MOAB FACE PROJECT ANALYSIS

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Chapter 1: Purpose and Need for Action

1.1 Introduction

The removal of fire from our ecosystems through fire suppression policies established by land management agencies has resulted in forest conditions that are now contributing to catastrophic wildfires. Large wildfires such as the three million-acre fire in 1910 that killed 85 people were part of our history (Smithsonian 2003). However, because of events like these, the Forest Service and other land management agencies chose to extinguish every fire possible. As fire-fighting methods improved the number of acres burned annually diminished. Fewer than 600,000 acres of Forest Service administered land burned each year from 1935 through 1986 (Gorte 2000). However, the effects of fire exclusion have caught up with us. The accumulation of wood and duff on the forest floor coupled with small dense stands of trees has resulted in wildfires like none we've seen before. In 2002 alone, almost seven million acres burned (Smithsonian 2003).

Firesheds are large landscapes delineated based on fire regime and condition class, fire history, fire hazard and risk, and the potential for using vegetation treatments to restore historic fire regimes. Fireshed assessment is a process for designing and scheduling site-specific projects that are consistent with the goals of the Healthy Forests Restoration Act of 2003 and the National Fire Plan of 2002. The Moab Face Project Analysis assesses the direct, indirect and cumulative effects of prescribed burning and mechanical treatments in a proposed analysis area encompassing approximately 58,530 acres. Across this landscape, 16 separate treatment units totaling 12,465 acres have been identified as needing hazardous fuels reduction and/or vegetative treatments. The project area is located on the Moab Ranger District within Grand and San Juan counties in Utah (Figure 1). More specifically, the project is located across the west, north and south facing slopes of the La Sal Mountains and contains townships 25,26, 27 and 28 south and ranges 23, 24 and 25 east. The Moab Face project is estimated to begin in 2005 and is targeted for completion in 2015.

Three terms should be defined in preparation for reading this document. They are as follows:

Fire Suppression- the act of distinguishing fires from the landscape by using suppression techniques (fire fighting).

Fire Exclusion- a long-standing policy within the Forest Service to eliminate fires from the landscape using fire suppression techniques.

Fire Regime- long-term characteristics of fire on the landscape described by such elements as frequency, intensity, severity, and pattern.

1.2 Purpose and Need

The purpose and need for this project are two-fold.

The immediate purpose of lower elevation treatment units in this project is **to reduce the potential for fire to move into or through wildland urban interface areas**. Modifying current fuel profiles by removing overgrown vegetation and increasing spacing between individual trees and shrubs would change fire behavior around structural developments so that flame lengths do not exceed 4 feet. Four feet flame lengths are the maximum firefighters with hand tools can safely treat. By changing the fire behavior, the desire is to increase safety to the public and fire suppression crews, reduce the potential for large catastrophic wildfires, reduce the “resistance to control” and reduce the risk to life, property and natural resources will be met.

The second primary purpose of this project is to **move aspen forests to a more healthy condition**. By ‘healthy’ we mean that all characteristics of an aspen ecosystem, while dynamic, mimic historic conditions and are resilient or able to sustain natural disturbances. A healthy aspen ecosystem has had the natural role of fire restored and provides a diversity of vegetation in both species and age classes. Many of the aspen communities on the Moab Face are approaching late seral stages due to a lack of natural disturbance. Seral means that through succession it will eventually be replaced by more dominant species such as sub-alpine fir. These seral communities are critical in maintaining biodiversity and sustainability of the forest. As side benefits of maintaining healthy aspen forests, forage plants for big game and livestock as well as nesting habitat for several sensitive wildlife species would be rejuvenated. In addition, maintaining deciduous trees across the landscape would enhance the scenery.

The need for this project is in response to goals and objectives of the National Fire Plan, the Healthy Forest Initiative, and the Manti-La Sal National Forest Land and Resource Management Plan (Forest Plan), (USDA Forest Service, 1986). In addition, requirements of the National Forest Management Act (NFMA) were met when a class of Continuing Education in Ecosystem Management students analyzed the Moab Face of the La Sal Mountains in 2001. Two weeks of intensive research included interviews with local citizens, field work, literature and data compilation. The result was a comprehensive report culminating in a list of management opportunities for the Moab Face landscape. This project is directly addressing the following three opportunities:

Aspen on the Moab Face is in need of regeneration (USU 2001, Pg.57).

