shared area making it problematic to maintain healthy aspen regeneration. A need to reduce elk numbers may be requested from the UDWR to minimize impacts to aspen regeneration. Once the treated areas begin to respond and have re-established a forage base, elk would return and utilize the area once again (less than 5 years). Indirect affects would be realized in other parts of the mountain as elk are dispersed from the treatments. Deer, cattle, and sheep range may be impacted if dispersed elk use their normal summer ranges. However, this would be a short-term issue as the treated areas offered many opportunities for additional forage into the future. This cumulative response would mean a better summer range to raise young, and improve body condition for winter months.

Table 123. Vegetation affected by alternatives, percentages, and acres treated compared to the analysis area

Compare CEA to Forested Type	Mechanical & Associated Slash Burning and Prescribed Fire - Mixed Burn Severities Factoring 60% of the Acres Get Burned	Total CEA acres	% of CEA proposed
Mixed Conifer----Alt. 2	2,607	5,220	49.9

Seral Aspen	12,241	31,129	39.3
Stable Aspen	8,820	17,009	51.9
Spruce-Fir	4,313	14,392	30.0
TOTAL	**27,981**	**67,750**	**41.3**
Mixed Conifer---Alt. 3	2,605	5,220	49.9
Seral Aspen	15,013	31,129	48.2
Stable Aspen	9,497	17,009	55.8
Spruce-Fir	5,348	14,392	37.2
TOTAL	**32,461**	**67,750**	**47.9**
Mixed Conifer---Alt. 4	2,609	5,220	50.0
Seral Aspen	17,150	31,129	55.1
Stable Aspen	10,146	17,009	59.7
Spruce-Fir	6,394	14,392	44.4
TOTAL	**36,300**	**67,750**	**53.6**
Mixed Conifer---Alt.5	2,605	5,220	49.9
Seral Aspen	13,742	31,129	44.1
Stable Aspen	9,406	17,009	55.3
Spruce-Fir	5,191	14,392	36.1
TOTAL	**30,944**	**67,750**	**45.7**

3.5.1.2 Cumulative Effects

Past, present and future activities in forested areas on Monroe Mountain may cause disturbance to elk in different ways. We have seen an increase of off-road vehicle traffic, camping, hunting, sightseeing, and private land development, on Monroe Mountain. We have seen an increase in mechanical treatments, natural and prescribed fire that have changed the density and patch size of older age aspen-mixed conifer on the mountain. Some recent work has been done to clear-cut, thin, or burn mixed conifer to stimulate aspen regeneration. Some of these recent treatments have caused a temporary shift in spring, summer, and fall elk use in the treatment areas. Once

the understory has re-established elk find the burned areas very attractive. They have to learn to balance cover areas. Cover areas would be island left un-burned in the mosaic pattern. These should be left unburned to allow a future balance of cover to forage. Hunters are attracted to newly burned areas because big game are attracted to these areas. Increased harvest success would occur in treated areas as well as an increase in wounding loss. Overall, and in the long term of large-scale treatments such as this proposal, as mosaic patterns are part of the design, big game animals are expected to thrive on the mountain.

Cumulative effects for elk will be considered on Forestlands (excluding Bureau of Land Management administered lands, State, or private) across the entire Monroe Mountain Unit since elk are migratory leaving summer range, transition range, and end up on winter range from November through April (depending length of winter condition).

Section 5 of Rasmussen 2014 describes the cumulative effects area, it's size, relationship with the actual analysis area and the rational behind the selection of the boundaries. The section also decscribes past,present, reasonably foreseeable projects and vegetative projects or fires that have occurred on Monroe Mountain. Also explained are "other" activities that have been known to or do occur on the mountain. All these activities may or may not have an effect on wildlife species that use the mountain at some part of their life cycle.

3.5.2 Mule Deer (*Odocoileus hemionus*)

This discussion is extrapolated directly from the Wildlife Specialist Report (Rasmussen 2014).

For a detailed description of the life history for this species refer to (Rodriguez 2008).

3.5.2.1 Direct and Indirect Effects

The UDWR collects post-season population data and monitors harvest levels and population trends of all big game species, such as mule deer. It should be noted that a hunting unit may be within approved herd unit objectives, and because of management strategies, population numbers may be reduced. The current and 5 year projected herd objective for Monroe Mountain is 8,000 deer. The unit is nearing herd unit objective, and active management is in the process of reducing total numbers (Table 124).

Hunting strategies in Utah are made through the Regional Advisory Council and Wildlife Board process. This process has been designed to involve the people in public meetings with a wide range of interests in Utah. Decisions for all hunting season bag limits and season dates are rendered based on political as well as biological input. This process demonstrates that the Forest Service does not control hunted game species in the State of Utah. Population fluctuations are the result of numerous influences including drought, cold winters, increased predation from large mammals, and habitat modifications and degradation. Although the numbers of young are recruited into the population are on a decline, the data show an increase in mature bucks into the population as well as an increase in buck to doe ratios.

The proposed project area is located at higher elevations that support summer range conditions for deer. A good balance of forage to cover ratios mixed with randomly dispersed water sources make the area ideal habitat for deer fawining and rearing, some deer rutting, and foraging in preparation for winter months.

A large portion of the proposed treatment area is in a 4B management stategy according to the LRMP. This management strategy gives the "benefit" to wildlife (MIS). Cumulative effects for deer are discussed in the cumulative effects section.

Table 124. Estimated deer population on Monroe Mountain Management Unit (UDWR)

YEAR	BUCK HARVEST	POPULATION EST.
1938	356	2,700
1941	823	6,300
1950	815	6,300
1960	2,000	15,400
1970	1,600	12,300
1980	1,161	8,900
1992	871	6,700
2000	1,031	7,900
2010	252	4,900
2013		7,800

Current Monroe Deer Plan Objective = 8,000

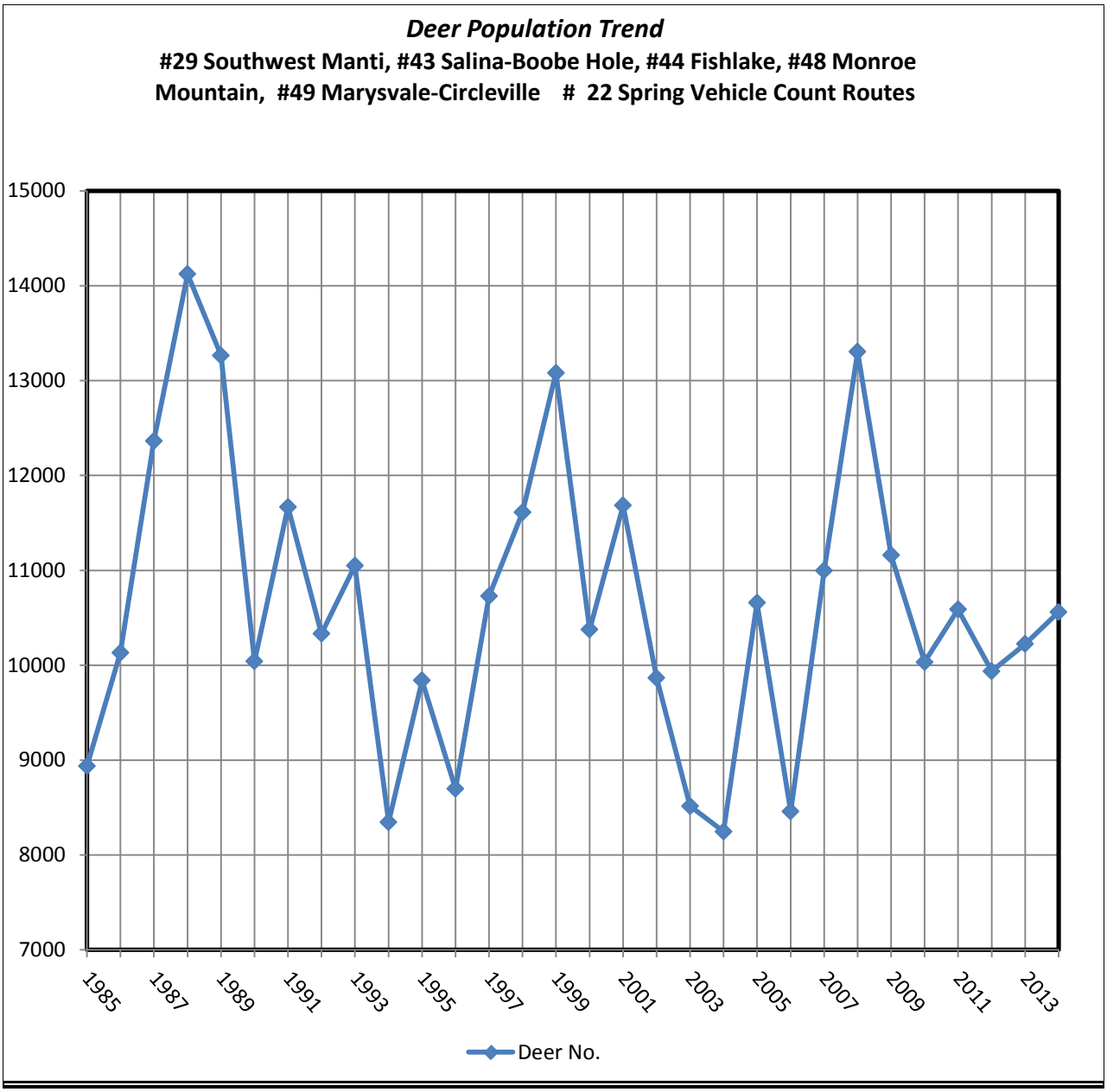


Figure 75. Deer trend data for central Utah including Monroe Mountain (Greenwood 2014)

Chart 1: Deer trend data for Central Utah including Monroe Mountain (Greenwood 2014).

Figure 75 shows spring trend data of deer populations in Central Utah (Sevier, Piute, Wayne, So. Sanpete). According to these data deer have peaked on an average of every 10 years.

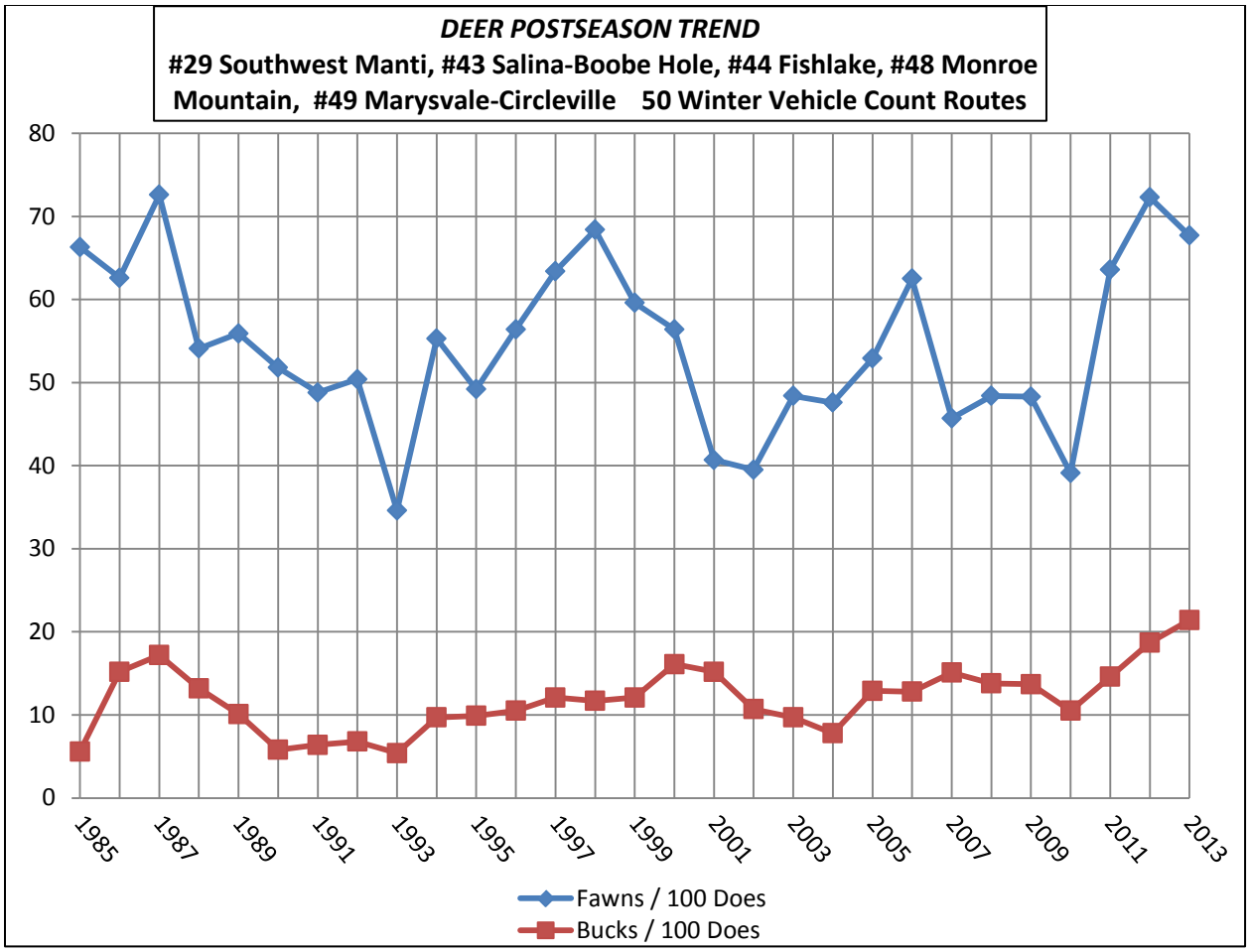


Figure 76. Deer post-season trend data for central Utah including Monroe Mountain (Greenwood 2013)

Figure 76 shows post-season trend data of deer populations in Central Utah (Sevier, Piute, Wayne, So. Sanpete). This chart shows buck to doe ratios and fawn to doe ratios. Data shows that buck to doe ratios are at an almost 30 year peak as well as fawn to do ratios.

Annual deer monitoring data has been gathered by the UDWR, Bureau of Land Management, and the Forest. Figure 75 and Figure 76 represent data gathered by the Bureau of Land Management and Forest. The need to gather deer (MIS) data by Federal agencies is connected to their respective land management plans.

Direct effects to deer may occur during the implementation period when burning operations may cause some individuals to be burned over. They would also be driven from their cover areas and need to re-located to adjacent areas. Indirectly deer would compound use on other adjacent areas for cover and forage with other deer.

Effects of Alternative 1 - No Action

If the no action alternative were selected, there would be no direct adverse impacts to habitat for late serial species, or improved habitat effectiveness on population numbers or viability of this species.

Since there would be no vegetation treatments under alternative 1, no decrease in immediate habitat effectiveness for deer would occur. Potential indirect effects may come from natural succession events as the areas move from early/mid seral species to late seral communities. This may create decreases in habitat effectiveness on the quality of deer habitat over time as the variety of vegetation species is reduced as conifer continues to expand into aspen communities resulting in a lack of habitat diversity.

The area would likely remain suitable until an uncharacteristic event occurs. The area would likely remain susceptible to wildfire. A wildfire would likely occur during the summer months when the area impacted could be larger, without a broken mosaic pattern. In addition, the severity could be high and plant recovery and re-establishment may take longer. This type of uncharacteristic wildfire could be stand replacing on a large scale that it could create areas of even age forest succession and be different than the type of forest that exist today. The balance of forage to cover ratios would likely affect usable deer across the landscape of Monroe Mountain. This would cause deer to concentrate (on a short-term basis 2 to 4 years) on other parts of Monroe Mountain, which would compound effects to forage, and space where other deer traditionally occupy.

This type of wildfire could be stand replacing on a large scale that it would create an even age forest succession and alter the type of forest that exist today providing optimum deer habitat across the landscape of Monroe Mountain; however, if this type of change occurred and the landscape had time to recover for a few years, deer would find the burned area attractive for forage consumption. A lack of cover would become an issue with fewer trees per acre.

Effects of Alternatives 2 through 5 - Mechanical treatments and/or prescribed burning.

Alternatives 2, 3, 4, and 5 all consist of a combination of mechanical forestry practices and prescribed fire. Mechanical treatments and/or prescribed burning proposed range from 27,981 to 36,300 acres. The total number of acres of conifer bearing acres is 18,877. Of these acres a mix of spruce and firs are combined. In alternative 2, 30 percent of spruce-fir is proposed for treatment, in alternative 3, 37 percent of spruce-fir is proposed for treatment, in alternative 4, 44 percent of spruce-fir is proposed for treatment, and in alternative 5, 36 percent of spruce/fir is proposed for treatment. Of mixed-conifer acres in the proposed area 30 to 44 percent treatment is proposed through the action alternatives (2 through 5) (percentages taken from spreadsheet Table 123, a comparison of the proposed treatment acres by forest type against the total acres of forest type).

Seral and stable aspen are found within their spring, summer and fall life cycle areas. In alternative 2, 39 percent of seral aspen is proposed for treatment, in alternative 3, 48 percent of seral aspen is proposed for treatment , in alternative 4, 55 percent of seral aspen is proposed for

treatment and in alternative 5, 44 percent of seral aspen is proposed for treatment. As for stable aspen, in alternative 2, 51 percent of stable aspen is proposed for treatment, in alternative 3, 56 percent of stable aspen is proposed for treatment, in alternative 4, 60 percent of stable aspen is proposed for treatment and in alternative 5, 55 percent of stable aspen is proposed for treatment (Table 123)

Deer will fawn in an aspen-mountain brush dominated forest type, but will soon train their offspring to use the aspen, mixed-conifer and spruce-fir forest types as thermal and hiding cover. A balance of open meadows associated with cover (forested types) is an important combination for deer on the mountain.

Direct impacts for deer will occur when treatments occur. Deer studies on Monroe Mountain indicate that most of the fawning occurs on the fringe areas of the Forest (Freeman et al. 2014). They will be displaced from their traditional summer ranges and have to combine with other deer in other summer range areas on the mountain. This could compress deer use in other areas. However, this would be short-term (less than 5 years) as the sudden response from treatments would improve and increase the summer forage for deer. Hiding cover would be affected to some extent, but with the percentages designed to be left for goshawk foraging areas (40 percent), ample cover should be maintained. Indirect affects would be realized in other parts of the mountain as deer are dispersed from the treatments. Elk, cattle, and sheep range may be impacted if dispersed deer used their normal summer ranges. However, this would be a short-term (less than 5 years) issue, as the treated areas would offer many opportunities for additional forage into the future. This cumulative response would mean a better summer range to raise young, and improve body condition for winter months.

3.5.2.2 Cumulative Effects:

Past, present and future activities in forested areas on Monroe Mountain may cause disturbance to deer in different ways. We have seen an increase of off-road vehicle traffic, camping, hunting, sightseeing, and private land development, on Monroe Mountain. We have seen an increase in mechanical treatments, natural and prescribed fire that have changed the density and patch size of older age aspen-mixed conifer on the mountain. Some recent work has been done to clear-cut, thin, or burn mixed conifer to stimulate aspen regeneration. Some of these recent treatments have caused a temporary shift in spring, summer, and fall deer use in the treatment areas. Once the understory has re-established deer find the burned areas very attractive. They have to learn to balance cover areas. Cover areas would be islands left un-burned in the mosaic pattern. These should be left unburned to allow a future balance of cover to forage. Hunters are attracted to newly burned areas because big game are attracted to these areas. Increased harvest success would occur in treated areas as well as an increase in wounding loss. Overall, and in the long term of large scale treatments such as this proposal, as mosaic patterns are part of the design, big game animals are expected thrive on the mountain.