Very little of the 20,000 acres of pinyon/juniper on the Moab Face is considered to be within reference condition (USU 2001 Pg. 58).

Increased structural diversity with greater ranges in age classes of the mountain brush vegetation type may be beneficial. (USU 2001 Pg. 58)

A comparison of the existing condition of the project area and the desired conditions from the Forest Plan indicates a need to:

- Increase safety to the public and fire suppression crews
- Reduce the potential for large, catastrophic wildfires by reducing ladder fuels and overall forest fuel loadings
- Reduce the “resistance to control” in urban interface areas areas (private land in-holdings)
- Reduce the risk to life, property and natural resources
- Restore the natural role of fire back into the ecosystem
- Enhance vegetation diversity by retarding the successional stage of some plant species, particularly quaking aspen

1.3 Proposed Action and Objectives

The proposed action is to prescribe burn, mechanically treat or a combination of both, approximately 12,465 acres of aspen, Gamble oak, mountain brush, pinyon/juniper and some ponderosa pine vegetation communities over the next ten years. Specifically,

- Approximately 1,569 acres of mixed conifer vegetation (predominantly spruce/fir) would be treated by burning both ground and ladder fuels. Higher intensity burning would be needed to set back succession in canopy species from spruce/fir to aspen and stimulate forest floor sprouting.

- Approximately 4,981 acres of aspen would be treated with fire by burning to reduce ground fuels, set back succession and stimulate regeneration of older aspen clones.

- Approximately 4,884 acres of mature mountain brush, pinyon/juniper and scattered ponderosa pine of variable slopes would be treated primarily by mechanical means and to a minimal extent by fire to breakup fuels and reduce fire hazard.

- The remaining 1,051 acres consists of vegetation types not targeted for treatment such as riparian/wetlands, sagebrush, perennial forbs, barren, desert shrub, etc.

- A total of 40-60% of the area within treatment units (5,000-6,300 acres) would be treated over the next 10 years. The percent of treatment depends on vegetation type, burning conditions and availability of burning opportunities (windows).

Prescribed fire would be the primary treatment method in the mixed conifer and aspen ecosystem types. This would also include hand cutting using chainsaws as needed. Hand cutting would be used where conditions dictate necessary pre-treatment to provide fuel breaks or to increase fuel for ignition and to carry a fire or, where burning is not an option.

Mechanical treatment would occur near Wildland Urban Interface (WUI) areas dominated by mountain brush and pinyon/juniper vegetation. Mechanical equipment is used next to houses where fire may be too risky until fuels are reduced. The use of hand cutting using chainsaws and prescribed fire primarily for brush pile burning would also be incorporated both during project implementation and follow-up treatments. Using heavy equipment to treat vegetation would not occur within inventoried roadless areas, within eligible wild and scenic river corridors, within riparian areas, or on slopes in excess of 30 percent.

By treating the proposed areas, we would achieve the following objectives:

- increase public and firefighter safety
- decrease the potential for catastrophic fires
- reintroduce the natural role of fire back into the ecosystem
- regenerate aspen communities
- promote establishment of native grasses and forbs
- improve wildlife habitat conditions for big game and several sensitive species
- rejuvenate forage for livestock
- improve scenery by maintaining deciduous trees across the landscape
- create a balance (mosaic) of successional stages, reducing vegetative susceptibility to insects and disease

1.4 Steps to Decision Making

This Project Analysis is not a decision document. It is used to analyze large landscapes. While the analysis may identify individual projects, it assesses them as a whole across the landscape so that cumulative effects are thoroughly examined.

The next step following this analysis is to make decisions on site-specific projects through appropriate NEPA decisions such as decision memos or decision notices. It is at this point the Moab/Monticello District Ranger, the deciding official, will determine the following:

- how many acres should be treated?
- which areas should be treated?
- what type of treatments should occur?
- what mitigation measures and design features are necessary?
- what types of monitoring should occur?
- should there be no action taken?

1.5 Relationship to the Forest Plan

This analysis tiers to the Final Environmental Impact Statement, Appendix, and Record of Decision as amended for the Manti-La Sal National Forest Land and Resource Management Plan (USDA Forest Service 1986) and incorporates by reference The Manti-La Sal National Forest Land and Resources Management Plan.

The majority of the project area is designated in the LRMP as Management Unit "RNG". The management prescription for "RNG" areas (USDA Forest Service 1986, Pg. III-64-66) emphasizes management for the production of forage and cover for domestic livestock and wildlife. SPR (Semi-primitive recreation) is also emphasized within the project area according to the forest plan. These areas focus on such recreation activities as hiking, horseback riding, hunting, cross-country skiing and ORV use. Timber (TBR) is the third emphasis which promotes wood fiber production and harvest. Developed recreation (DRS) is only slightly emphasized.

The following describes the primary emphases within the project site:

Range	8,857 acres	71% of total area
Semi-primitive Recreation	3,100 acres	25% of total area
Timber	186 acres	1.5% of total area
General Big Game Winter Range	132 acres	<1% of total area
Private land not planned for treatment	190 acres	1.5% of total area

The following Forest Management Goals (followed by Forest Plan page number) apply to this proposal:

<u>Wildlife</u>
"Maintain or improve habitat carrying capacity for elk and deer." (Forest Plan Pg. III-3).

"Maintain or improve wildlife habitat diversity" (Forest Plan Pg. III-3).

"Protect, maintain, and/or improve habitat for threatened or endangered and sensitive plants and animals" (Forest Plan Pg. III-3).

<u>Range</u>
"Maintain upward or stable trends in vegetation and soil condition." (Forest Plan Pg. III-3).

<u>Vegetation</u>
"Certain vegetative types are to be managed such that varying successional stages will be present to provide for a high level of vegetative diversity and productivity" (Forest Plan Pg. III-2).

"Aspen is to be managed, with commercial or noncommercial treatments, with the goal of maintaining 13 percent of the Forest in the aspen type or increasing the aspen type toward the 19 percent it represented in 1915" (Forest Plan Pg. III-2).

Recreation
Maintain, enhance, and/or rehabilitate visual resources to the planned VQO (Forest Plan Pg. III-2).

Protection
"Minimize hazards from flood, wind, wildfire, and erosion" (Forest Plan Pg. III-5).

"Reduce the accumulated fuels to a tolerable risk level" (Forest Plan Pg. III-5).

The following are Desired Future Conditions stated in the Forest Plan:

Wildlife
" ...Populations of deer and elk would increase over current levels. Management Indicator species habitat would be maintained at levels that meet or exceed requirements for minimum viable populations" (Forest Plan Pg. III-10).

"Habitats of threatened and endangered species would be maintained and Habitats for sensitive species would be managed to reduce the potential of these species becoming threatened or endangered" (Forest Plan Pg. III-10).

Aspen
"The aspen vegetative type would be managed and maintained in a condition of high productivity" (Forest Plan Pg. III-8).

Gambel Oak and Mountain Shrub Types
"Intensive management practices would maintain structural diversity within the wood species…vegetative diversity within the grass and forb ground cover would also be improved" (Forest Plan Pg. III-9).

Soil and Water
"Water quality and soil productivity would be maintained or improved".

"Maintain satisfactory watershed conditions. Improve deteriorated watershed conditions where feasible. Protect soil and water productivity so that neither will be significantly or permanently impaired" (Forest Plan Pg. III-4).

Fire
"Prescribed fire from planned or unplanned ignitions would be used for fuels treatment and resource improvement" (Forest Plan Pg. III-13).

1.6 Tiering and Referencing

The management direction for the Moab Face project area can be found in the Manti-La Sal National Forest Land and Resource Management Plan of 1986 (Forest Plan). Prescribed burns would be implemented under direction provided in the Manti-La Sal National Forest Fire Management Plan, Section 5, of 2002, the Utah Fire Amendment Environmental Analysis of 2000, the Utah Smoke Management Plan of 1999, revised March 23, 2000. Prescribed burns would be implemented under direction provided in the Prescribed Fire Guidelines, Manti-La

Sal National Forest (USDA Forest Service 1993) and Manti-La Sal National Forest Smoke Management Guidelines for Prescribed Fires (USDA Forest Service 1992a), all incorporated by reference. A copy of the incorporated documents are available from the Moab/Monticello Ranger District.

1.7 Project Record

Additional supporting documentation and data used in this analysis can be found in the project file for the Moab Face Project Analysis. This file is available for review at the Manti-La Sal National Forest, Moab/Monticello Ranger District office in Moab, Utah.