Section 5 of Rasmussen 2014 describes the cumulative effects area, it’s size, relationship with the actual analysis area and the rational behind the selection of the boundaries. The section also decscribes past,present, reasonably foreseeable projects and vegetative projects or fires that have occurred on Monroe Mountain. Also explained are “other” activities that have been known to or

do occur on the mountain. All these activities may or may not have an effect on wildlife species that use the mountain at some part of their life cycle.

3.5.3 Domestic Ungulates (Cattle (*Bos taurus*) and Sheep (*Ovis aries*))

This discussion is extrapolated directly from the Rangeland Resource Specialist Report (Partridge 2014).

3.5.3.1 Methodology for Analysis

The rangeland analysis examines the current vegetation conditions and the desired vegetation condition on Monroe Mountain. It identifies the gap between the two conditions and analyzes the proposed alternatives and the design features of the alternatives to determine the effects that each alternative would have on the rangeland resources on Monroe Mountain.

The analysis discusses the acres to be treated by alternative and includes a simple analysis on the value of forage for livestock grazing.

3.5.3.2 Environmental Indicators

The environmental indicators to be measured are:

1. The number of acres to be treated or disturbed by alternative.
2. The percentage of the historical aspen ecosystem acres on Monroe Mountain to be treated.
3. The percentage of National Forest System land on Monroe Mountain to be treated.
4. An estimated cost per AUM.

There are slight differences in the number of acres to be treated in the alternatives. The percentage of the historical aspen ecosystem acres to be treated by each alternative gives a reference of how much of the historical aspen will be treated. The percentage of National Forest System lands on Monroe Mountain to be treated provides a big picture view of just how much of Monroe Mountain will be treated by the project for cumulative effects purposes.

The estimated cost per AUM measure provides an insight of the impact to the permittees from resting treated areas.

3.5.3.3 Affected Environment

Existing Condition

The Fishlake National Forest manages 1.7 million acres of National Forest System lands of which more than 1,036,000 acres are rangelands. There are 74 designated grazing allotments managed by the Forest. Livestock are trailed to and from forest grazing allotments in early summer and fall. There are numerous structural (water trough, pipelines, fences, corrals, etc.) and nonstructural (seeding, chaining, prescribed burns, etc.) range improvements on the forest associated with these allotments.

This aspen ecosystem restoration project focuses on restoring aspen on Monroe Mountain with mechanical and prescribed burn treatments in the aspen, mixed conifer, and spruce/fir cover types. Monroe Mountain is located in south-central Utah, south of Richfield, west of Koosharem, and east of Marysvale. It encompasses approximately 175,705 acres of National Forest System lands administered by the Fishlake National Forest, Richfield Ranger District, and approximately 11,805 acres of private inholdings. It is divided into 11 livestock grazing allotments. The proposed action is to implement treatments designed to restore aspen on 10 of the allotments. The 10 affected allotments are divided into 33 pastures/units.

Aspen is a keystone species and historically was a landscape dominant on Monroe Mtn. Aspen is an early successional tree species (sun loving and shade intolerant). Individual aspen trees arise almost exclusively from root suckers. Aspen sprouts heavily following disturbance and is relatively short-lived (i.e. 100 to 200 years). As it matures natural selection, self-thinning, and competition from other tree species work to reduce and replace aspen with late successional vegetation. Without some kind of a disturbance (i.e. fire or logging), aspen will eventually be replaced by late successional species. Grazing of aspen by animals tends to speed up the succession process because some of the aspen seedlings do not survive after being grazed. Stable aspen is not replaced by late successional species, but in the lack of disturbance to stimulate it to sprout, the aspen may die.

Range conditions on Monroe Mountain are different today than they were before Euro-American settlement. Changes in human uses (grazing, timber harvests, recreation, water use, etc.), disturbance regimes (fire, insects, etc.), climatic conditions, and wildlife species density have led to a decline in aspen and an increase in conifer species. Of the 175,705 National Forest System acres on Monroe Mountain, aspen historically occurred on approximately 71,000 acres. Aspen-dominated cover (stable aspen) currently occurs on approximately 17,009 acres. Much of this stable aspen has a component of mixed conifer in the understory (primarily subalpine fir). Approximately 31,129 acres are dominated by seral aspen; much of this seral aspen co-exists with mixed conifer (primarily subalpine fir). Approximately 5,210 acres on Monroe Mountain are dominated by mixed conifer (Engelmann spruce, Douglas fir, ponderosa pine, and white fir). Much of this mixed conifer co-exists with aspen. Approximately 13,667 acres are dominated by spruce/fir with an aspen component. Approximately 43,877 acres in the project area are dominated by sagebrush cover types (primarily big sagebrush), some (approximately 12,231 acres) of which may have been aspen communities in the recent past. Dominance by sagebrush is not a successional pathway for aspen; however, in the absence of recruitment, aspen can be

replaced with shrub cover types. These sagebrush-dominated communities still have some scattered aspen trees/stands.

These changes have resulted in a smaller forage base for livestock and wildlife. Charles Kay (2003) reported that, "On average, aspen communities produce around 2,000 pounds of air-dried forage per acre, while conifers typically produce 150 pounds or less (Muggler 1988). Historically, there were over 300,000 acres of aspen on the Forest, but today, aspen occupies only about 150,000 acres (Bartos and Campbell 1998a). As aspen communities have been converted to conifers, approximately 150,000 AUMs have been lost on the Fishlake."

In 2008, Stam et al. (2008) reported that conifer cover affected aspen understory biomass in a major way in studies done on the Cedar City Ranger District of the Dixie National Forest, the Richfield Ranger District of the Fishlake National Forest, and private land on Cedar Mountain east of Cedar City, Utah. Their 2003 data showed a range of 1482 kilograms per hectare^{-1} at 0 (zero) percent conifer cover to a low of 10 kilograms per hectare^{-1} at 60 percent conifer cover. They quoted Mueggler, "Production can reportedly be reduced by 50 percent when conifers make up as little as 15 percent of the total tree basal area on the site (Mueggler 1985 and 1988)."

In a 2004 study titled *Quantifying Losses of Understory Forage in Aspen Stands on the Dixie and Fishlake National Forests*, by Stam et al. (2004), they reported approximately 10 million to 13 million dollars in additional revenue could be realized if historic aspen sites on the Dixie and Fishlake National Forests had not experienced reduced forage production because of conifer encroachment. This revenue would only be realized by livestock producers if additional forage were allocated totally to livestock grazing. They also reported that the additional grazing capacity could generate as much as $309,297.00 in the current year alone in livestock grazing fees for the two forests, if it was all allocated to livestock.

Historically, cattle and sheep use on Monroe Mountain was much higher than current use (Figure 5). Cattle and sheep use began in the late 1800s, and peaked around 1910 with use of about 23,000 AUMs. There was a steep decline (about three-fold) in livestock AUM use on Monroe Mountain reaching a low in the 1960s and 1970s of about 7,000 AUMs. Cattle use declined since 1910 by about 7,000 AUMs and sheep use about 6,700 AUMs. Livestock use has remained flat since the 1950's. Although Figure 5 shows total AUMs in 2010 are similar to total AUMs in 1910, the 1910 AUMs displayed in Figure 5 are likely conservative because mule deer AUMs are not included. In 1910, the AUMs were cattle and sheep while in 2010 the AUMs were cattle, sheep, deer, and elk. All these animals browse aspen.

Historical deer use is particularly hard to estimate, but using harvest data as a surrogate, mule deer use increased from 1930 reaching a peak of about 20,000 AUM's in the 1960s. Mule deer use has declined since the 1960s to about 7,000 AUMs today. Certainly, the number of deer in central Utah is nowhere near the peak numbers of the 1960s.

Elk use of Monroe Mountain appears much heavier than historically. Old-time residents of the region can recall seeing their first elk on Monroe Mountain in the 1960s. Using winter counts as a basis to estimate, elk AUMs have increased from 0 (zero) in the 1960s to a peak of about 9,000 AUMs in 2000 and about 6,000 in 2010.

Noxious weeds and invasive species (e.g. cheatgrass) management are a big concern on rangelands managed by the Forest. Various weed and vegetation treatments have been implemented to control the spread of noxious weeds and invasive species. There have not been large infestations of noxious weeds identified on Monroe Mountain. No noxious weeds are known to occur where prescribed fire or mechanical treatments are proposed.

Desired Condition

Aspen communities are persistent with multi-aged stems and adequate recruitment. Aspen ecosystems contain a variety of age classes and structural components distributed across the landscape (Table 2). Aspen systems regain dominance, reclaimed mainly from Engelmann spruce/subalpine fir, and mixed conifer types accompanied by marked increases in understory vegetation and groundcover. Conifers occupy less than 15 percent of the canopy (Campbell and Bartos 2001). Mature and old aspen stands comprise about 40 percent of the structural class distribution. Young aspen comprise about 20 percent of the structural class distribution (Table 3). Dominant aspen trees are generally less than 100 years old. Other age classes are evenly distributed between early, young, and mid-age classes. Diverse aspen conditions support a large variety of animals. Associated herbaceous and woody vegetation are highly variable. Perennial grasses and forbs dominate the understory areas with a range of shrub cover resulting in minimal bare ground within aspen systems. Site productivity generally determines individual stand densities. Aspen regeneration success is achieved through an integrated sprout protection program (see appendix C). Fire regimes are adequate to perpetuate aspen, particularly in areas seral to conifer.

Stable aspen is a term used to describe aspen stands in which conifer trees play little or no role. The stable aspen stands were classified into three broad categories based upon the density of living canopy trees. In addition to the dominant canopy trees, aspen recruits (greater than 12 feet tall but clearly below the dominant canopy), aspen saplings (6 to 12 feet tall and at low risk to being top-browsed), and aspen sprouts (less than 6 feet tall and at relatively high risk to being top-browsed) are also generally present.

Data was collected from 58 stable aspen stands on Monroe Mountain. The stands were divided into the following categories listed in order of decreasing health **full (F)** for fully self-replacing; **transitional (T),** with recruitment levels that are borderline to those necessary for self-replacement; **marginal (M)**, where recruitment is happening but at a level that might not be sufficient for self-replacement; and **non-self-replacing (N)** where recruitment is not happening, or is at a level that is clearly too low to maintain the stand through time. The stands were then further classified by the density of the canopy trees. The categories for canopy density are greater than 1,000 canopy trees per acre **high density Stable Aspen Class 1 (SA1), low density Stable Aspen Class 2 (SA2)** with canopy tree densities of less than 200 trees per acre, and **intermediate-density Stable Aspen Class (SA3)** is defined by a density of 200 to 1000 canopy trees per acre. Overall, in 2013, 11 of 58 (19 percent) stable aspen stands were classified as fully self-replacing, 5 (9 percent) as transitional, 13 (22 percent) as marginal and 29 (50 percent) as non-self-replacing (Table 4). To move towards the desired conditions of having persistent aspen communities, with multi-height stems and adequate recruitment to perpetuate the aspen

communities, the desire is for the stable aspen stands to be in SA1, SA2-F, or SA3-F; therefore, 79 percent (47 stands) of the stable aspen stands need to improve.

3.5.3.4 Environmental Consequences

This aspen ecosystem restoration project focuses on restoring aspen on Monroe Mountain with mechanical and prescribed burn treatments in the aspen, mixed conifer, and spruce/fir cover types. The cumulative effects boundary for this analysis will be the area considered as Monroe Mountain (Figure 1). There are five alternatives being considered for detailed analysis. The acres to be treated under the alternatives range from 0 (zero) under alternative 1 (no action) to 47,274 acres under alternative 4 (Table 43 and Table 125). These tables also show the miles of temporary roads that are proposed for each alternative.

The expected timeframe to implement this project is 10 years, minimum. The scale and timing of the mechanical and prescribed fire treatments are likely to affect the level of impacts that both wild and domestic grazers have on aspen response to treatments. Under all of the alternatives, most of the rangeland resources will continue to be managed as they are currently being managed with pasture rotations based on utilization standards. There will be a temporary loss of vegetation when areas are treated and temporary roads are built and used. After areas are treated, they will be rested from livestock grazing for at least two growing seasons to allow the vegetation some recovery time. It is expected that diversity and amount of understory vegetation in conifer/aspen stands will improve as the treatments are completed.

Table 125. Alternative comparison table for livestock grazing

Alternative	Acres on Monroe Mountain Treated/ Disturbed	% of Historical Aspen on Monroe Mountain Treated	% of NFS Land on Monroe Mountain Treated
Alternative 1	0	0%	0%
Alternative 2	41,177	58%	23%
Alternative 3	45,004	63%	26%
Alternative 4	47,274	67%	27%
Alternative 5	41,525	58%	24%

The rest from livestock grazing will be a work in progress depending on the specifics and timing of the individual treatments. The treatments may require anything in between entire allotments being rested, to a very small portion of an allotment needing rest. Grazing rotations will be modified, as needed, which may result in not following existing rest or deferment schedules for a limited time (i.e. 1 to 3 years). Herding and temporary electric fences can help minimize the effects to the permittees brought on by the required rest period after treatment. If these are ineffective then complete rest of the pasture will be considered. The Forest also installed some structural improvements as part of the *Monroe Mountain Livestock Management Improvement Project* (USFS 2013). These structural improvements are expected to indirectly improve grazing animal distribution and help with the rest requirements of this project. The planning and implementation of livestock grazing rest for treatment areas will require a solid working relationship between the Forest Service and livestock grazing permittees. This working relationship will play a key role in the success of this aspen restoration project.

Figure 77. Aspen ecosystem on Monroe Mountain

Figure 78. Aspen ecosystem on Monroe Mountain

Wildlife will still be grazing treatment areas after they are treated. This continued wildlife grazing presents a risk to aspen recovery following treatments. To address this risk, the District is proposing quantifiable browsing thresholds and response options to aid in accomplishing desired conditions. See the overview of the proposed action section of the Rangeland Resource Specialist Report (Partridge 2014) and appendix C for details.

Any time vegetation is treated or soil is disturbed on the forest there is a risk of noxious weed establishment. Currently there are no noxious weeds known to occur in the proposed treatment

areas and there are weed related design features to help minimize the potential effects (chapter 2).

Alternative 1 - No Action

The no action alternative is to continue with the current management. This alternative does not address the stated purpose and need of the project as described above. Under this alternative 0 (zero) acres of the aspen ecosystems targeted in this project would be treated. The most likely time aspen disturbance would occur is during a wildfire event or until a NEPA analysis is completed to authorize the treatment of aspen. There is no means of predicting when or where this would occur.

Direct Effects

Consequences of this alternative are continued degradation of the aspen ecosystem and continued loss of understory habitat and forage. Aspen dominated acres are expected to decline without disturbance to remove competition and stimulate the aspen to regenerate. This decline in aspen will reduce the forage that is available for livestock.

Indirect Effects

Continued livestock and wildlife grazing will speed up the rate of aspen decline (succession) as aspen sprouts are grazed. This could lead to a need to reduce livestock grazing as the carrying capacity of the land changes.

Figure 79. Unsuccessful treatment on Monroe Mountain. There is no aspen regeneration left because it was grazed off.

Cumulative Effects

A list of the past, present, and reasonably foreseeable projects on Monroe Mountain has been assembled and is attached in appendix A of the Rangeland Resource Specialist Report (Partridge 2014). Many of those projects are vegetation manipulation projects. Usually there is a short-term loss of vegetation associated with vegetation projects followed by an increase in rangeland vegetation (grasses, forbs, shrubs, and aspen). Rangeland resources benefit from the increased vegetation. The increase in vegetation provides more forage for grazing animals, which reduces the intensity and frequency of grazing on the plants. It also provides beneficial ecological effects such as plant species diversity, plant age class diversity, and decreased bare ground, etc.

Other projects listed in appendix A of the Rangeland Resource Specialist Report (Partridge 2014) include projects to manage livestock grazing. Effects of grazing (from livestock and wildlife) have played a part of Monroe Mountain's history and the aspen ecosystem decline. Grazing of aspen sprouts tends to speed up vegetation succession from early seral aspen plant communities to late seral (conifer) communities. Grazing will continue to play a role in the future condition of Monroe Mountain as wildlife use the forest and livestock are permitted to graze on the forest.

Aspen ecosystems on Monroe Mountain are still declining despite numerous small-scale past vegetation treatments (mechanical and prescribed fire). The Forest has not been able to do large enough vegetation treatments and control ungulate grazing on the treatment areas to improve the aspen ecosystems on the Monroe Mountain landscape (Figure 77). The cumulative effects of the no action alternative added to the lack of large-scale vegetation manipulation projects in the past, present, and reasonably foreseeable future increases the risk of losing the aspen ecosystem from Monroe Mountain entirely. Approximately 76 percent of the historic aspen ecosystem acres have already been lost or is experiencing a conversion of dominant cover type (Campbell and Bartos 2001; Figure 78 and Figure 79). Appendix A of the Rangeland Resource Specialist Report (Partridge 2014) indicates that presently and in the foreseeable future approximately 28 percent of the National Forest acres on Monroe Mountain will be treated if the no action alternative is chosen.

Irreversible and Irretrievable Commitments of Resources

Losing the aspen ecosystems entirely because of no action (no treatment, reduced recruitment, continued grazing, and succession) would be an irreversible and irretrievable commitment of resources.

Alternatives 2 through 5 (Actions Applicable all Action Alternatives)

Under all of the alternatives, the 4,212 acre Dairies pasture of the Koosharem Allotment would be rested for the duration of this project. The permittees on the Koosharem Allotment would have to get through the implementation of this project with seven pastures instead of eight. Approximately 782 acres would be treated in the Dairies Pasture under alternatives 2 through 5. Loss of this pasture may result in impacts to the permittees on the Koosharem Allotment if other pastures do not have enough forage for livestock.

Temporary fencing (approximately 7.8 miles) would be installed around Manning Meadows Reservoir and Barney Lake. This fence would be approximately 8 feet tall and constructed with net wire, t-post, and wooden post. Maintenance of the temporary fence would occur for 4 to 6 years until the aspen sprouts are greater than 6 feet tall, after which the fence would be removed. This fence would allow grazing of the non-treated areas around Manning Meadows Reservoir and Barney Lake while providing rest for the treated areas. Ground disturbance associated with this fence would be between approximately 1.9 and 7.6 acres depending on the width of the disturbance needed to put up the fence:

$$\frac{(7.8\,miles\ \times 5{,}280\,feet) \times 2\,feet\,of\,disturbance}{43{,}560\,feet} \approx 1.9\,acres$$

$$\frac{(7.8\,miles\ \times 5{,}280\,feet) \times 8\,feet\,of\,disturbance}{43{,}560\,feet} \approx 7.6\,acres$$

One of the treatment options considered for the mechanical treatments is to thin conifer up to 8 inch DBH from below within IRAs and draft UUAs. This option would leave conifer trees that are greater than 8 inch DBH in the stand so conifers would continue to make up part of the basal area of the stand. The increase in early seral plants (biomass/forage) after treatment will be reduced, because the larger conifers are left and make up part of the basal area in the stand. The treatment may have a shorter lifespan because the larger conifer trees that are left continue to grow and shade the ground. If the trees that are left are affected by bark beetles, the shading effect might not be as bad, and the trees might eventually fall and break down opening the canopy so aspen and understory plants could increase. Stam et al. (2008) reported that conifer cover affected aspen understory biomass in a major way. They cited Mueggler, "Production can reportedly be reduced by 50 percent when conifers make up as little as 15 percent of the total tree basal area on the site (Mueggler 1985, 1988)."