1.8 Analysis Team

The team of people who have been involved with this analysis has evolved over the years as people have come and gone. However, the predominant team members who contributed greatly to this document are as follows:

Name	Title	Subjects
Julie Gott	Forest Hydrologist	Watershed
Jeff Bruggink	Regional Soil Scientist	Soils
Don Irwin	District Archaeologist	Cultural Resources
Barb Smith	District Wildlife Biologist	Wildlife
Tomas Gonzalez	District Fire and Fuels Specialist	Fire, Fuels
Brent Hanchett	Forest landscape Architect	Visual Quality, Recreation
Shannon Skibeness	District Recreation Program Manager	Recreation
Heather Musclow	Team Leader, District Resource Specialist	Forest Users, Range, Roadless, Vegetation

Chapter 2: Issues and Alternatives

2.1 Introduction

The National Environmental Protection Act uses issues to drive alternatives in environmental analyses. In this analysis, three types of issues were used in the development of the action alternative: those generated from public scoping, those developed from internal concerns, and those developed nationally and used in prescribed fire analysis templates. Many issues are addressed with design features and mitigation measures. Others are covered in the proposal itself. Still others are mitigated through avoidance.

2.2 Internal and Public Participation

Internal scoping for the Moab Face project involved a Project Scoping document that began circulation on December 14, 1998. This document was sent to staff in the Supervisor's Office and on the District. Specialist notes and reports were requested based on this document.

External efforts included a Public Notice in the official newspaper of record, *Times Independent,* published December 24, 1998. A public notice was also published on December 23, 1998 in the *San Juan Record* newspaper. In addition, letters were sent to 146 individuals, organizations and agencies on the Moab/Monticello mailing list who expressed interest in all activities proposed by the forest and those only interested in vegetation treatments. The letter was dated December 14, 1998 and signed by former ranger Glenn Casamassa. The Forest Schedule of Proposed Actions (SOPA) was and has continued to be used to list the project and an estimated timeline. As a result of these scoping efforts, eleven letters were received.

Numerous newspaper articles have been published since 1999. An open house where people received information and exchanged ideas and concerns was conducted February 26, 1999. A list of common questions and responses regarding the project was handed out. A filmed interview with IDT members was aired on local channel 6 television news on February 25 and 26, 1999. A "Travelling Town Meeting" was presented to a variety of communities as follows:

January 8, 1999	Southern Utah Wilderness Alliance
February 16, 1999	Grand County Council
February 22, 1999	San Juan County Commission
February 23, 1999	Moab City Council
March 26, 1999	Pack Creek Community
April 1999	La Sal Community
April 7, 1999	Castle Valley Community

For two weeks from May 7-20, 2001 eleven resource specialists from Idaho, Utah, New Mexico, Colorado and Wyoming representing BLM, USFS, BIA, Utah

Div. Of Forestry, Fire and State Lands and Utah State University converged on the town of Moab. They were called the CEEM group (Continuing Education in Ecosystem Management). The Moab Face landscape was the focus of this class offered by Utah State University. During their two weeks in Moab, the class collected information, conducted 28 interviews, synthesized information and developed a list of opportunities for managing the Moab Face landscape. They assessed the Physical, Biological and Human Dimension settings. Two issues identified tie directly into the need for the Moab Face project: Loss of wildlife habitat and vegetation communities in unhealthy conditions. This class initiated the NFMA (National Forest Management Act) process for the Moab Face project which this document completes.

A presentation was made at the Moab Information Center on July 12, 2001 describing the Moab Face project and soliciting comments. A sign-up sheet was offered for those wanting to be on our mailing list.

A series of speakers presented a variety of fire topics at the USU Extension Classroom in Moab from October 2002 through May 2003. Letters were sent to 358 people advertising the fire information series and it's connection to the proposed Moab Face project. A public field trip was conducted across the Moab Face Project area on June 21, 2003. The speakers and their presentation dates were as follows:

Date	Speaker	Topic
Oct. 22	John Shaw Utah State Univ. Extension	Artificial Disturbances
Nov. 12	Liz Hebertson USFS, Forest Health Protection	Natural Disturbances
Nov. 19	Danny Kellogg USFS, Moab/Monticello Fire Mgmt. Officer	Fire Ecology
Dec. 10	Darren McCavoy Utah State Univ. Extension	Forest Ecology
Jan. 15	Mike Allred Utah Dept. Water Quality	Water Quality
Feb. 12	Bob Campbell & Dale Barton USFS Fishlike Ecologist & USFS Research	Aspen Ecology
March 12	Don Irwin USFS, Moab/Monticello Archaeologist	Fire Effects on Archaeology
April 9	Mike Kuhn Utah State Univ. extension	Urban Interface/Defensible Spaces
May 7	Heather Musclow USFS, Moab/Monticello Resource Specialist	Moab Face
June 21	Heather Musclow & Tomas Gonzales USFS, Resource Specialist & Fuels Management Specialist	Field Review Moab Face