Alternative 2

This alternative is to treat 41,177 acres of Monroe Mountain with a combination of mechanical and prescribed fire treatments. This alternative would include 8,186 acres of mechanical and 32,991 acres of prescribed fire treatments. There would be 8.8 miles of temporary road construction under this alternative. Approximately 2.4 acres are disturbed for each mile of road constructed (15 feet road width, 20 feet disturbance width):

$$\frac{(20\,feet\,distrubance\,width \times 5{,}280\,feet\,per\,mile)}{43{,}560\,feet\,per\,acre} \approx 2.4\,acres\,per\,mile$$

About 21 acres would be disturbed for temporary road construction.

This alternative would allow the treatment of the least amount of acres of any of the alternatives excluding the no action alternative.

Direct Effects

The direct effects of Alternative 2 treatments on the rangelands of Monroe Mountain are a short-term loss of vegetation followed by an increase in early seral vegetation (grasses, forbs, shrubs, and aspen), and vegetative diversity. To control the amount of vegetation lost at one time and allow for recovery of treated areas before more acres are treated, restrictions on the amount of a HUC 6 that can be treated at one time and grazing rest are design features of this alternative (chapter 2).

When vegetation is removed and ground is disturbed for temporary road construction and mechanical treatments there is an increased risk of invasive plant and noxious weed

establishment. To reduce the risk of invasive plant and noxious weed establishment equipment would be washed and inspected, prior to entering National Forest System lands, to remove any soil and debris that may contribute to the spread of noxious weeds. Treatment areas would be monitored post-implementation. If noxious and/or invasive weeds were detected, the District would take the appropriate actions to control spread and eliminate the noxious and/or invasive weeds from the treatment areas.

Indirect Effects

The short-term loss of vegetation could result in a loss of AUMs. The timeframe for this project is approximately 10 years, which would be treating about 4,100 acres per year.

Resting treated areas from livestock grazing could lead to a loss of grazing opportunities for livestock permittees, through reducing the season of use or authorized numbers of livestock. If grazing opportunities are lost, permittees will have to find other feed (AUMs) for their livestock during the rest period. Generally, finding feed to replace lost AUMs on the forest is more expensive because the current grazing fee charged by the forest is only $1.35 per AUM. If permittees have to feed hay, the cost could be about $90 per AUM:

$$\frac{900\ pounds\ of\ forage\ required\ per\ 1\ AUM}{2000\ pounds\ of\ hay\ (1\ ton)} \times \$200\ per\ ton\ of\ hay \approx \$90\ per\ 1\ AUM$$

Impacts to the permittees would be minimized using herding and temporary electric fences so that treatment areas can be rested while non-treatment areas can continue to be grazed. Continued livestock grazing in the non-treatment areas is subject to the Fishlake National Forest forage utilization standards and guidelines. Annual monitoring and enforcement of these standards and guidelines would continue.

Cumulative Effects

A list the past, present and reasonably foreseeable actions that are relevant to range management on Monroe Mountain is included in appendix A of the Rangeland Resource Specialist Report (Partridge 2014). Most of the projects identified in this appendix are vegetation management and livestock grazing improvement projects. Vegetation management projects usually end up being beneficial for the rangeland resources. The livestock management projects distribute grazing over a larger area to reduce the impact to any particular location. Most of the acres treated on Monroe Mountain have been with fire (prescribed fire and wildfire). Prescribed fire is the treatment that will be used to treat most of the acres included in all the alternatives.

The past treatments in the aspen communities have been relatively small and the aspen regeneration (sprouts) have suffered from the effects of grazing, as animals keyed in on those small treatments which produced more and better forage. Appendix A of the Rangeland Resource Specialist Report (Partridge 2014) also shows that approximately 49,000 (28 percent of National Forest Service acres on Monroe Mountain) acres of vegetation (mixed vegetation types) have been or will be treated from 1969 through 2015 (46 years) a little over 1,000 acres per year.

Alternative 2 would treat almost that many acres (41,000) in the aspen ecosystem in a 10-year period 4,100 acres per year.

Alternative 2 is a large-scale vegetation project designed to restore the aspen ecosystem on Monroe Mountain. Approximately 58 percent of the historical aspen ecosystem on Monroe Mountain will be treated by this alternative:

$$\frac{41{,}177\ acres\ proposed\ for\ treatment}{71{,}000\ acres\ of\ historical\ aspen\ habitat} \approx 0.58\ (or\ 58\ percent)$$

The thought behind this large-scale treatment is that to restore the aspen communities large landscape scale projects are needed so grazing animals will not overuse any one area and wipe out the aspen regeneration. This should be beneficial to the rangeland resources and provide more forage for grazing animals using the Monroe Mountain aspen ecosystem.

This 41,177 acres represents 23 percent of the NFS acres on Monroe Mountain:

$$\frac{41{,}177\ acres\ proposed\ for\ treatment}{175{,}705\ acres\ on\ Monroe\ Mountain} \approx 0.23\ (or\ 23\ percent)$$

When added with the past, present and reasonably foreseeable actions the cumulative effect that Alternative 2 would have on the environment is that approximately 51 percent of the National Forest System acres on Monroe Mountain would have better forage conditions.

Alternative 3

Under this alternative 45,004 acres will be treated which is 3,827 (9 percent) more acres of aspen treatment than Alternative 2. Alternative 3 would include 13,647 acres of mechanical and 31,357 acres of prescribed fire treatments. There would be 8.8 miles of temporary road construction under this alternative. About 21 acres would be disturbed for temporary road construction.

Direct Effects

The direct effects of proposed alternative 3 treatments on the rangelands of Monroe Mountain are a short-term loss of vegetation followed by an increase in early seral vegetation (grasses, forbs, shrubs, and aspen), and vegetative diversity. To control the amount of vegetation lost at one time and allow for recovery of treated areas before more acres are treated, restrictions on the amount of a HUC 6 that can be treated at one time and grazing rest are design features of this alternative (see chapter 2).

When vegetation is removed and ground is disturbed for temporary road construction and mechanical treatments there is an increased risk of invasive plant and noxious weed establishment. To reduce the risk of invasive plant and noxious weed establishment equipment would be washed and inspected, prior to entering National Forest System lands, to remove any soil and debris that may contribute to the spread of noxious weeds. Treatment areas would be

monitored post implementation. If noxious and/or invasive weeds were detected, the District would take the appropriate actions to control spread and eliminate the noxious and/or invasive weeds from the treatment areas.

Indirect Effects

The short-term loss of vegetation could result in a loss of AUMs. The timeframe for this project is approximately 10 years, which would be treating about 4,500 acres per year.

Resting treated areas from livestock grazing could lead to a loss of grazing opportunities for livestock permittees, through reducing the season of use or authorized numbers of livestock. If grazing opportunities are lost, permittees will have to find other feed (AUMs) for their livestock during the rest period. Generally finding feed to replace lost AUMs on the forest is more expensive because the current grazing fee charged by the forest is only $1.35 per AUM. If permittees have to feed hay, the cost could be about $90 per AUM (see equation above). Impacts to the permittees would be minimized with herding and temporary electric fences so that treatment areas can be rested while non-treatment areas can continue to be grazed. Continued livestock grazing in the non-treatment areas is subject to the Fishlake National Forest forage utilization standards and guidelines. Annual monitoring and enforcement of these standards and guidelines would continue.

Cumulative Effects

A list the past, present and reasonably foreseeable actions that are relevant to range management on Monroe Mountain is included in appendix A of the Rangeland Resource Specialist Report (Partridge 2014). Most of the projects identified in this appendix are vegetation management and livestock grazing improvement projects. Vegetation management projects usually end up being beneficial for the rangeland resources. The livestock management projects distribute grazing over a larger area to reduce the impact to any particular location. Most of the acres treated on Monroe Mountain have been with fire (prescribed fire and wildfire). Prescribed fire is the treatment that will be used to treat most of the acres included in alternative 3.

The past treatments in the aspen communities have been relatively small and the aspen regeneration (sprouts) have suffered from the effects of grazing, as animals keyed in on those small treatments which produced more and better forage. Appendix A of the Rangeland Resource Specialist Report (Partridge 2014) also shows that approximately 49,000 (28 percent of National Forest System acres on Monroe Mountain) acres of vegetation (mixed vegetation types) have been or will be treated from 1969 through 2015 (46 years) a little over 1,000 acres per year. Alternative 3 would treat almost that many acres (45,000) in the aspen ecosystem in a 10-year period 4,500 acres per year.

Alternative 3 is a large-scale vegetation project designed to restore the aspen ecosystem on Monroe Mountain. Approximately 63 percent of the historical aspen ecosystem on Monroe Mountain will be treated by this alternative:

$$\frac{45{,}004\ acres\ aspen\ proposed\ for\ treatment}{71{,}000\ acres\ of\ historial\ aspen\ habitat} \approx 0.63\ (or\ 63\ percent)$$

The thought behind this large-scale treatment is that to restore the aspen communities large landscape scale projects are needed so grazing animals will not overuse any one area and wipe out the aspen regeneration. This should be beneficial to the rangeland resources and provide more forage for grazing animals that are using the Monroe Mountain aspen ecosystem.

This 45,004 acres represents 26 percent of the NFS acres on Monroe Mountain:

$$\frac{45{,}004\ acres\ proposed\ for\ treatment}{175{,}705\ acres\ on\ Monroe\ Mountain} \approx 0.26\ (or\ 26\ percent)$$

When added with the past, present and reasonably foreseeable actions the cumulative effect that Alternative 3 would have on the environment is that approximately 54 percent of the NFS acres on Monroe Mountain would have better forage conditions.

Alternative 4

Alternative 4 is to treat 47,274 acres of Monroe Mountain with a combination of mechanical and prescribed fire treatments. Of the five alternatives being analyzed, this alternative proposes the most acres for treatment. It includes 6,097 (15 percent) more acres for treatment than alternative 2. This alternative would include 19,838 acres of mechanical and 27,436 acres of prescribed fire treatments. There would be 13.3 miles of temporary road construction under this alternative. About 32 acres would be disturbed for temporary road construction.

Direct Effects

The direct effects of proposed alternative 4 treatments on the rangelands of Monroe Mountain are a short-term loss of vegetation followed by an increase in early seral vegetation (grasses, forbs, shrubs, and aspen), and vegetative diversity. To control the amount of vegetation lost at one time and allow for recovery of treated areas before more acres are treated, restrictions on the amount of a HUC 6 that can be treated at one time and grazing rest are design features of this alternative (see chapter 2).

When vegetation is removed and ground is disturbed for temporary road construction and mechanical treatments there is an increased risk of invasive plant and noxious weed establishment. To reduce the risk of invasive plant and noxious weed establishment equipment would be washed and inspected, prior to entering National Forest System lands, to remove any soil and debris that may contribute to the spread of noxious weeds. Treatment areas would be monitored post implementation. If noxious and/or invasive weeds were detected, the District would take the appropriate actions to control spread and eliminate the noxious and/or invasive weeds from the treatment areas.

Indirect Effects

The short-term loss of vegetation could result in a loss of AUMs. The timeframe for this project is approximately 10 years, which would be treating about 4,700 acres per year.

Resting treated areas from livestock grazing could lead to a loss of grazing opportunities for livestock permittees, through reducing the season of use or authorized numbers of livestock. If grazing opportunities are lost, permittees will have to find other feed (AUMs) for their livestock during the rest period. Generally finding feed to replace lost AUMs on the forest is more expensive because the current grazing fee charged by the forest is only $1.35 per AUM. If permittees have to feed hay, the cost could be about $90 per AUM (see equation above). Impacts to the permittees would be minimized with herding and temporary electric fences so that treatment areas can be rested while non-treatment areas can continue to be grazed. Continued livestock grazing in the non-treatment areas is subject to the Fishlake National Forest forage utilization standards and guidelines. Annual monitoring and enforcement of these standards and guidelines would continue.

Cumulative Effects

A list the past, present and reasonably foreseeable actions that are relevant to range management on Monroe Mountain is included in appendix A of the Rangeland Resource Specialist Report (Partridge 2014). Most of the projects identified in this appendix are vegetation management and livestock grazing improvement projects. Vegetation management projects usually end up being beneficial for the rangeland resources. The livestock management projects distribute grazing over a larger area to reduce the impact to any particular location. Most of the acres treated on Monroe Mountain have been with fire (prescribed fire & wildfire). Prescribed fire is the treatment that will be used to treat most of the acres included in all the alternatives.

The past treatments in the aspen communities have been relatively small and the aspen regeneration (sprouts) have suffered from the effects of grazing, as animals keyed in on those small treatments which produced more and better forage. Appendix A of the Rangeland Resource Specialist Report (Partridge 2014) also shows that approximately 49,000 (28 percent of National Forest System acres on Monroe Mountain) acres of vegetation (mixed vegetation types) have been or will be treated from 1969 through 2015 (46 years) a little over 1,000 acres per year. Alternative 4 would treat almost that many acres (47,000) in the aspen ecosystem in a ten-year period 4,700 acres per year.

Alternative 4 is a large-scale vegetation project designed to restore the aspen ecosystem on Monroe Mountain. Approximately 67 percent of the historical aspen ecosystem on Monroe Mountain will be treated by this alternative:

$$\frac{47{,}274\ acres\ proposed\ for\ treatment}{71{,}000\ acres\ of\ historical\ aspen\ habitat} \approx 0.67\ (or\ 67\ percent)$$

The thought behind this large-scale treatment is that to restore the aspen communities large landscape scale projects are needed so grazing animals would not overuse any one area and wipe

out the aspen regeneration. This should be beneficial to the rangeland resources and provide more forage for grazing animals that are using the Monroe Mountain aspen ecosystem.

This 47,247 acres represents 27 percent of the National Forests System acres on Monroe Mountain:

$$\frac{47{,}247\ acres\ proposed\ for\ treatment}{175{,}705\ acres\ on\ Monroe\ Mountain} \approx 0.27\ (or\ 27\ percent)$$

When added with the past, present and reasonably foreseeable actions the cumulative effect that Alternative 4 would have on the environment is that approximately 55 percent of the National Forest System acres on Monroe Mountain would have better forage conditions.

Alternative 5

Alternative 5 is to treat 41,525 acres of Monroe Mountain with a combination of mechanical and prescribed fire treatments. The acres treated by alternative 5 are slightly higher (1 percent) than the acres treated under alternative 2 the difference lies in the amount of mechanical treatment compared to the amount of prescribed fire treatment. This alternative would include 15,072 acres of mechanical and 26,453 acres of prescribed fire treatments. There would be 12.8 miles of temporary road construction under this alternative. About 31 acres would be disturbed for temporary road construction.

Direct Effects

The direct effects of proposed Alternative 5 treatments on the rangelands of Monroe Mountain are a short-term loss of vegetation followed by an increase in early seral vegetation (grasses, forbs, shrubs, and aspen), and vegetative diversity. To control the amount of vegetation lost at one time and allow for recovery of treated areas before more acres are treated, restrictions on the amount of a HUC 6 that can be treated at one time and grazing rest are design features of this alternative (see chapter 2).

When vegetation is removed and ground is disturbed for temporary road construction and mechanical treatments there is an increased risk of invasive plant and noxious weed establishment. To reduce the risk of invasive plant and noxious weed establishment equipment would be washed and inspected, prior to entering National Forest System lands, to remove any soil and debris that may contribute to the spread of noxious weeds. Treatment areas would be monitored post implementation. If noxious and/or invasive weeds were detected, the District would take the appropriate actions to control spread and eliminate the noxious and/or invasive weeds from the treatment areas.

Indirect Effects

The short-term loss of vegetation could result in a loss of AUMs. The timeframe for this project is approximately 10 years, which would be treating about 4,200 acres per year.

Resting treated areas from livestock grazing could lead to a loss of grazing opportunities for livestock permittees, through reducing the season of use or authorized numbers of livestock. If grazing opportunities are lost, permittees will have to find other feed (AUMs) for their livestock during the rest period. Generally finding feed to replace lost AUMs on the forest is more expensive because the current grazing fee charged by the forest is only $1.35 per AUM. If permittees have to feed hay, the cost could be about $90 per AUM (see equation above). Impacts to the permittees would be minimized with herding and temporary electric fences so that treatment areas can be rested while non-treatment areas can continue to be grazed. Continued livestock grazing in the non-treatment areas is subject to the Fishlake National Forest forage utilization standards and guidelines. Annual monitoring and enforcement of these standards and guidelines would continue.

Cumulative Effects

A list the past, present and reasonably foreseeable actions that are relevant to range management on Monroe Mountain is included in appendix A of the Rangeland Resource Specialist Report (Partridge 2014). Most of the projects identified in this appendix are vegetation management and livestock grazing improvement projects. Vegetation management projects usually end up being beneficial for the rangeland resources. The livestock management projects distribute grazing over a larger area to reduce the impact to any particular location. Most of the acres treated on Monroe Mountain have been with fire (prescribed fire and wildfire). Prescribed fire is the treatment that will be used to treat most of the acres included in all the alternatives.

The past treatments in the aspen communities have been relatively small and the aspen regeneration (sprouts) have suffered from the effects of grazing, as animals keyed in on those small treatments which produced more and better forage. Appendix A of the Rangeland Resource Specialist Report (Partridge 2014) also shows that approximately 49,000 (28 percent of National Forest System acres on Monroe Mountain) acres of vegetation (mixed vegetation types) have been or will be treated from 1969 through 2015 (46 years) a little over 1,000 acres per year. Alternative 5 would treat almost that many acres (42,000) in the aspen ecosystem in a 10-year period 4,200 acres per year.

Alternative 5 is a large-scale vegetation project designed to restore the aspen ecosystem on Monroe Mountain. Approximately 58 percent of the historical aspen ecosystem on Monroe Mountain will be treated by this alternative:

$$\frac{41{,}525\ acres\ proposed\ for\ treatment}{71{,}000\ acres\ of\ historical\ aspen\ habitat} \approx 0.58\ (or\ 58\ percent)$$

The thought behind this large-scale treatment is that to restore the aspen communities large landscape scale projects are needed so grazing animals will not overuse any one area and wipe out the aspen regeneration. This should be beneficial to the rangeland resources and provide more forage for grazing animals that are using the Monroe Mountain aspen ecosystem.

This 41,525 acres represents 24 percent of the National Forest System acres on Monroe Mountain:

$$\frac{41{,}525\ acres\ proposed\ for\ treatment}{175{,}705\ acres\ on\ Monroe\ Mountain} \approx 0.24\ (or\ 24\ percent)$$

When added with the past, present and reasonably foreseeable actions the cumulative effect that Alternative 5 would have on the environment is that approximately 52 percent of the National Forest System acres on Monroe Mountain would have better forage conditions.