A questionnaire was given to each public participant at the beginning of the fire talk series and at the end. This was used to measure changes in their knowledge and awareness for issues related to the application of fire. The average pre-seminar knowledge level was 2.83 (Range 1.7-3.7). The average post-seminar knowledge level was 4.14 (range 3.6-4.6). This shows a 68% increase in awareness. The following is a list of questions asked:

		Low High
1.	What level of knowledge do you have of the differences between prescribed and wildfire?	1 2 3 4 5
2.	What level of knowledge do you feel you have concerning affects on vegetation from wild or prescribed fire?	1 2 3 4 5
3.	What level of knowledge do you feel you have concerning impacts to archaeological resources from wild or prescribed fire?	1 2 3 4 5
4.	Do you feel comfortable in your knowledge of what a “healthy forest” is?	1 2 3 4 5
5.	Do you know what role fire (wild or prescribed) plays in forest health?	1 2 3 4 5
6.	How knowledgeable do you feel about water quality issues in general?	1 2 3 4 5
7.	How knowledgeable do you feel about potential affects of fire on water quality?	1 2 3 4 5
8.	Are you familiar with the relationship between aspen trees and fire?	1 2 3 4 5
9.	If you had a house surrounded by trees and brush on the La Sal mountains, are you aware of ways to minimize the risk of wildfires?	1 2 3 4 5
10.	Are you familiar with any proposed prescribed fires on the La Sal Mountains?	1 2 3 4 5

A web site was established through Utah State University http://www.cnr.usu.edu/staff/jshaw). Power point presentations and notes from each of the fire series speakers are provided. Specialist reports, fire talk presentations and other information is currently available to the public via the Manti-La Sal National Forest webpage (http://www.fs.fed.us/r4/mantiLa Sal/projects/).

A half-page newsletter was placed in the *Times Independent* newspaper on September 25, 2003 to update the local community of the need, proposal, and continued opportunity to comment.

2.3 Summary of Issues

This section of the analysis looks at all issues, whether mitigated or not, and shows how each is analyzed. The following are the issues used to analyze Alternative A “No Action Alternative” with Alternative B, “Combination Treatment”. A comparison is made between the two alternatives using the following evaluation criteria.

2.3.1 Issue 1: Air Quality

Issue Statement: Air Quality may diminish as a result of this project.

Evaluation Criteria: The amount of Smoke Emission or particulate matter under wildfire/pre-treatment conditions versus post-treatment conditions.

2.3.2 Issue 2: Visual Quality

Issue Statement: Forest plan visual quality objectives may not be met.

Evaluation Criteria: Number of acres where visual quality objectives will not be met

2.3.3 Issue 3: Forest Users

Issue Statement: Implementation of this project may disrupt forest users.

Evaluation Criteria: The length of time, the amount of area and the type of forest user impacted

2.3.4 Issue 4: Vegetation

Issue Statement: Because of past management practices (fire suppression, over-grazing, high-grade timber harvest) vegetation communities are unhealthy and outside of natural fire regimes.

Evaluation Criteria: Number of acres treated by fire and therefore, moved towards the natural disturbance regime

Evaluation Criteria: Number of acres adjacent to structural developments where fuel loads are reduced

2.3.5 Issue 5: Fire Environment

Issue Statement: Because of past management practices (fire suppression, over-grazing, high-grade timber harvest) fuel loads are unnaturally high causing catastrophic fire behavior and the potential for extreme smoke conditions during wildfires.

Evaluation Criteria: Difference in fire behavior between the wildfire/pre-treatment situation and the proposed action/post-treatment situation.

2.3.6 Issue 6: Fish, Wildlife and Plants of Concern

Issue Statement: This project may have negative effects on fish, wildlife, and plants.

Evaluation Criteria:

Goshawk:
- -% of foraging areas (territories) treated
- -Impact Determination

Three-toed Woodpecker:
- -Acres of suitable habitat impacted
- -Impact Determination

Deer and Elk:
-Acres of aspen regeneration
-Cover:forage ratio

2.3.7 **Issue 7: Inventoried Roadless Area Values**

Issue Statement: This project may diminish roadless values in inventoried roadless areas.