3.5.3.5 Irreversible and Irretrievable Commitments of Resources

Since aspen reproduces by suckering, losing the aspen ecosystem entirely after treatment would be irreversible and irretrievable. Alternatives 2 through 5 are all large-scale aspen ecosystem treatments designed to restore aspen ecosystems. Adequate regeneration and protection of the regeneration from the effects of overgrazing (from livestock and wildlife) are keys to the success of this project. Section 2.6 and appendix C outline treatment monitoring and response options that could be taken to control the effects of overbrowsing on aspen regeneration.

3.5.3.6 Conclusions

With many demands for forage in the West, including elk, deer, and permitted livestock grazing the decision to take no action and face losing such prolific producers of forage, as aspen are capable of should not be acceptable. A decision to make no changes in management (including no treatments) is still a decision and it carries its own risks and consequences as succession continues to move the vegetation toward late seral vegetation communities. The risks and consequences include (1) continued degradation of the aspen ecosystem, (2) continued loss of forage, and (3) increased risks of large wildfires with associated concerns.

Alternatives 2 through 5 are all large-scale aspen ecosystem treatments designed to restore aspen ecosystems. All of these alternatives would treat approximately 23 to 27 percent of the National Forest System acres on Monroe Mountain. Adequate regeneration and protection of the regeneration from the effects of overgrazing (livestock and wildlife) are keys to the success of this project, to restore aspen ecosystems. The rangeland resources should benefit from any of the treatments. The difference between the alternatives regarding disturbance associated with the miles of temporary roads is small and should not affect the results of the project.

There were two issues effecting rangeland resources identified during project scoping. All the alternatives include design features and mitigation measures to address the issues.

Issue 5: *Browsing by domestic and wild ungulates on new aspen shoots post-treatment and/or the continued high levels of aspen browsing in the stable aspen areas may result in complete loss of aspen stands.* There are design features and mitigation measures built into this proposed project that are designed to address this issue. First, livestock will not be allowed to graze treated areas for at least two growing seasons after treatment. Second, the District is proposing quantifiable aspen browse thresholds and response options that would be implemented if thresholds are exceeded (section 2.9 and appendix C). These browse thresholds and response

options are applicable to Alternatives 2 through 5. Based on implementation of the browse thresholds and response options, an adequate number of new aspen sprouts following treatments are expected to reach 6 feet in height and stable aspen stands are expected to begin showing improvement; thus moving towards accomplishing the desired conditions outlined for this project.

Issue 6: *Project activities may result in livestock permittees not having a place to graze their livestock while vegetation is reestablishing on Monroe Mountain (two, or more, growing seasons).* The acres that are proposed for treatment through this project are spread across nine different grazing allotments. Impacts to permittees would be minimized by the use of herding and temporary electric fences so that treatment areas and/or stable aspen stands can be rested while non-treatment areas can continue to be grazed. The permittees will also be notified at least 1 year in advance of treatments being done on their allotments so that they can plan accordingly. Based on this summary, the District anticipates that permittees will have a place to graze their livestock while treatment areas or stable aspen stands are being rested. Based on this summary, the District anticipates that permittees would have a place to graze their livestock while treatment areas or stable aspen stands are being rested.

Even though the difference in effects may be minor, alternative 4 would be the best alternative for range management on Monroe Mountain because more acres, 27 percent of National Forest System land on Monroe Mountain, would be treated. This alternative has the potential to produce the biggest increase in forage resources for grazing animals.

3.6 Issue 7 – Project activities may result in adverse impacts to old growth characteristics

This discussion is extrapolated directly from the Vegetation Specialist Report (Holsclaw 2014).

3.6.1 Methodology for Analysis

The primary source of information for the analysis in this report is derived from common stand exam (CSE) data. Data was collected during the 2013 field season. The project area was divided into thirds providing a northern, central, and southern section. Stands were chosen by cover type within each zone ensuring that we had a sample that covered the entire project area. The goal was to collect data on 10 percent of the stands and 10 percent of the acres by cover type across the project area. The cover types targeted were: 1) aspen (stable and seral), 2) spruce/fir, and 3) mixed conifer. Data was collected using random plot sampling and a common stand exam recommendation of 1 plot per 10 acres with a minimum of 3 plots for those stands less than 30 acres (Natural Resource Information System (NRIS) 2013). It is the professional opinion of the District forester that this sampling is representative of the above cover types and is sufficient for analyzing the entire project area.

Data derived from CSE was used in the Forest Vegetation Simulator (FVS) model. This is a growth and yield model able to calculate the growth and yield of stands through time. The FVS

model is also capable of modeling different management alternatives and silvicultural systems and project them through time.

Many years of research have gone into the development of the FVS model and it is very good at calculating growth and yield. The model uses the common stand exam data to project growth and yield; however, (with the exception of species that sucker (mainly aspen and oaks)) it cannot predict the amount or input regeneration through time. Because the model behaves in this way, trees that are removed due to harvest, fire, and/or density mortality, etc., are not replaced. When projected through time, it will eventually run out of trees and outputs can then become erroneous and unreliable. With that said, assumptions were made concerning regeneration. The assumptions are based on experience related to regeneration density and survival rates, the Fishlake LRMP, and input from the interdisciplinary team. The assumptions are based on cover types to maintain consistency with this report and the LRMP.

Aspen Cover Type- minimum average of 5,000 suckers (aspen trees less than 6 feet in height) per acre. This number is outlined as the desired condition for this project. The LRMP outlines a minimum value of 300 seedlings per acre with a desired of 600 seedlings per acre (pg. IV-32).

Spruce/fir Cover Type- Natural regeneration (stocking) of 155 seedlings per acre (pg. IV-32 of LRMP).

Mixed Conifer- Natural regeneration (stocking) of 215 seedlings per acre (pg. IV-32 of LRMP).

Photos taken during CSE data collection were also used in this analysis to illustrate stands as examples of composition, structure, etc. These photos are included in the project record.

Geographic Information System (GIS) information was also used as part of the analysis. This use would be in the form of maps. These maps are included in the project record.

3.6.2 Affected Environment

Old growth is analyzed by cover type as written by Hamilton (1993) in *Characteristics of Old Growth in the Intermountain Region*. In addition, the Intermountain Regional Office issued a memo in 2007 to further clarify the measures needed to establish what the minimum old growth standard is. In this memo, it is stated, “The minimum criteria to define old-growth forest in the Intermountain Region are: DBH, trees per acre, and age.” Old growth is getting its own heading because the (LRMP states in the General Direction section on page IV-II, 1(c), “in a forested unit 5 percent or more should be in old growth”. A forested unit is being defined as the entire forested area within the project boundary. This includes all the cover types. Table 126 outlines what the current conditions are as it relates to old growth.

Points of clarification: In each cover type, Hamilton (1983) offers an area of application. He describes where these attributes need to be applied. Under the aspen cover type, Hamilton explains that the old growth aspen definition applies to the stable and grazing disclimax stands. The seral stands may contain what may qualify as old growth, but its maintenance would require

a treatment to remove the competing conifers. In Table 126 seral aspen stands are included within the calculations because the proposed action, in part, is removing conifers as a "maintenance action and to promote aspen regeneration". Therefore, it is the professional opinion of the District forester that the analysis meets the requirements as outlined by Hamilton.

Hamilton does not have a cover type listed as mixed conifer; therefore, the District forester chose to use the Douglas fir cover type. It was chosen because Hamilton's description of dry or colder, lower productivity sites fit with the composition of most of the mixed conifer stands in the project area. Hamilton's best description is, "Douglas fir often the seral dominant as well as the climax dominant. Engelmann spruce or subalpine fir also are climax habitat types series". Some of the surveyed stands contained white fir. Although Hamilton does not address those in his description, they are a common associate at lower, drier elevations.

Table 126. Current percentage of forested acres of old growth in areas proposed for treatments

Cover Type	Acres	Acres in Old Growth	Percentage of Old Growth
Aspen	35,985	13,314	37%
Mixed Conifer	4,280	0	0%
Spruce/fir	8,065	807	10%
Forested Acres	**48,330**	**14,121**	**29%**

Most of the old growth currently exists within the aspen cover type followed by spruce/fir. Mixed conifer contains elements of old growth but did not fully meet the definition (mainly because it did not have enough trees per acre greater than or equal to 15 inches DBH) and none of the mixed conifer stands had trees old enough to meet the greater than or equal to 200 years old.

There has been an outbreak of spruce beetles on Monroe Mountain. Little if any was picked up in the common stand exam in the form of measured dead trees. The outbreak consisted mainly in the Indian Peaks area as of 2013. The outbreak has moved south and it has reached the Manning Meadows Reservoir and Barney Lake areas. Site visitations in 2014 revealed massive loss of overstory and likely mature trees. This epidemic will likely decrease the old growth within the spruce/fir cover type. In addition to the spruce beetle, a spruce budworm outbreak is occurring. Spruce budworm is a defoliator insect attacking the new needles. There preferred species is Douglas fir and subalpine fir. They will go after spruce but that is not the preferred. The spruce budworm does not usually kill the larger trees (although they can kill the smaller ones) but stresses them making them more susceptible to other things such as the Douglas fir beetle. Halloin (2003) confirms the last statement in his research stating, **"**Smaller trees tend to suffer more from the effects of defoliation, and larger trees tend to suffer more mortality from subsequent bark beetle attack."

3.6.3 Environmental Consequences

3.6.3.1 Alternative 1 – No action

Direct Effects

Old growth is described in chapter 1 as it relates to the current condition on Monroe Mountain. Old growth currently meets the desired condition as outlined in the LRMP (Table 127). The percentage of old growth increases with this alternative as time progress. As with the VSS, the old growth for the aspen cover type is somewhat misleading in some stands in year 50 and 100 because it is likely that some of those stands would convert to mixed conifer and/or spruce/fir or die because of old age. Some mixed conifer qualifies as old growth 100 years from now.

In addition, current spruce beetle outbreak is likely to affect the larger trees in the spruce/fir and mixed conifer cover types because larger older trees are preferred by the beetle. Larger, older Douglas fir trees are susceptible to Douglas fir beetle and maybe affected if an outbreak of Douglas fir beetle were to occur.

Table 127. Old growth for alternative 1 - no action

Current			
Cover Type	Acres	Acres in Old Growth	Percentage of Old Growth
Aspen	35,985	13,314	37%
Mixed Conifer	4,280	0	0%
Spruce/fir	8,065	807	10%
Forested Acres	**48,330**	**14,121**	**29%**
Desired Forested Acres		**5%**	
Year 50- No Action			
Cover Type	Acres	Acres in Old Growth	Percentage of Old Growth
Aspen	35,985	24,830	69%
Mixed Conifer	4,280	0	0%
Spruce/fir	8,065	2,984	37%
Forested Acres	**48,330**	**27,814**	**58%**
Desired Forested Acres		**5%**	

Year 100- No Action			
Cover Type	Acres	Acres in Old Growth	Percentage of Old Growth
Aspen	35,985	32,746	91%
Mixed Conifer	4,280	1,712	40%
Spruce/fir	8,065	3,629	45%
Forested Acres	**48,330**	**38,088**	**79%**
Desired Forested Acres		**5%**	

3.6.3.2 Alternative 2

Direct Effects

Table 128 compares forested old growth between alternative 2, options 1 and 2, with alternative 1.

Table 128. Old growth comparison between alternatives 1 and 2

Old Growth									
	Mech Treatment (total Acres)	Mechanical Acres in Old Growth Option 1 and 2	60% of Acres Burned	Acres in Old Growth- 60% of Acres Burned	Current Forested Acres	Current Acres in Old Growth	Total Acres of Old Growth Affected by Treatments	Difference	Percentage of Old Growth Remaining After Treatment
Alt 1	0	0	0	0	48330	14121	0	0	29%
Alt 2	8,186	92	19,795	5,479	48,330	14,121	5,571	8,550	18%

Alternative 2 shows an 11 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 2, options 1 and 2 result in LRMP related old growth standards being achieved.

Cumulative Effects

Old growth would decline by 11 percent via past and present actions and decline 1 percent through foreseeable future actions, totaling 12 percent for past present and foreseeable future actions (Table 129). The LRMP related old growth standards would be achieved.

Table 129. Cumulative effects on old growth for alternative 2

Cumulative Effects- Old Growth							
	Present Forested Acres	Present Acres in Old Growth	Alt. 2 Acres of Old Growth Affected	Foreseeable Future Actions Affecting Old Growth	Total Acres Affecting Old Growth (Past, Present and Foreseeable Future)	Percent of Old Growth remaining after Alt. 2	Percentage of Old Growth remaining after all past, present, and reasonably foreseeable actions are completed
Alt 1	48,330	14,121	0	0	0	0	29%
Alt 2	48,330	14,121	5,571	135	5,706	18%	17%

3.6.3.3 Alternative 3

Direct Effects

Table 130 compares forested old growth between alternative 3, options 1 and 2, with alternative 1.

Table 130. Old growth comparison between alternative 1 and alternative 3

Old Growth									
	Mech Treatment (total Acres)	Mechanical Acres in Old Growth Option 1 and 2	60% of Acres Burned	Acres in Old Growth- 60% of Acres Burned	Current Forested Acres	Current Acres in Old Growth	Total Acres of Old Growth Affected by Treatments	Difference	Percentage of Old Growth Remaining After Treatment
Alt 1	0	0	0	0	48330	14121	0	0	29%
Alt 3	13,648	236	18,814	5,223	48,330	14,121	5,459	8,662	18%

Alternative 3 shows an 11 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 3, options 1 and 2 result in LRMP related old growth standards being achieved.

Cumulative Effects

Old growth will decline by 11 percent via past and present actions and decline 1 percent through foreseeable future actions, totaling 12 percent for past present and foreseeable future actions (Table 131). The LRMP related old growth standards would be achieved.

Table 131. Cumulative effects on old growth for alternative 3

Cumulative Effects- Old Growth							
	Present Forested Acres	Present Acres in Old Growth	Alt. 3 Acres of Old Growth Affected	Foreseeable Future Actions Affecting Old Growth	Total Acres Affecting Old Growth (Past, Present and Foreseeable Future)	Percent of Old Growth remaining after Alt. 2	Percentage of Old Growth remaining after all past, present, and reasonably foreseeable actions are completed
Alt 1	48,330	14,121	0	0	0	0	29%
Alt 3	48,330	14,121	5,459	228	5,687	18%	17%

3.6.3.4 Alternative 4

Direct Effects

Table 132 compares forested old growth between alternative 4, options 1 and 2, with alternative 1.

Table 132. Old growth comparison between alternative 1 and alternative 4

Old Growth									
	Mech Treatment (total Acres)	Mechanical Acres in Old Growth Option 1 and 2	60% of Acres Burned	Acres in Old Growth- 60% of Acres Burned	Current Forested Acres	Current Acres in Old Growth	Total Acres of Old Growth Affected by Treatments	Difference	Percentage of Old Growth Remaining After Treatment
Alt 1	0	0	0	0	48330	14121	0	0	29%
Alt 4	19,837	411	16,462	4,547	48,330	14,121	4,958	9,163	19%

Alternative 4 shows a 10 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 4, options 1 and 2 result in LRMP related old growth standards being achieved.

Cumulative Effects

Old growth will decline by 10 percent via past and present actions and decline 1 percent through foreseeable future actions, totaling 11 percent for past present and foreseeable future actions (Table 133). The LRMP related old growth standards would be achieved.

Table 133. Cumulative effects on old growth for alternative 4

Cumulative Effects- Old Growth							
	Present Forested Acres	Present Acres in Old Growth	Alt. 4 Acres of Old Growth Affected	Foreseeable Future Actions Affecting Old Growth	Total Acres Affecting Old Growth (Past, Present and Foreseeable Future)	Percent of Old Growth remaining after Alt. 2	Percentage of Old Growth remaining after all past, present, and reasonably foreseeable actions are completed
Alt 1	48330	14121	0	0	0	0	29%
Alt 4	48,330	14,121	4,958	228	5,186	19%	18%

3.6.3.5 Alternative 5

Direct Effects

Table 134 compares forested old growth between alternative 5, options 1 and 2, with alternative 1.

Table 134. Old growth comparison between alternative 1 and alternative 5

Old Growth									
	Mech Treatment (total Acres)	Mechanical Acres in Old Growth Option 1 and 2	60% of Acres Burned	Acres in Old Growth- 60% of Acres Burned	Current Forested Acres	Current Acres in Old Growth	Total Acres of Old Growth Affected by Treatments	Difference	Percentage of Old Growth Remaining After Treatment
Alt 1	0	0	0	0	48330	14121	0	0	29%
Alt 5	15,072	291	15,872	4,325	48,330	14,121	4,616	9,505	20%

Alternative 5 shows a 9 percent decline in forested old growth for option 1 and 2 versus alternative 1. Implementation of alternative 5, options 1 and 2 result in LRMP related old growth standards being achieved.

Cumulative Effects

Old growth will decline by 9 percent via past and present actions and decline 1 percent through foreseeable future actions, totaling 10 percent for past present and foreseeable future actions (Table 135). The LRMP related old growth standards would be achieved.

Table 135. Cumulative effects on old growth for alternative 5

Cumulative Effects- Old Growth							
	Present Forested Acres	Present Acres in Old Growth	Alt. 5 Acres of Old Growth Affected	Foreseeable Future Actions Affecting Old Growth	Total Acres Affecting Old Growth (Past, Present and Foreseeable Future)	Percent of Old Growth remaining after Alt. 2	Percentage of Old Growth remaining after all past, present, and reasonably foreseeable actions are completed
Alt 1	48330	14121	0	0	0	0	29%
Alt 5	48,330	14,121	4,616	228	4,844	20%	19%

3.7 All Other Resources

The analyses of the resources related to the issues are outlined above. These resources were extrapolated from the specialists' resource reports. The rest of the analysis for these resources can be found directly in the resource reports. These reports have been incorporated into this document by reference. They are as follows:

- Air Quality (Chappell 2014)
- Aquatic Species (Whelan 2014)
- Botany (Tait 2014)
- Climate Change (Holsclaw 2014)
- Cultural/Heritage (Leonard 2014)
- Fire and Fuels (Chappell et al. 2014)
- Hydrology and Soils (Solt 2014)
- Inventoried Roadless Areas and Draft Unroaded-Undeveloped Areas (Christensen 2014a)
- Recreation (Christensen 2014b)
- Wildlife (Rasmussen 2014)
- Visuals (Christensen 2014c)
- Vegetation (Holsclaw 2014)

Please refer to these reports for the potential direct, indirect, and cumulative effects that this project may have on these resources. All specialists' reports can be found on the Fishlake National Forest's website at www.fs.usda.gov/projects/fishlake/landmanagement/projects. Paper copies of all reports are available upon request at the Fishlake National Forest Supervisor's Office located in Richfield, Utah.

3.8 Short-term Uses and Long Term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Overall, aspen restoration along with other proposed treatments including mechanical and prescribed fire would be expected to increase ecosystem resiliency to uncharacteristic fire, and move soils and watersheds toward satisfactory and functional condition in both the short- and long-term and maintain or improve long-term soil productivity and water quality (see the Hydrology and Soils Specialist Report (Solt 2014)).

Short-term effects of tree removal and prescribed fire would reduce inter tree competition and free-up growing space for residual trees and understory vegetation. Under all alternatives, the proposed actions and associated design features would not affect long-term productivity of forest vegetation and timber resources (see the Vegetation Specialist Report (Holsclaw 2014)).

3.9 Unavoidable Adverse Effects

There would not be any unavoidable adverse effects to hydrology and soil resources. Potential adverse effects would be minimized or mitigated through appropriate use of resource protection measures outlined and project design criteria.

There would not be any unavoidable adverse effects related to forest vegetation and timber resources as adverse effects are mitigated by design features and mitigation.

For Northern goshawk, there is likely to be a short-term decrease in habitat quantity and quality; however, these values would increase in the long-term.

In the short-term (1 to 5 years), visual disturbances from restoration activities would be within the referenced conditions of the area. Disturbances would be visible and would lower the scenic quality. Potential short-term effects include exposure of bare soil, tree stumps, and contrasting color and texture of surfacing materials. The effects would become less noticeable as natural vegetation is reestablished and the surface material begins to be incorporated into the soil horizon.

The alternatives would cause short-term and temporary decreases in provision of recreation opportunities on parts of the District. There may be short-term displacement of recreationists during implementation and a temporary decrease in the quality of recreation settings due to the presence of slash, skid trails, log landings, temporary road construction, and creation of dust and noise from logging operations and log hauling. Logging operations including loss of herbaceous

cover, disorderly management activities, and noise and dust, as well as lack of information, have been found to decrease the quality of recreation settings and user satisfaction.

3.10 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

An irretrievable commitment of resources is associated with alternative 1, the no action alternative. In alternative 1, there is the likelihood that there would be additional larger fires with larger areas with higher severity fires than occurred historically. Post-fire effects that require decades of recovery would be irretrievable in the short-term and potentially the long-germ. For example, topsoil that is critical to healthy surface vegetation would take centuries to recover. The loss of old growth and old trees would be irretrievable, as it would require decades and centuries to recover. When considered with climate change, it is unknown exactly what the ecological trajectory would be for the replacement of old growth and old trees (see Fire and Fuels Specialist Report (Chappell et al. 2014).

3.11 Cumulative Effects

Cumulative effects are addressed in the environmental consequences 'topics' discussions listed above or in each of the referenced specialists' reports (see section 3.7). Please refer to the specific discussion or resource report for a detailed discussion of cumulative effects for this project.

3.12 Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

- All potentially affected tribes were contacted during the Notice-of-Intent phase of project development. No tribe provided comments during this phase. However, a copy of this draft document will be sent to all tribes for their comment as per consultation requirements of the National Historic Preservation Act.
- The Utah State Historic Preservation Office (SHPO) has been contacted regarding this project and the consultation package for this draft document is being prepared. Section 106 concurrence and clearance for the project will be documented completed in the final EIS.

- The U.S. Fish and Wildlife Service (USFWS) were contacted during the Notice-of-Intent phase of project development. They stated that they had no comments for the project at that time. No affects to threatened, endangered, candidate, or proposed species would occur with project implementation, therefore, consultation with the USFWS is not required. However, a copy of this document will be sent to the USFWS for their comment.
- No section 404 permits would be required from the U.S. Army Corps of Engineers as no stream channel alterations would occur because of this project.

4 CONSULTATION AND COORDINATION

4.1 Preparers and Contributors

The Forest Service consulted the following individuals, Federal, state, and local agencies, tribes, and non-Forest Service persons during the development of this draft environmental impact statement.

The following personnel (Table 136) were directly involved with preparation of this draft environmental impact statement.

Table 136. DEIS preparers and contributors

Name	Title	DEIS Contribution
Chappell, Linda	Fire Ecologist	Fire/Fuels; Air Quality
Child, Daniel	Civil Engineer	Transportation
Christensen, David	Recreation Specialist	IRA/draft UUA; Recreation; Visuals
Cornwall, Kelly	Fuels Specialist	Fire/Fuels
Freeborn, Wess	Fuels Specialist	Fire/Fuels
Hollingsworth, LaWen	Fire Behavior Specialist	Fire/Fuels
Holsclaw, Terry	Forester	Vegetation; Climate Change
Jensen, Dustin	GIS Specialist	GIS; Data Analysis
Kitchen, Stanley G.	Research Biologist	Fire/Fuels; Browse Thresholds
Kling, Jason	Richfield District Ranger	NEPA; Writer/Editor
Knight, Jenneka	GIS Specialist	GIS; Data Analysis
Leonard, Robert	Archaeologist	Cultural/Heritage
Pace, Vince	Range Management Specialist	Range
Partridge, Art	Range Management Specialist	Range
Rasmussen, Kreig	Wildlife Biologist	Wildlife
Rodriguez, Ron		Wildlife
Solt, Adam	Forest Hydrologist	Hydrology/Soils
Tait, David	Botanist	Botany
Tobler, Scott	Fire Planner	Fire/Fuels
Torres, Amy	Wildlife Biologist (ACT2)	ID Team Lead; Writer/Editor
Whelen, James	Fisheries Biologist	Aquatics

Zapell, John	Public Affairs Specialist	

4.2 Federal, State, and Local Agencies and Representatives

Federal
U.S. Forest Service, Rocky Mountain Research Station

State
Utah Division of Wildlife Resources
Utah Division of Forestry, Fire, and State Lands
Utah Division of Agriculture and Food

Local
Piute County Commission
Sevier County Commission

Working Groups

Utah Forest Aspen Restoration Working Group-Ecology Committee

- Christensen, Bill
- Dremann, Paul
- Hopkin, Bill
- MacWhorter, Rob
- Mueller, Kevin
- O'Brien, Mary
- Rogers, Paul
- Rowley, Allen

Monroe Mountain Working Group

- Brigham Young University
- Grand Canyon Trust
- Piute County Commission
- Rocky Mountain Elk Foundation
- Sevier County Commission
- Sportsmen for Fish and Wildlife
- Trout Unlimited
- Utah Cattlemen's Association
- Utah Division of Agriculture and Food
- Utah Division of Forestry, Fire, and State Lands
- Utah Division of Wildlife Resources
- Utah Farm Bureau
- Utah State University Extension

- Utah Woolgrowers Association
- Western Aspen Alliance

Universities
Brigham Young University
Utah State University Extension

4.3 List of Acronyms

AIS	Aquatic Invasive Species
ATV	All-Terrain Vehicle
AUM	Animal Unit Month
BA	Basal Area
BCI	Biotic Condition Index
BMPs	Best Management Practices
BVCT	Bonneville Cutthroat Trout
CEA	Cumulative Effects Area
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CSE	Common Stand Exam
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
District	Richfield Ranger District
EPA	Environmental Protection Agency
ERA	Equivalent Roaded Area
Forest	Fishlake National Forest
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
GIS	Geographic Information Systems
GHG	Greenhouse Gas
HFRA	Healthy Forest Restoration Act
HUC	Hydrologic Unit Code
IRA	Inventoried Roadless Area
IRE	Integrated Riparian Evaluation
LRMP	Fishlake National Forest's Land and Resource Management Plan
MA	Management Area
MIS	Management Indicator Species
MMWG	Monroe Mountain Working Group
NA	Nest Area
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
PARC	Partners in Amphibian and Reptile Conservation

PFA	Post-Fledgling Area
PFC	Properly Functioning Condition
PM	Particulate Matter
PSD	Prevention of Significant Deterioration
R4	Region 4
RAC	Resource Advisory Committee
RACR	Roadless Area Conservation Rule
RHCA	Riparian Habitat Conservation Area
SOPA	Schedule of Proposed Actions
CTQ	Community tolerance Quotient
TOC	Threshold of Concern
UCP	Utah Conservation Partnership
UDWR	Utah Division of Wildlife Resources
UFRWG	Utah Forest Aspen Restoration Working Group
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
UUA	Unroaded-Undeveloped Area
VSS	Vegetative Structural Stage
WEPP	Water Erosion Prediction Project

APPENDICIES

Appendix A

Modeled photos depicting current and post-treatment conditions.

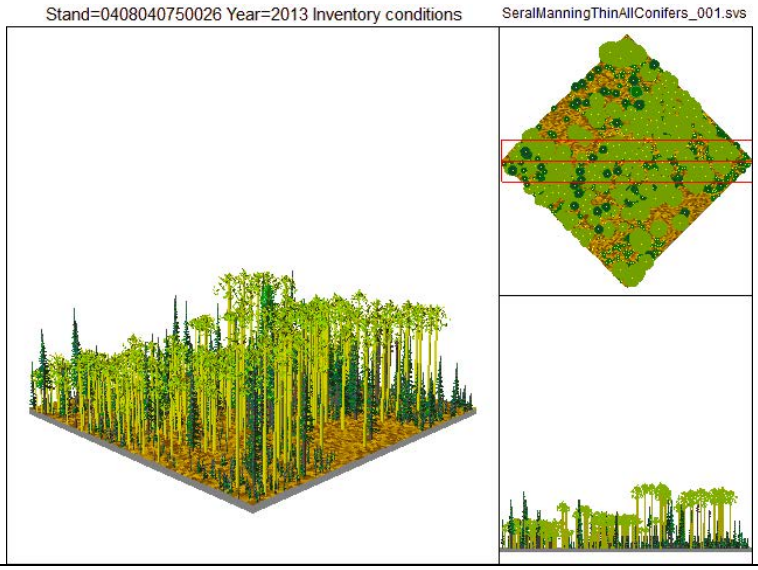


Photo 13. Seral aspen stand 750026. Depiction of current condition. This stand is located near Manning Meadows Reservoir.

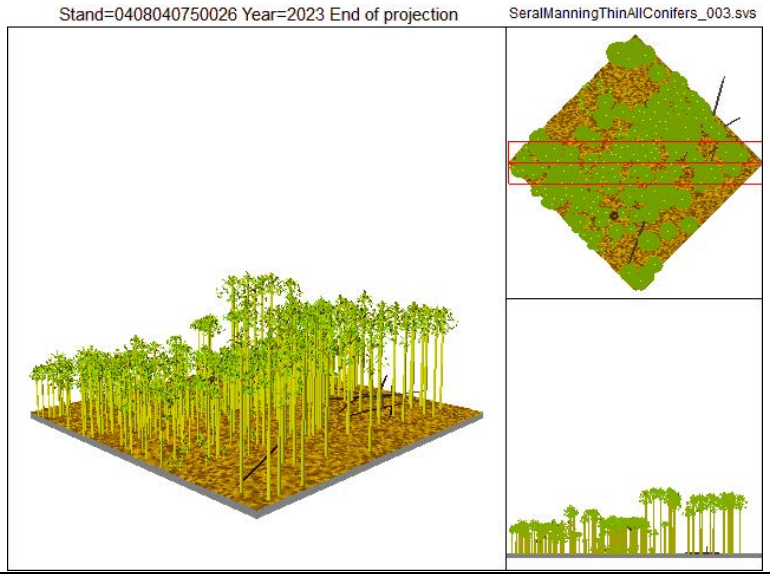


Photo 14. Seral aspen stand 750026. Depiction following removal of conifer. This stand is located near Manning Meadows Reservoir.

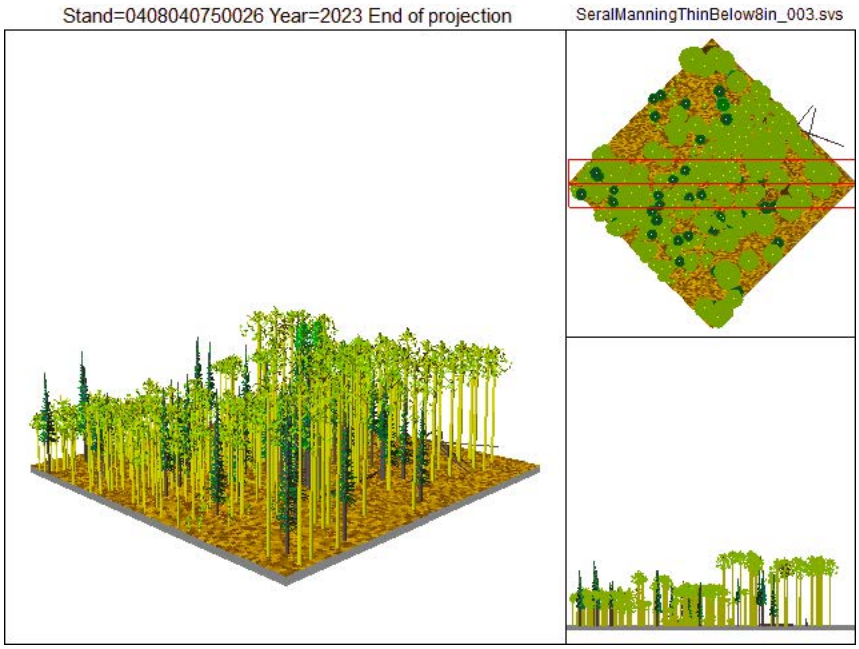


Photo 15. Seral aspen stand 750026. Depiction following removal of conifer up to 8-inch diameter at breast height. This stand is located near Manning Meadows Reservoir.

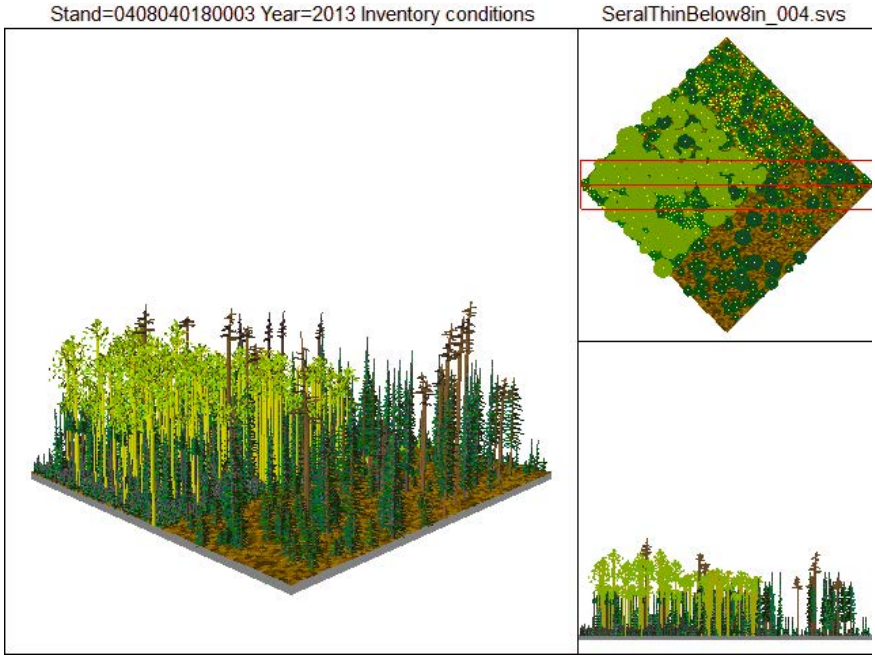


Photo 16. Seral aspen stand 180003. Depiction of current condition.

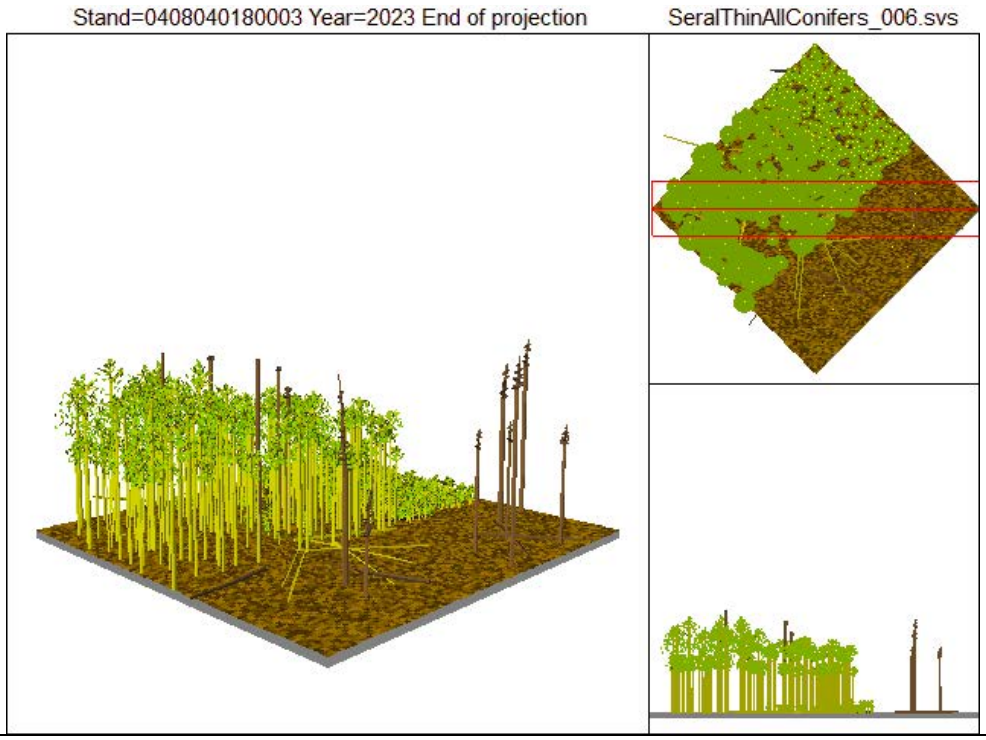


Photo 17. Seral aspen stand 180003. Depiction following removal of conifer.

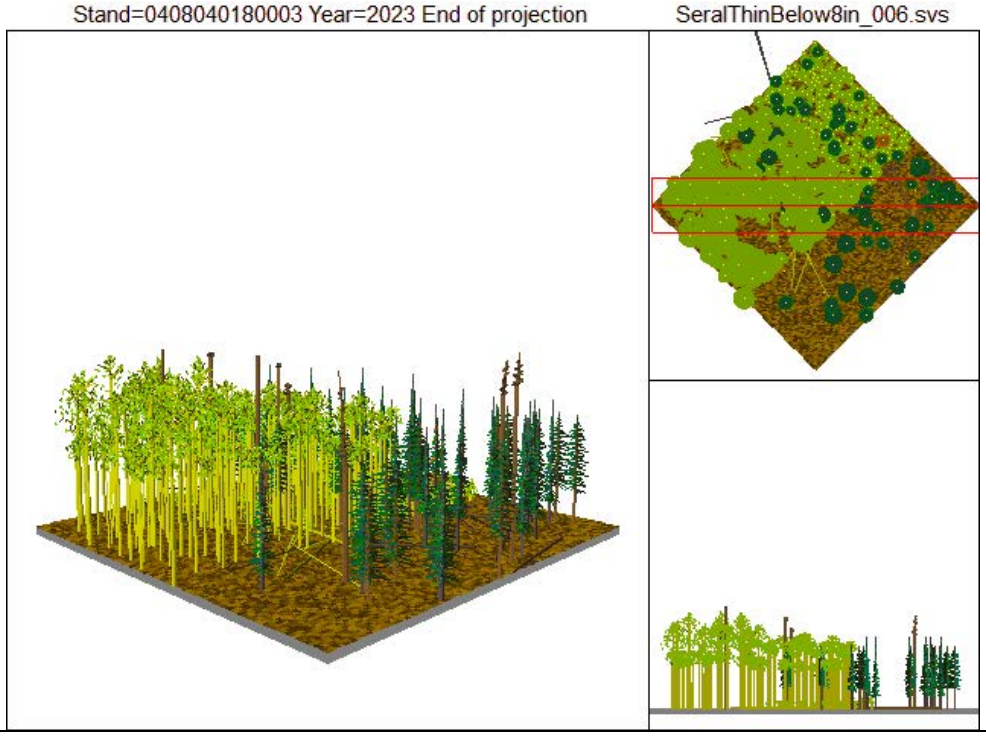


Photo 18. Seral aspen stand 180003. Depiction following removal of conifer up to 8-inch diameter at breast height.