Evaluation Criteria: Number of acres within inventoried roadless areas impacted by this project

2.3.8 **Issue 8: Cultural/Heritage Resources**

Issue Statement: This project has potential to impact prehistoric and historic cultural resources that are eligible for listing in the National Register of Historic Places as stipulated in the National Historic Preservation Act (1966, as amended). Therefore, a key management issue is to protect cultural resources from impacts during the project.

Evaluation Criteria: Number of cultural resources eligible for registration protected during this
Project.

2.3.9 **Issue 9: Soils and Watershed Resources**

Issue Statement: Removal of ground surface cover (vegetation, litter, etc.) by burning may cause accelerated erosion within the burn units causing a loss of site productivity and impacts to water quality.

Evaluation Criteria: Amount of detrimental disturbance

Evaluation Criteria: Qualitative comparison of erosion potential using the Water Erosion Prediction Project model (WEPP)

Issue Statement: Prescribed fire may cause more than 15% of an activity area to be left in detrimental soil conditions.

Evaluation Criteria: Detrimental disturbance estimates

Issue Statement: Prescribed treatments may affect water quality and result in changes in watershed stability.

Evaluation Criteria: Amount of change in water quality including designated use classes and TMDL listing.

Evaluation Criteria: Change in watershed risk associated with high intensity storms.

2.3.10 **Issue 10: Livestock Operations**

Issue Statement: Livestock operators may be impacted by implementing this project.

Evaluation Criteria: Number of head months impacted

2.4 Alternatives Considered but Eliminated

2.4.1 Commercial Timber Harvest

One of the primary objectives of this proposal is to reintroduce fire back into the natural regime of the ecosystem. Trees cut commercially would not include fire except to reduce fuelwood slash. A Forest Service Timber Sale Administrator was brought in to examine potential treatment units across the landscape. He analyzed each unit in terms of its location, access, terrain and other factors to determine if harvesting timber would be economically feasible. Areas commercially viable for timber harvest were removed from consideration. The treatment units proposed in this assessment would not be economically viable to harvest.

2.4.2 Fuelwood Cutting

This alternative was analyzed briefly but was eliminated from detailed study because it did not meet the purpose and need of the proposal. One of the primary objectives of this proposal is to reintroduce fire back into the natural regime of the ecosystem which fuelwood cutting does not. In addition, it is anticipated that this alternative would be labor intensive and consequently, less cost effective. Fuel loading (dead trees, limbs and brush) would increase in some areas and remain high where firewood cutters do not go.

2.4.3 Girdling and Chaining

This alternative was analyzed briefly but was eliminated from detailed study because it did not meet the purpose and need of the proposal. One of the primary objectives of this proposal is to reintroduce fire back into the natural regime of the ecosystem which girdling and chaining do not. In addition, it is anticipated that this alternative would be labor intensive and consequently, less cost effective. Fuel loading would increase under this alternative with the increase of dead and down timber. Chaining or pushing trees over would result in an increase in the short term potential for soil displacement because the understory root system would be disturbed. The topography of the landscape, particularly at high elevations, with rolling to steep hills leaves disturbed and exposed soils a concern and the use of heavy equipment limiting.

2.4.4 Herbicide

Fuel loading would increase under this alternative with the increase of down timber. The extent of effect from herbicides depends on the type used. Some herbicides are selective and would not alter understory shrubs, forbs and grasses. Others would remove all vegetation for a short period of time, exposing soil to erosion. In general, increases in forbs is much greater following a burn or chaining than on areas sprayed with herbicides.

The herbicide, 2,4-D, is the one primarily used to treat aspen. 2,4-D degrades in forest litter at about 85-90 percent after 13 days when applied at two pounds acid equivalent per acre. There is a minor introduction of 2,4-D into the air during and immediately after application. This cannot be seen but the smell is noticeable for a few days. Degredation of 2,4-D in plants has been found to reach 85 percent in 13 days following application. This herbicide tends to affect certain forbs and not others and does not affect grass. 2,4-D defoliates shrubs but allows for their resuckering. Aspen trees generally loose their canopy but roots sprout profusely. Conifer species eventually die from 2,4-D but death may take 3-5 years, increasing fuel loads over time.