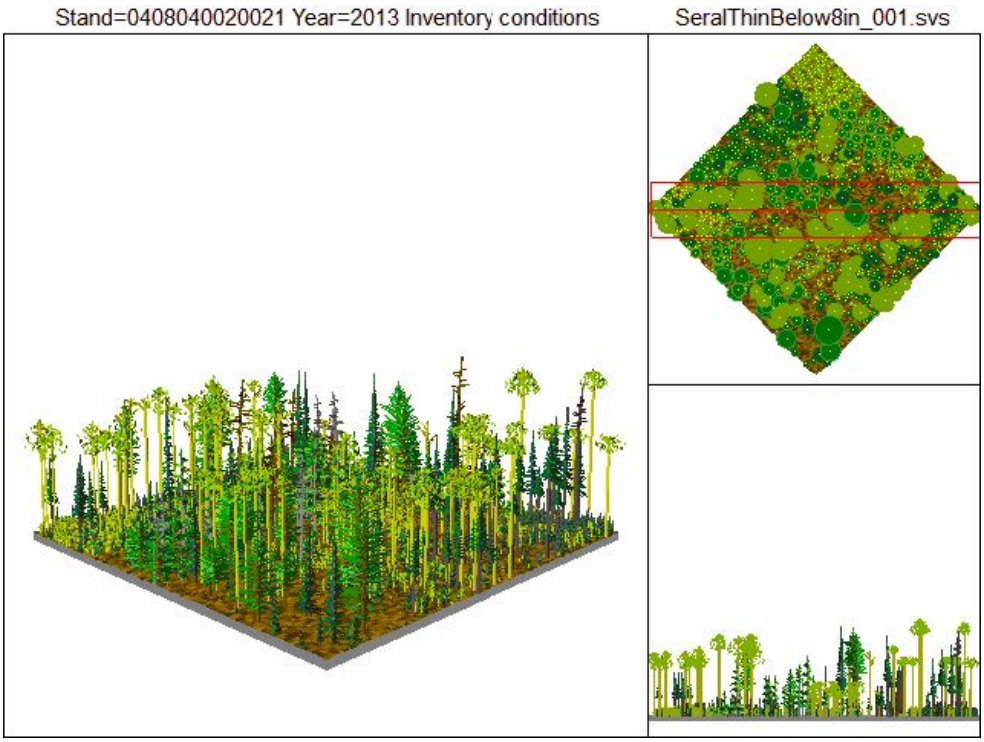


Photo 19. Seral aspen stand 20021. Depiction of current condition.

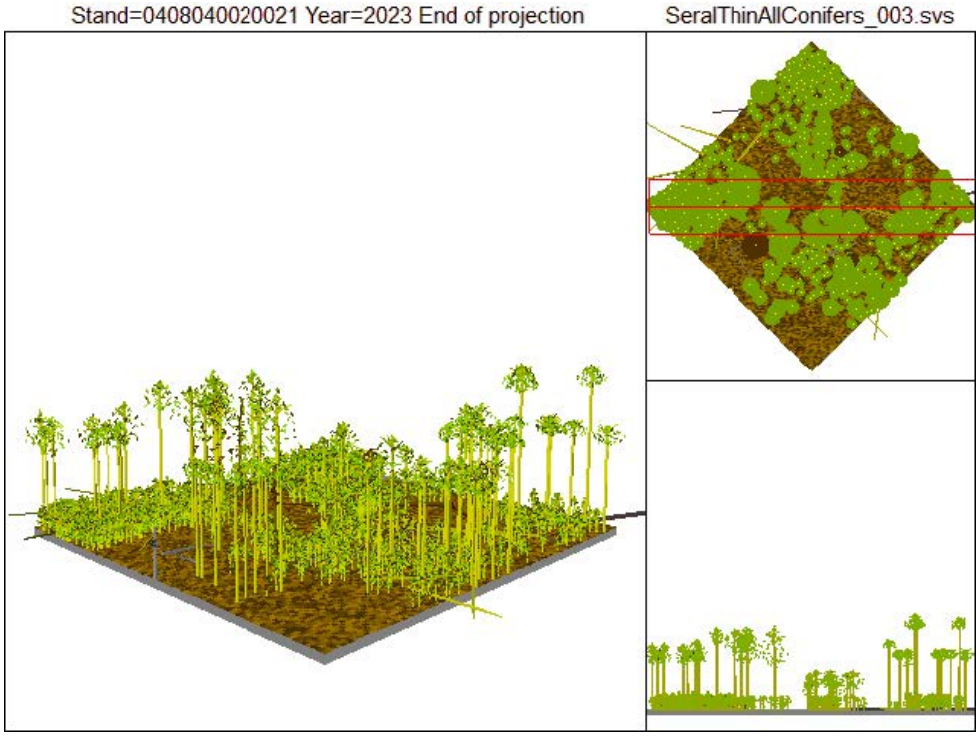


Photo 20. Seral aspen stand 20021. Depiction following removal of conifer.

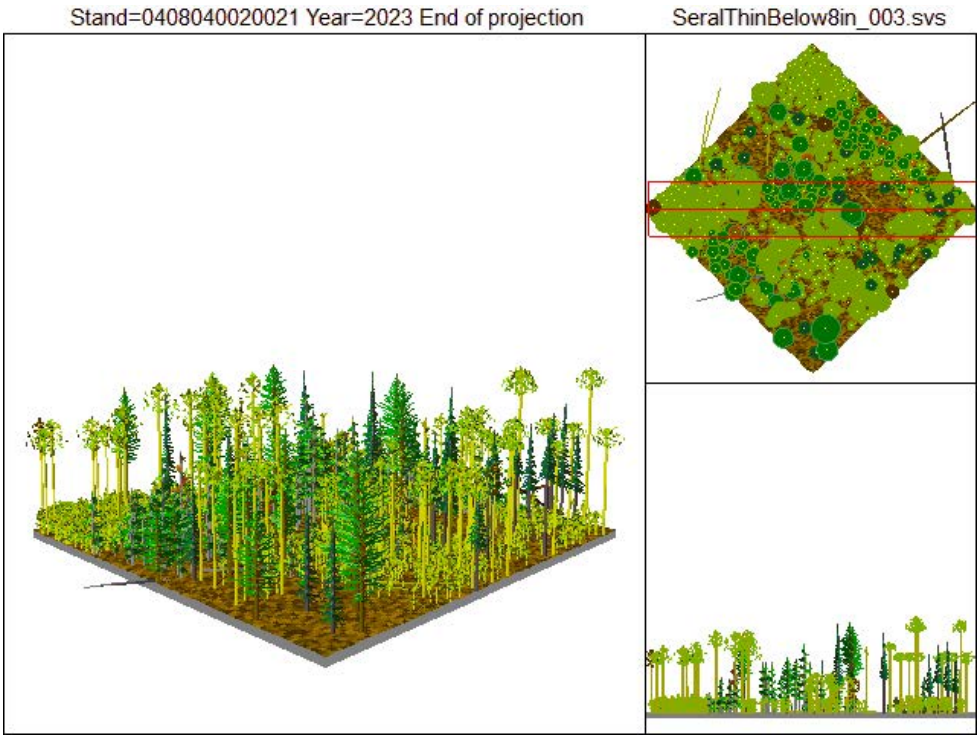


Photo 21. Seral aspen stand 20021. Depiction following removal of conifer up to 8-inch diameter at breast height.

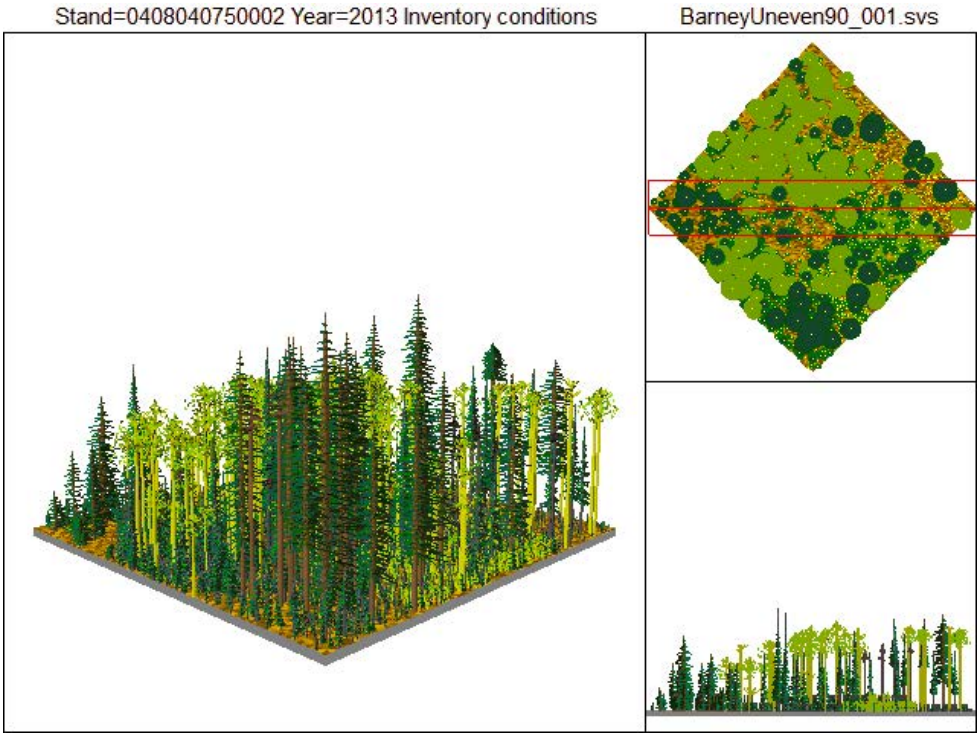


Photo 22. Spruce/fir stand 750002. Depiction of current condition. This stand is located near Barney Lake.

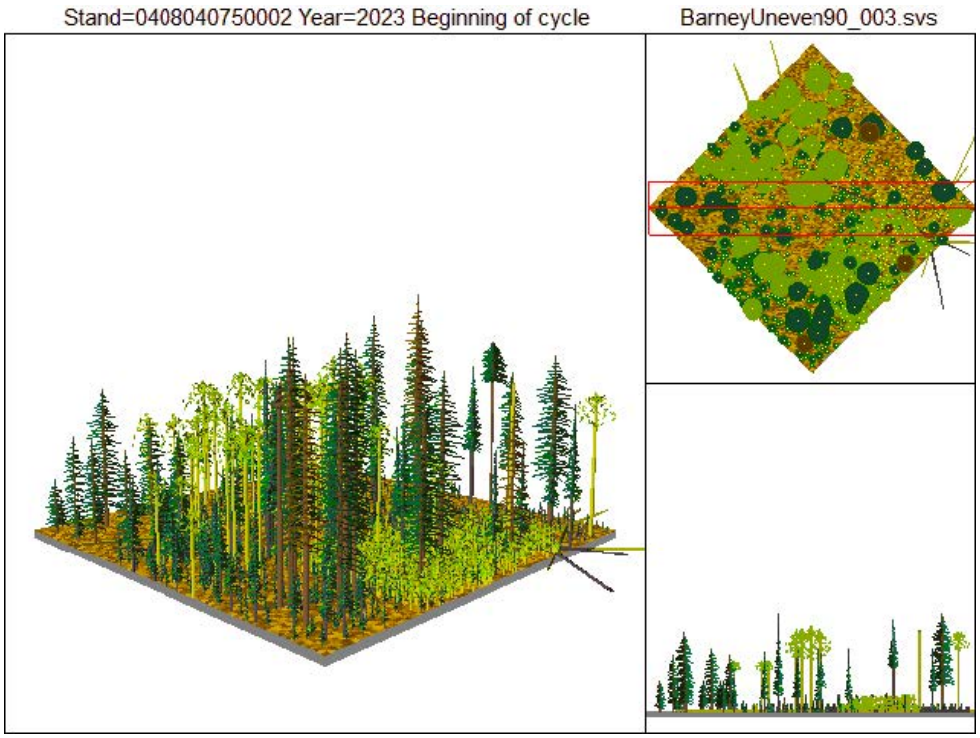


Photo 23. Spruce/fir stand 750002. Depiction following removal of conifer to a basal area 90. This stand is located near Barney Lake.

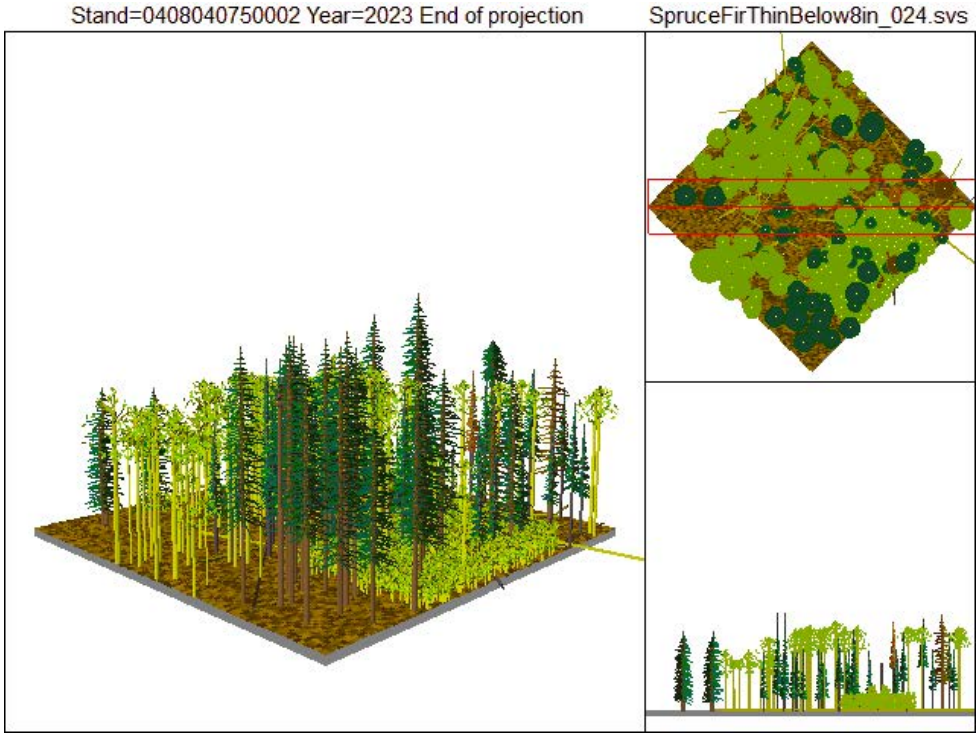


Photo 24. Spruce/fir stand 750002. Depiction following removal of conifer up to 8-inch diameter at breast height. This stand is located near Barney Lake.

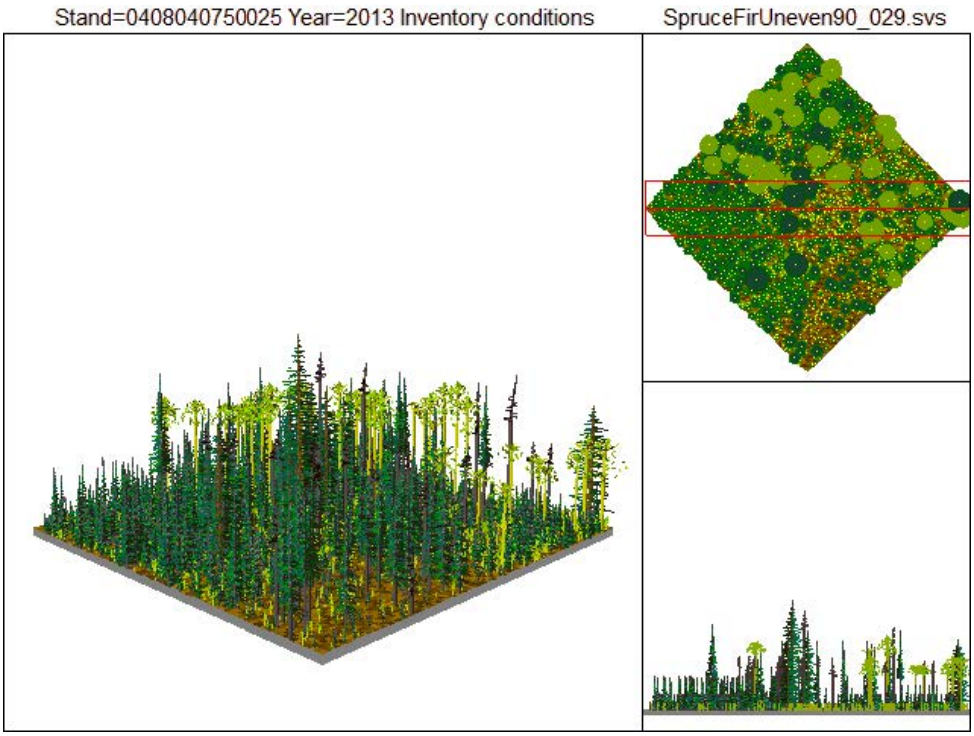


Photo 25. Spruce/fir stand 750025. Depiction of current condition.

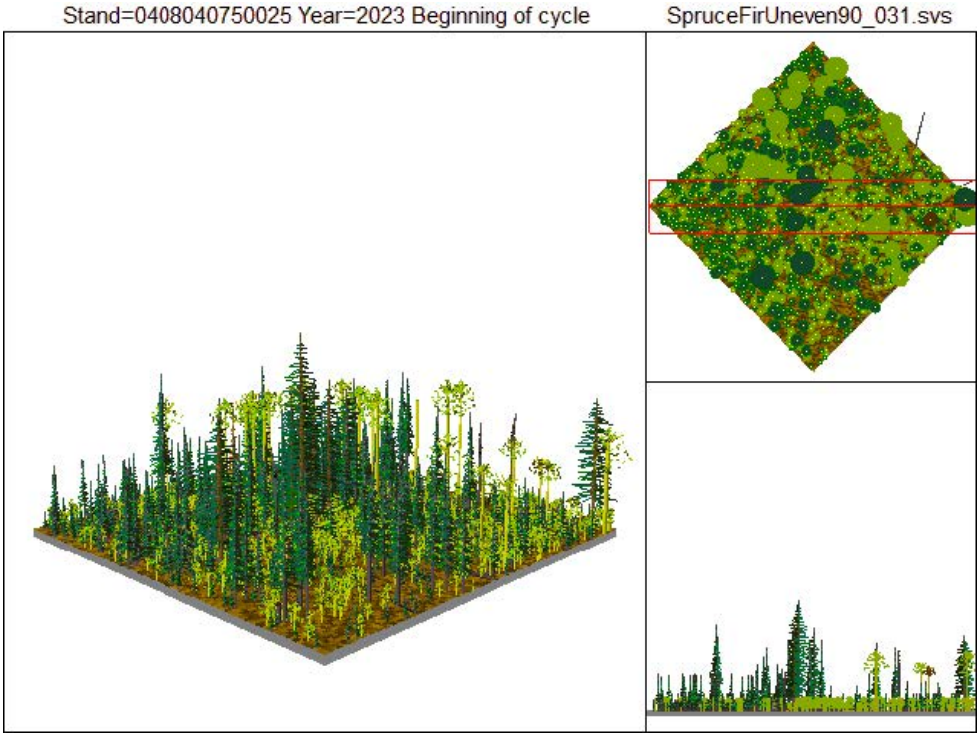


Photo 26. Spruce/fir stand 750025. Depiction following removal of conifer to a basal area 90.

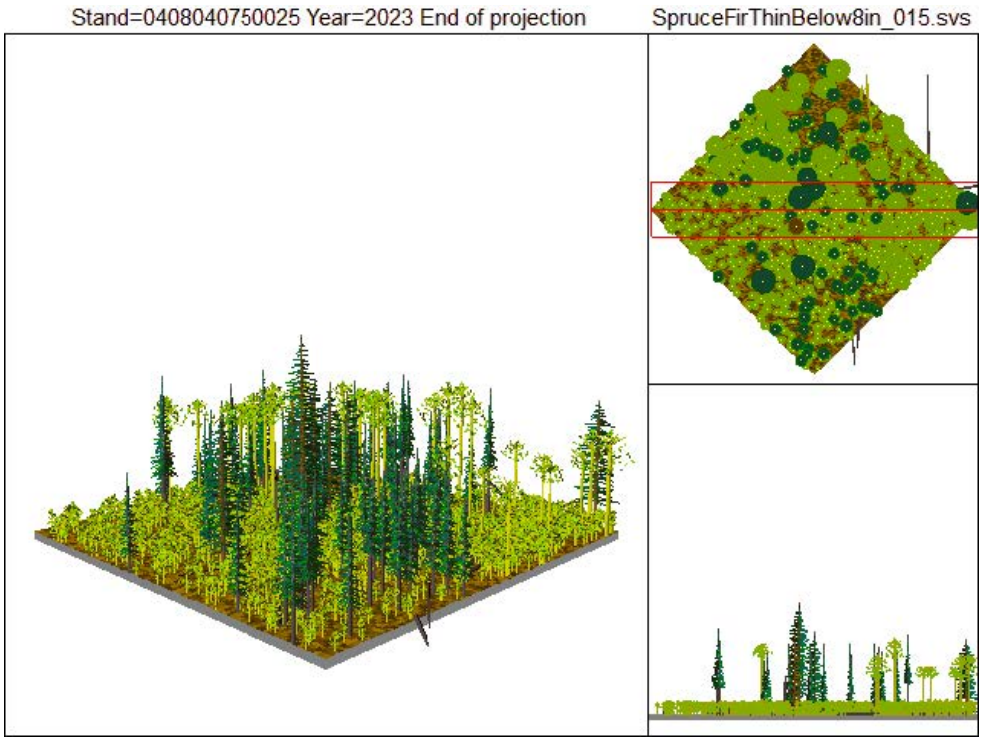


Photo 27. Spruce/fir stand 750025. Depiction following removal of conifer up to 8-inch diameter at breast height.

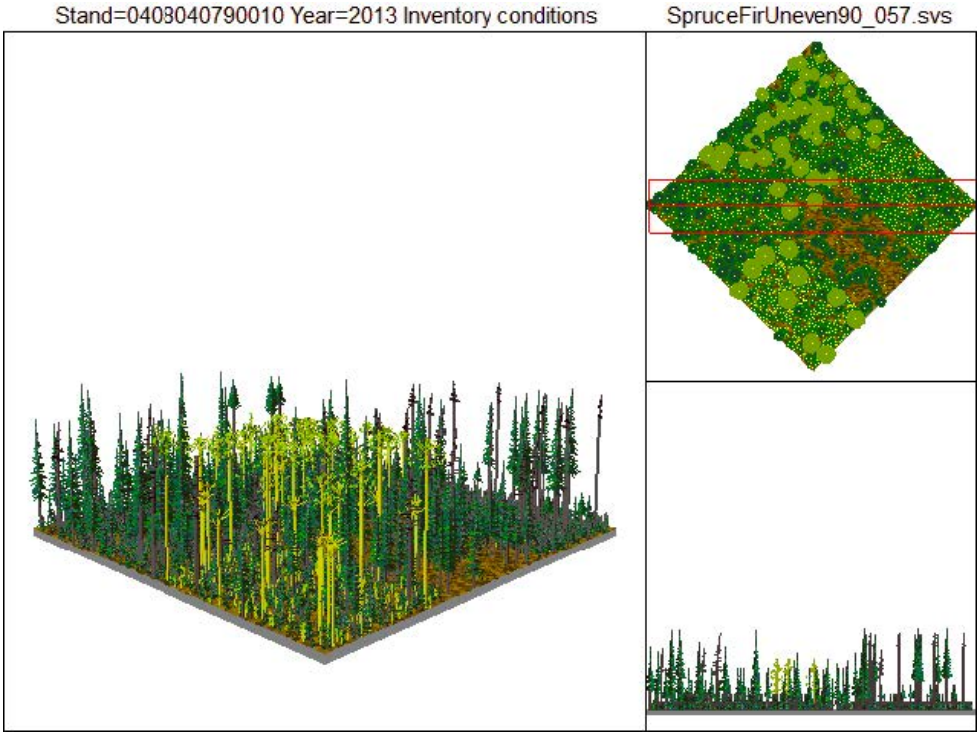


Photo 28. Spruce/fir stand 790010. Depiction of current condition.

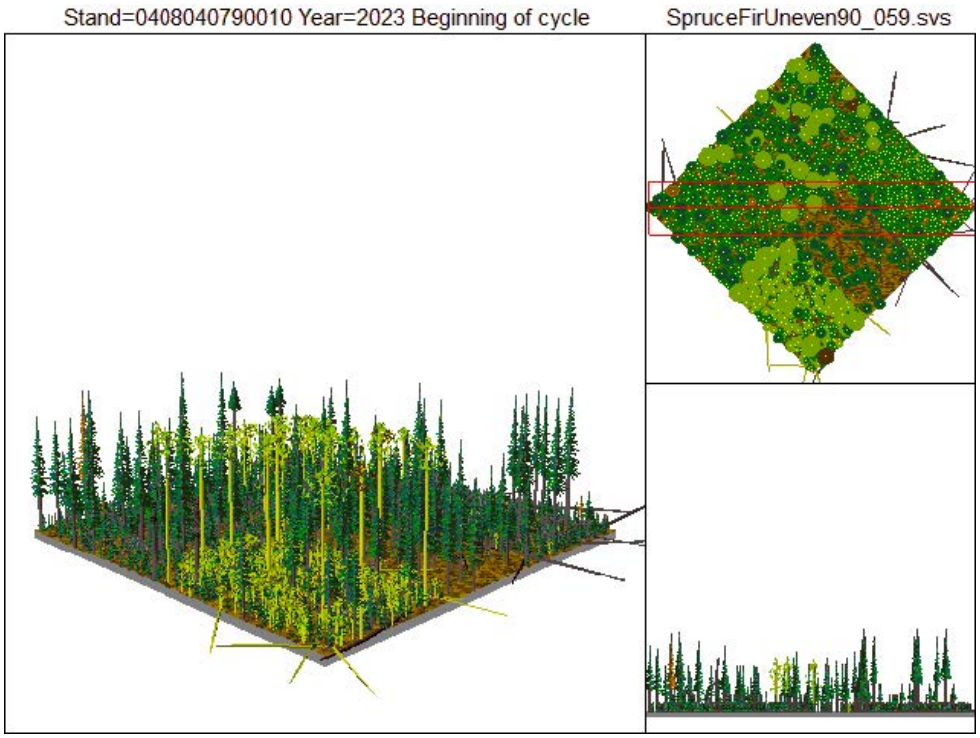


Photo 29. Spruce/fir stand 790010. Depiction following removal of conifer to a basal area 90.

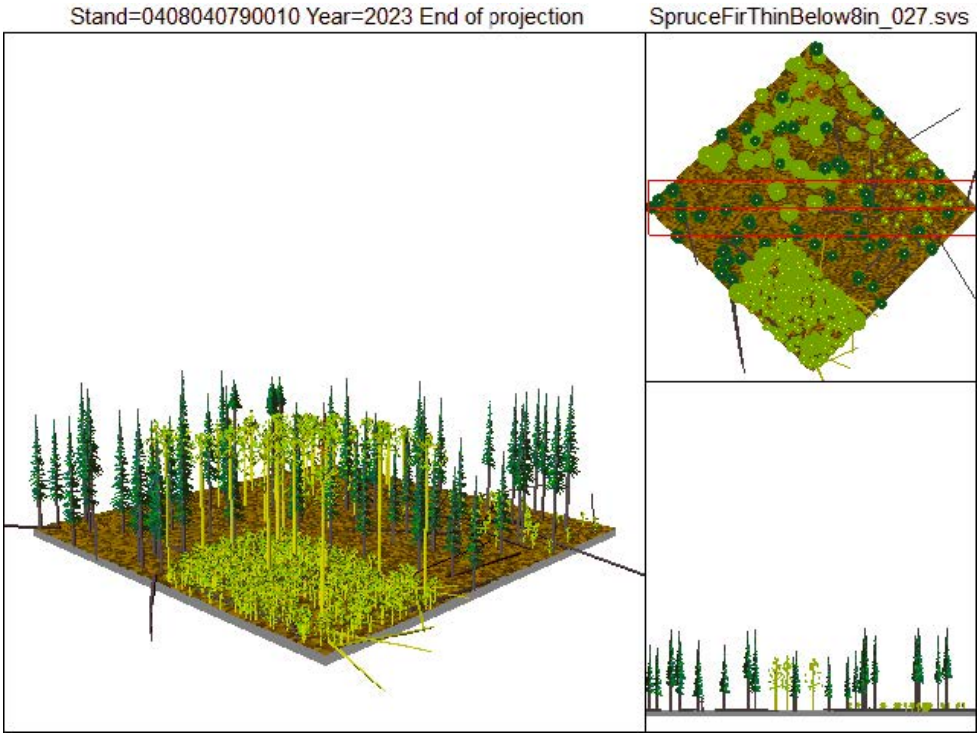


Photo 30. Spruce/fir stand 790010. Depiction following removal of conifer up to 8-inch diameter at breast height.

Appendix B

Monroe Mountain Aspen Ecosystems Restoration Project
Consistency with
2010 Guidelines for Aspen Restoration on the National Forests in Utah

The *2010 Guidelines for Aspen Restoration on the National Forests in Utah* (*Guidelines*) document describes the goal of an ecological aspen restoration decision process as being the promotion of sustainable and biodiverse aspen forests. The document describes four major steps to use in making a decision about aspen forest restoration: (1) assess the condition of the aspen, (2) identify problematic aspen conditions and their agents/causes, (3) select from among appropriate response options that address the potentially problematic conditions, and (4) monitor to assess aspen stand conditions and management/restoration. In developing the action alternatives for the Monroe Mountain Aspen Ecosystems Restoration Project, as described below, the Richfield Ranger District (District) has been implementing the four fundamental steps in the aspen forest restoration decision process.

Step 1: Assess the condition of aspen

a) Assess the condition of aspen in the landscape/area including the determination of the aspen types
b) Assess the extent, and significance of aspen (e.g., aspen's aerial coverage, stand structure, stand composition, overstory/understory coverage) in the project area, and the relationship of the project area to the landscape setting or watershed

The District, with assistance from the MMWG, assessed the condition of aspen in the project area for the Monroe Mountain Aspen Ecosystems Restoration Project EIS. As described in the EIS, soil survey data; aerial photography data; Geographic Information Systems (GIS) data' stand exam data collected from stable aspen, seral aspen, mixed conifer, and spruce/fir dominated stands; aspen browse data; camera data; and fire history research were all used and considered in assessing the conditions of aspen in the project area on Monroe Mountain.

Step 2: Identify problematic aspen conditions and their agents/causes

a) Identify through data collection the condition(s) considered potentially problematic
b) Identify through data collection the likely agents/causes of problematic conditions, as observed in the stand and surrounding area

The District, with assistance from the MMWG, identified two primary underlying causes for aspen decline on Monroe Mountain: (1) conifer encroachment that occurs due to the reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression, and (2) aspen overbrowsing by domestic and wild ungulates.

As described in Chapter 1 of the Monroe Mountain Aspen Ecosystems Restoration project EIS, fire history research; stand exam data collected from stable aspen, seral aspen, mixed conifer,

and spruce/fir dominated stands; aspen browse data; and camera data were all used and considered in determining that conifer encroachment and overbrowsing are two major, underlying causes for aspen decline on Monroe Mountain.

Step 3: Select from among appropriate response options that address the potentially problematic conditions

The following passive and/or active responses were selected from the *Guidelines* to be part of the action alternatives described in the Monroe Mountain Aspen Ecosystems Restoration Project.

1. Cut subdominant conifers.
2. Burn aspen and conifers.
3. Selectively cut overstory conifers.
4. Hinge trees as an effort to impede ungulate access
5. Change livestock grazing management (e.g., length and/or timing of grazing, class of livestock, or number of livestock, placement of salt and nutritional supplements).
6. Fence/temporarily fence for livestock and/or wild ungulates, dependent on prior determination of type of ungulate pressure.
7. Rest the pasture or allotment of excessively-browsed aspen stands
8. Work within the existing framework for wildlife management to set specific herd objectives that match other resource conditions within the area.
9. Explore evolving technology and methods to mitigate wild ungulate impacts on aspen regeneration and recruitment. Explore the issue of scale to success ratio.
10. Restore natural fire regimes.
11. In conifer-dominant stands, create scattered canopy gaps in conifer overstory so the aspen component persists over time in later successional forest.
12. Change annual browse utilization limits in grazing systems to ensure aspen sucker recruitment into the 6'+ height class.

Step 4: Monitor to assess aspen stand conditions and management/restoration

The District has been assessing aspen stand conditions (see Steps 1and 2 above) and is proposing a monitoring plan for assessing aspen response to management and restoration actions. Approximately 120 to 140 long-term aspen transects would be used to monitor status and trend of aspen following implementation of the selected alternative. Sixty to seventy transects would be in the seral aspen, spruce/fir, and mixed conifer areas, and 60-70 in the stable aspen areas.

Monitoring would address aspen regeneration/recruitment and understory conditions. Monitoring would be in conjunction and coordinated with aspen monitoring/research currently being done on Monroe Mountain by Dr. Sam St. Clair of Brigham Young University. Thresholds are also tied to this monitoring. If thresholds are exceeded, the District is proposing several response options to ensure aspen browse thresholds are not continually exceeded (see section 2.7 in the Monroe Mountain Aspen Ecosystems Restoration Project EIS).

By following these four major steps in making a decision about aspen forest restoration on Monroe Mountain, the Monroe Mountain Aspen Ecosystems Restoration Project is consistent with and following the *2010 Guidelines for Aspen Restoration on the National Forests in Utah.*

Appendix C

Browsing Thresholds and Adaptive Management
Pursuant to Aspen Restoration on Monroe Mountain
15 January 2014

Goals:

- Establish thresholds of maximum percent browse for a given initial (post-treatment) or sustained (untreated 'stable' aspen) density of recruits that are expected to result in adequate recruitment to perpetuate the aspen stand.

- Establish timely adaptive management responses that will take place if thresholds are not met.

- Offer these recommendations fully recognizing that livestock and wildlife management decisions are made within well-established policy structures in USDA-Forest Service and Utah Division of Wildlife Resources, respectively.

Needed:

Detection methods that document shoot density, height progression, and browsing intensity, as they may vary independently

1) **Aspen-mixed conifer post-treatment (prescribed fire and/or mechanical) areas**
    a. Characteristic sprouting: a dense stand of similar-aged (cohort) aspen sprouts, although some stands may exhibit relatively weak sprouting initially due to depleted root systems, genetic variation, shading by conifers, or other factors.
    b. A proposed quantitative threshold: Use the chart and figure below, adapted from estimation of the maximum browsed aspen allowed that would assure the conservative outcome of at least 400-600 recruits[32]/acre (i.e. 1,000-1,500 recruits/hectare; Mueggler 1989, Campbell and Bartos 2001) (Attachment A and B).
        i. Assumptions for the probability table and figure
            1. Once a shoot is browsed (majority of top 6" [150 mm] of leaders,) the probability of it recruiting into the overstory is extremely low.
            2. A conservative minimum of 1,000 saplings[33]/acre (2,500 saplings /ha) is needed to regenerate a fully stocked aspen stand.
            3. Unbrowsed shoots will reach a relatively safe height (approximately 6' or 1.8 m) in 4-6 years.
            4. Shoots occur as a single pulse or cohort (same or similar age) of regeneration (no secondary regeneration).

[32] A recruit is defined as an aspen shoot that has successfully reached full canopy height.
[33] A sapling is an aspen shoot = 6-12' (1.8-3.7 m) height

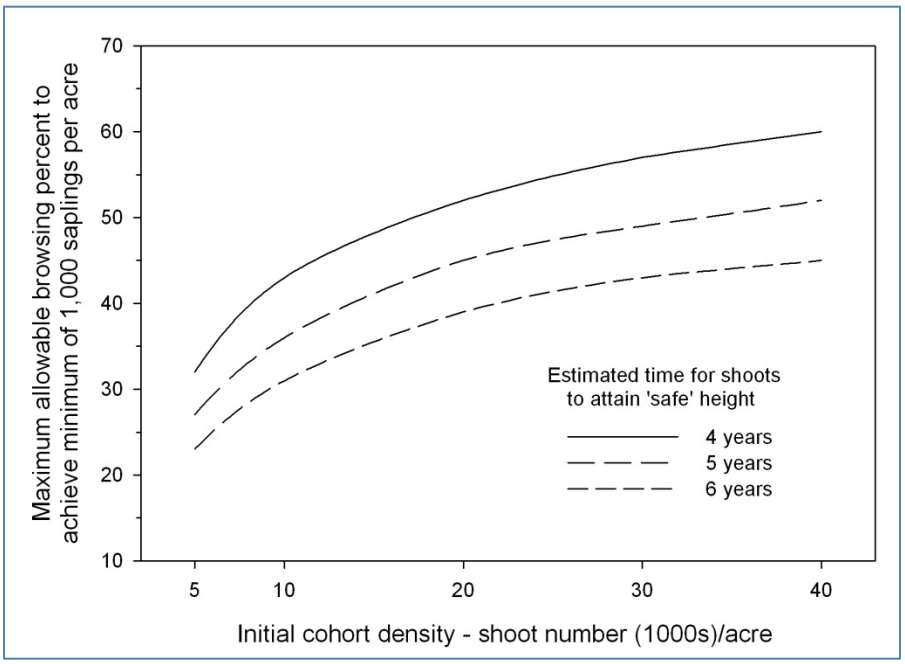
5. There is no mortality to other causes.[34]
6. The level of browsing as defined by the percent of total shoots browsed is constant (from year to year and across spatial variation in shoot density).
7. Browsers show no preference between browsed and un-browsed shoots.

ii. The assumptions will not hold in the field but the table and figure provide an initial basis for deriving appropriate thresholds that predict success or failure for aspen recruitment after treatments (mechanical or fire) that result in a range of initial densities.

iii. Application of the table or figure will require a method to select the appropriate number of years (i.e. 4-6) for shoots to attain 'safe' heights. This can be based on site productivity, weather conditions, cumulative experience, etc.

2) Table 1. Suggested annual browse thresholds.

Years after which 1,000 aspen saplings (≥6' tall)/acre will be present	5,000 initial sprouts/ acre	10,000 initial sprouts/ acre	20,000 initial sprouts/ acre	30,000 initial sprouts/ acre	40,000 initial sprouts/ acre
	percent browse				
4	32	43	52	57	60
5	27	36	45	49	52
6	23	31	39	43	45



[34] It is true that at high densities (e.g. 20,000 shoots per acre), reductions in stem density through natural thinning will be substantial. This thinning will continue in the sapling stage but this is accounted for as the stand can thin from 1,000 to 400-600 stems per acre as the stand matures.

Figure 1. Projected maximum browse pressure in relation to initial aspen shoot density and time (years) needed for shoots to reach a safe height.

c. Suggested browse threshold detection
    i. Use two perpendicular belt transects (e.g., 6' x 100' or 2m x 30m) per plot, and include pellet counts for insight into use by types of ungulates.
    ii. A minimum of one plot per 300 acres (120 ha) treated, but a greater number of plots when needed to assess percent browse.
    iii. The plots should reflect the variability of the treatment area. Care should be taken to adequately represent areas of known higher use and/or vulnerability, e.g., <30% slope, <30 pre-treatment aspen stems/acre among the conifer.
    iv. Browse thresholds for a specific treatment are violated (exceeded) when:
        1. Across all plots, average plot browse percentage exceeds the maximum allowable browse threshold calculated from plot shoot density ; or
        2. At least 40% of the individual plots associated with the treatment exceed the percent browse threshold.[35]
    v. The above monitoring scheme will be adapted as necessary on the basis of experience using this scheme.
d. Browse threshold benchmarks for post-treatment aspen-mixed conifer
    i. Browse = apical meristem damaged or removed on a majority of leaders within 6 vertical inches of the tallest leader.
    ii. More than 20% of sprouts are browsed each year in stands with less than 5,000 initial post-treatment sprouts/acre.
    iii. More than 27% of sprouts are browsed each year in plots with 5,000-10,000 initial post-treatment sprouts/acre
    iv. More than 36% of sprouts are browsed each year in plots with 10,000-20,000 initial post-treatment sprouts per acre.
    v. More than 45% of sprouts are browsed each year in plots with more than 20,000 initial post-treatment sprouts per acre.
    vi. The above percent browse thresholds are comparable to those recommended by Olmstead (1979; 30%), Jones et al. (2005; 20%) and White and Feller (2001) while allowing for a greater range in sprout number. These values should be adapted as necessary on the basis of observed success in stand recruitment.
e. <u>Adaptive management</u>
    i. Scale and timing of aspen restoration treatments: Recognizing that the scale and timing of treatments are likely to affect the level of impact that both wild and domestic grazers have on aspen response to treatments, consider designing treatments that would occur at the largest practical scale (neighborhood of 5,000 acres annually), while still being sensitive to other resource concerns (i.e. aquatics) for any given year. Adaptive management responses and their

[35] Both elements of threshold exceedance are important to avoid outliers having determinative influence.

probability of success are expected to be highly correlated with the location, timing, and scale of treatments.

ii. Prior to treatments, recommend to the UDWR, RAC, and the Utah Wildlife Board a pre-approved antlerless hunt that could be implemented, if deemed necessary, immediately following treatments in order to reduce browse pressure adequately to facilitate greater aspen recruitment. This recommendation would be subject to the Wildlife Board and RAC approval process. If approved and following treatments, the UDWR, in coordination with the USDA Forest Service, would initiate implementation of the antlerless hunt.

iii. Post-treatment period with no livestock use: If browse thresholds are exceeded during the period of rest from livestock use (typically 2 years post-treatment), the USDA Forest Service undertakes one or more of the following adaptive management responses in order to achieve balanced livestock and wildlife use, while avoiding exceeding browse thresholds:

a. Recommend to the UDWR, RAC, and the Utah Wildlife Board a reduction of wild ungulate browsing pressure using antlerless hunts as needed at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds. This recommendation would be subject to the Wildlife Board and RAC approval process.
b. Co-ordinate with the UDWR to hire/contract adequate number of seasonal employees and/or coordinate the use of volunteers (i.e. Dedicated Hunter Program) to spend time in treatment areas hazing wildlife at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds.
c. Treatment areas be fenced for protection.
d. Restrict livestock use until aspen recovery objectives are met.

iv. Post-treatment period after return of livestock to treatment area(s): If percent browse threshold is exceeded in a treatment area(s) grazed by both wild ungulates and livestock (typically after 2 years post-treatment), the USDA Forest Service undertakes one or more of the following adaptive management responses in order to achieve balanced livestock and wildlife use, while avoiding exceeding browse thresholds:

a. Recommend to the UDWR, RAC, and the Utah Wildlife Board a reduction of wild ungulate browsing pressure using antlerless hunts as needed at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds for combined livestock and wildlife use. This recommendation would be subject to the Wildlife Board and RAC approval process.
b. Co-ordinate with the UDWR to hire/contract adequate number of seasonal employees and/or coordinate the use of volunteers

(i.e. Dedicated Hunter Program) to spend time in treatment areas hazing wildlife at levels expected to result in sufficient reduction in browse to avoid surpassing browse thresholds.

c. Fence treatment areas.
d. Improve time, timing, and intensity of livestock grazing.
e. Recommend to the UDWR utilize the Grass Bank Program on state Wildlife Management Areas to help offset temporary loss of livestock opportunities.

v. The above-mentioned adaptive management responses are not intended to be all-inclusive. Additional or alternative adaptive management responses that are proposed, and which have been shown to be effective, should also be considered.
vi. After overstory aspen trees are removed or killed (i.e., mechanical or burn treatment), healthy roots systems typically are able to sustain vigorous shoot growth for a limited time (2-3 years,) providing a brief opportunity to modify management when browse pressure exceeds threshold levels. Therefore, the above-mentioned potential adaptive management responses have been identified for consideration as timely management responses as each treatment phase is implemented.
vii. Although management changes that reduce wild or domestic ungulate numbers may be necessary to restore healthy aspen communities on Monroe Mountain, such changes will be viewed as temporary and will not be interpreted as support for permanent or long-term reductions in stocking levels or population objectives. The Forest Service should be actively engaged in the UDWR's elk management plan revision process in order to promote understanding and consideration of resource conditions on objectives.
viii. If adaptive management responses are needed, the number and type of responses are anticipated to vary depending on location and timing of treatments. Considering the location, size, and timing of treatments, adaptive management responses and the probability of success are expected to vary. Decision authorities for the adaptive management responses also vary. For these reasons, continued and close communication between USDA Forest Service, UDWR, RAC, Utah Wildlife Board, and all other interested stakeholders is critical. The adaptive management responses are intended to avoid surpassing browse thresholds and to achieve a 1,000 saplings/acre.

3) Stable aspen stand response to changed management of ungulates and of fire and mechanical treatments in aspen-mixed conifer

a. Long-term monitoring plots: Sixty long-term monitoring plots will be established to represent the range of conditions thought to occur in stable aspen stands on Monroe Mountain. Aspen stands will be classified as stable when all of the following criteria are met.

i. Mature conifer stem counts per unit of area (acre) < 20% of total mature tree stem count (surrogate for BA [basal area] or cover)
ii. Total conifer stems (all sizes) < 40/acre (100/ha)
iii. Judgment will be used when required. For example, apparent intermixing of stable and seral conditions across uniform topography may require moving the plot to where stable conditions prevail. In addition, the age/size structure of conifer populations might be used supplementally to infer stand stability.

Data will be collected on overstory condition, aspen regeneration and recruitment (including browse use), fecal pellets and cow pies and understory for these plots starting in 2013. These data will provide a baseline dataset from which to detect change in subsequent years. Data for aspen shoot density, height, and percent browse will continue to be collected on an annual basis. Overstory and understory data will be collected at longer intervals (3-5 years).

b. Stable aspen stand type classification: Although it is well recognized that in many areas stable aspen is not recruiting, it should be assumed that some plots would be located in stands that are appropriately described as self-replacing. Self-replacing stands may be classified into three basic conceptual types with intermediate conditions expected. These stand types are: 1) stands of dense, even-aged stems that have successfully recruited following recent (10-30+ yrs.) disturbance (e.g. fire or mechanical) to heights that they are now safe from ungulate browse pressure and generally exhibit little or no new regeneration; 2) stands with depleted overstories but with vigorous regeneration and ample stems in the sapling to sub-canopy size classes; or 3) multi-aged stands with stratified canopies (long time since last disturbance). It is essential that we be able to characterize all types of self-replacing, stable aspen stands using reasonable metrics to in turn be able to quantify the variables that will be used in their classification.

i. **Stable Aspen stand type 1 (SA1)** will have a minimum of 1,000 live stems/ acre (2,470 stems/ha). This is approximately double the density of a fully stocked aspen stand (Mueggler 1989, Guidelines for Aspen Restoration 2010). Subsequently, additional natural thinning is expected. Aspen stands with densities greater than 1,000 live stems/acre are common when vigorous suckering follows disturbance (e.g., fire) in healthy aspen stands and browse impacts remain low. Consequently, tree density is high enough that the absence of active shoot generation in SA1 stands should not be considered a disqualifier for self-replacing status.
ii. **Stable Aspen stand type 2 (SA2)** is what might be expected when stands with depleted overstories exhibit sufficient recruitment that full recovery is expected as stems mature. In general, recruitment synchrony for self-replacing SA2 stands is intermediate between that of the disturbance-initiated SA1 stands and that of the more continuous stable aspen type 3 (SA3) stands described below. The upper density limit for live canopy trees is arbitrarily set at 200/acre for the SA2 stand type, or less than half that of a fully stocked aspen stand. SA2 stands

are further sub-divided into four levels based upon the combined density of sapling and sub-canopy trees[36] relative to the density of live canopy trees. The levels are defined as follows: **full self-replacing (SA2-F)** when the combined density of saplings and sub-canopy trees is ≥ 200% of the density of live canopy trees; **transitional self-replacing (SA2-T)** when the combined density of sapling and sub-canopy trees is ≥ 100% but < 200% of the live canopy-tree density; **marginal self-replacing (SA2-M)** when the combined density of sapling and sub-canopy trees is ≥ 50% but < 100% of the live canopy-tree density; and **non-self-replacing (SA2-N)** when the combined density of sapling and sub-canopy trees is < 50% of the live canopy-tree density.

Table 2. Threshold benchmarks for Full, Transitional, and Marginal self-replacing levels of Class 2 stable aspen (SA2).

Density of live canopy trees	**Minimum sapling + sub-canopy tree density for SA2-F level**	**Minimum sapling + sub-canopy tree density for SA2-T level**	**Minimum sapling + sub-canopy tree density for SA2-M level**
(trees/acre)			
200	400	200	100
150	300	150	75
100	200	100	50
50	100	50	25
25	50	25	13

iii. All self-replacing, stable aspen stands not classified as type SA1 or SA2 will by default be classified as **stand type 3 (SA3)**; multi-aged stands with densities that are greater than 200 and less than 1000 live trees/acre. Stratified canopies of continuous or pulsed recruitment and a basal level of new shoot production are descriptive of SA3 stands. In reality, SA2 and SA3 stand types represent different segments on a single continuum of overstory condition; however, the corresponding recruitment effort may differ substantially between the two types as a function of overstory live-tree density and corresponding differences in apical dominance. Specifically, as canopy tree density increases for SA2, a corresponding 2-fold increase in recruitment-size stems is required to qualify for the fully self-replacing status. However, for SA3 stands, sapling/sub-canopy tree density is expected to decrease with increasing canopy density (Figure 2). Thus at the low end of the SA3 spectrum (200 live canopy trees/acre), a minimum of 400 saplings/sub-canopy trees per acre are required for full self-replacing (SA3-F) status while at the high end (999 live canopy trees/acre) none are required

[36] Sub-canopy trees are >12' (3.65 m) in height with crowns clearly below the dominant canopy structure which will vary in height for mature stands with microsite conditions and genotype.

for the same. More specifically, SA3 stands will be assigned to the **SA3-F (full self-replacing)** level based upon the following equation where (a) = density of live canopy trees and (b) = combined density of saplings and sub-canopy trees.

$b \geq a(-0.5) + 500$

Stands will be assigned to the **SA3-T (transitional self-replacing)** level if the sapling + sub-canopy density is at least ½ of the minimum threshold for F-SR status as indicated by the equation:

$a(-0.5) + 500 > b \geq a(-0.25) + 250$

Stands will be assigned to the **M-SR (marginal self-replacing)** level if sapling + sub-canopy density is at least ¼ of the minimum threshold for F-SR status as indicated by the equation:

$a(-0.25) + 250 > b \geq a(-0.125) + 125$

SA3 stands are assigned to the **N-SR (non-self-replacing)** level when recruiting stem densities are below the M-SR minimum threshold:

$$b \geq a(-0.125) + 125$$

Table 3. Threshold benchmarks for Full, Transitional, and Marginal self-replacing levels of Class 3 stable aspen (SA3).

Density of live canopy trees (trees/acre)	**Minimum sapling + sub-canopy tree density for SA3-F level**	**Minimum sapling + sub-canopy tree density for SA3-T level**	**Minimum sapling + sub-canopy tree density for SA3-M level**
200	400	200	100
400	300	150	75
600	200	100	50
800	100	50	25
1000	0	0	0

c. <u>Stable aspen improvement thresholds:</u> Using 2013 (and possibly 2014) monitoring data, each of the 60 stable aspen plots will be classified into the appropriate class and level based upon live canopy tree and recruitment (saplings + sub-canopy trees) densities as described above. Although monitoring will continue on all plots, those plots initially classified as SA1 or SA2/SA3 level F (fully self-replacing), will not be used to determine treatment-related improvement in stable aspen because it is assumed that these plots are already fully self-replacing.

Improvement for the subset of plots initially classified in levels T (transitional), M (marginal), and N (non-self-replacing) will be recognized and documented when plots move upward from one level to another (N to M, M to T, T to F). Similarly, degradation will be acknowledged if plots drop a level.

i. A minimum benchmark of success in restoring stable aspen on Monroe Mountain will be that average improvement for all eligible plots (SA2 and SA3 levels T, M, and N) must be equal to one full level increase as a benefit of the project. Thus, for every plot that fails to move up a level, another will have to move up two levels. Plot degradation (drop in levels) will also be factored in.

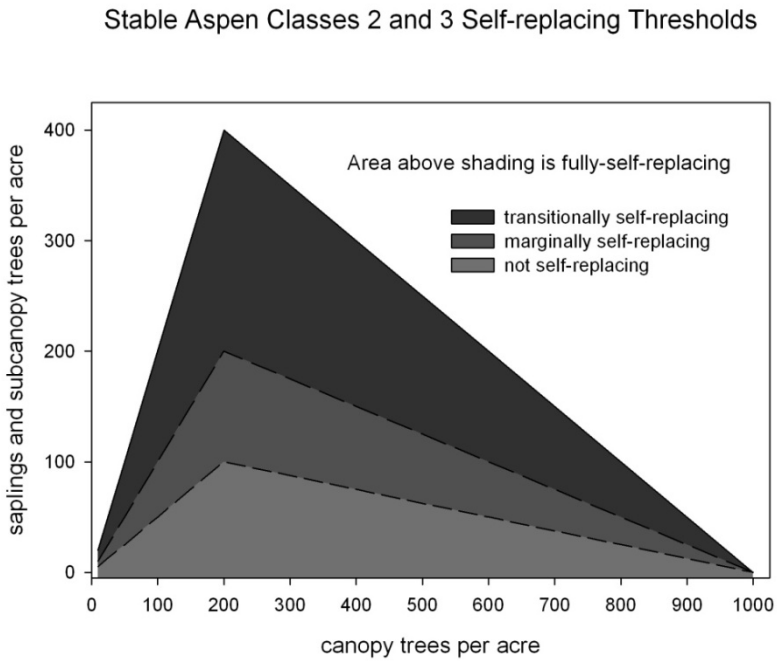
ii. It is not acceptable to have to wait 10-15 years until the entire Monroe Mountain project is completed to determine the degree to which it has been successful. A process must be adopted to incrementally assess whether management actions are leading to the desired outcome and, if not, additional management actions on the mountain will be warranted.

iii. Aspen response (including stable aspen) should be proportional to the area treated (as a percent of the total area planned for treatment) across the duration of the project. It may not be possible to accurately predict how browse relief will be distributed spatially. Therefore, stable aspen improvement should be interpreted at the broadest spatial scale (all 60 plots). For example, one scenario might allow that 10% of the area planned for treatment, be treated. Assuming in the same scenario that 50 of the 60 stable aspen plots are classified as being eligible for improvement (as defined above) then an expectation for reclassification to at least one level higher might be expected for a minimum of 5 (10%) of the 50 eligible plots, with no plots being downgraded in response to this first year of treatment. It is anticipated that level changes may be detectable within 3 years of treatment.

d. Adaptive management: A failure to detect sufficient improvement after an appropriate lag time (allowing some flexibility for unknowns such as extreme weather events) will trigger a recommendation for an appropriate adaptive management response(s) (selecting from the adaptive management responses listed above) to temporarily reduce browse pressure by domestic and/or wild ungulates sufficient to allow for stable aspen recovery. These recommendations will not be interpreted as endorsement of permanent changes in livestock or wildlife management. As additional area is treated, a proportionate increase will be expected in the number of plots that improve sufficiently to warrant reclassification to a higher level. A lag period of approximately 3 years will continue to be employed for each treatment. Hypothetically, this could result in a recommendation to reduce browse pressure after treatment of seral aspen stands even when aspen recovery within the treatment area is satisfactory but where there is no corresponding improvement in stable aspen monitoring plots. The opposite is also possible, that is we could have improvement in stable aspen but unsatisfactory results in the treated area. Either way, under these conditions management actions designed to reduce browse pressure would be desirable.

e. Boundaries described herein between stable aspen classes and levels of recruitment, though somewhat artificial, are based upon expert opinion and best science available. These boundaries are subject to modification if site-specific data from stable aspen plots and/or exclosures provide clear rationale for doing so. The lag period (3 years) between treatment and time of expected recruitment enhancement may also be adjusted with experience. In such cases, proposed changes and supporting rationale will be documented and subject to review prior to implementation. For this reason, continued and close communication between USDA Forest Service, UDWR, RAC, Utah Wildlife Board, and all other interested stakeholders is critical.
f. Stable aspen classes and recruitment levels are based directly upon the densities of stems that reach relatively safe heights and will not initially take into account the browse intensity values that will clearly influence those densities. Patterns in annual browse data will be analyzed over time with the objective of determining how they might be incorporated to improve assessments of stable aspen condition and trajectory on Monroe Mountain.

Figure 2.



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