Tebuthyron is a herbicide often used to control woody species such as oak. Since oak is a prolific sprouter following mechanical and fire treatments, benefits of treatments are often short-lived. The use of herbicides can prolong benefits of treatments such as in WUI areas where oak management can be a key to maintaining fire breaks. While this can be an effective tool, it was not considered in this analysis. Follow-up treatments using fire which have also been shown to be effective in controlling oak if conducted at the proper time of year and at frequent intervals is part of this assessment.

2.4.5 **Prescribed Natural Fire**

Use of natural fire under prescription conditions to accomplish the project goals was not analyzed in depth. When a fire ignition from lightening occurs, the fire may be allowed to burn when weather and fuel conditions allow, but an approved fire management plan must be in place prior to the ignition. Most ignitions occur when unacceptably hot, dry conditions prevail. Therefore most natural fires would not be allowed to burn. It could take a very long time to obtain the needed lightning strike during prescribed weather conditions in order to accomplish objectives. Therefore, although use of wildland natural ignition fire would be desirable, it would not meet the purpose and need of this project in the proposed time frame.

The use of natural fire for management purposes is minimally allowed in the Forest Plan. A larger planning effort is currently underway forest- and state-wide to analyze the broader use of natural fire to accomplish management objectives. Therefore analyzing the use of the method for this project is beyond the scope of the present analysis.

2.5 Alternatives Considered

2.5.1 **Alternative A: No Action**

Alternative A addresses the need to provide a "No Action" alternative (40 CFR 1502.14). Under this alternative there would be no prescribed burning or mechanical treatment of vegetation except what has been authorized by previous decisions. Management would continue as currently carried out, including full fire suppression.

No mitigation measures or monitoring would be required as part of this alternative other than meeting Forest Plan direction, standards, and guidelines.

2.5.2 Alternative B: Combination Treatment

Prescribed fire would be the primary treatment method in the mixed conifer and aspen ecosystem types. This would also include hand cutting using chainsaws as needed. Hand cutting would be used where conditions dictate pre-treatments that are necessary to provide a fuel break, to lay down fuels to ignite and carry a fire or, where burning is not an option.

Mechanical treatments are planned to achieve openings in mountain brush and pinyon-juniper vegetation, set-back vegetation succession in a mosaic pattern, and stimulate plant diversity. Various pieces of equipment have been used in the Four Corners area to achieve these objectives including the brushog, hydroax, rollerchopper and hydromower. Mechanical treatment would be used near Wildland Urban Interface (WUI) areas but the use of prescribed burning and hand cutting using chainsaws would also be incorporated. Follow-up treatment using mechanical and/or burning may be required to control oak sprouting in WUI areas. Inventoried roadless areas, eligible wild and scenic river corridors, riparian areas, and slopes in excess of 30 percent would not be treated by mechanical means except hand cutting by chainsaws where needed.

- Approximately 1,569 acres of mixed conifer vegetation (predominantly spruce/fir) would be treated by burning both ground and ladder fuels. Higher intensity burning would be needed to set back succession in canopy species from spruce/fir to aspen and stimulate forest floor sprouting.

- Approximately 4,981 acres of aspen would be treated with fire by burning to reduce ground fuels, set back succession and stimulate regeneration of older aspen clones.

- Approximately 4,884 acres of mature mountain brush, pinyon/juniper and scattered ponderosa pine of variable slopes would be treated primarily by mechanical means and to a minimal extent by fire for brush pile burning, to breakup fuels and to reduce fire hazard.

- The remaining 1,031 acres consists of vegetation types not targeted for treatment such as riparian/wetlands, sagebrush, perennial forbs, barren, desert shrub, etc.

- A total of 40-80% of the area within treatment units (5,000-10,000 acres) would be burned over the next 10 years. The percent of treatment depends on vegetation type, burning conditions and availability of burning opportunities (windows).

Before a resource manager can utilize prescribed fire, they must prepare a burn plan. Each burn plan includes: resource management goals and objectives, the desired fire behavior to meet those objectives, the conditions under which the burn may be ignited (the prescription), how the fire will be ignited (firing pattern), how it will be confined to the allowable boundaries, and what actions will be taken should the fire burn outside of prescription or escape the boundaries.

2.6 Mitigation Measures

Mitigation measures are actions, guidelines and recommendations to be incorporated during project implementation to meet legal mandates, forest plan standards or specific constraints. Implementing these measures will align project implementation with the effects analysis for each resource. The following are mitigation measures incorporated into the action alternative.

Forest Users

1. The general public would be informed about a planned burn. Should the burn be cancelled, the public would also be informed, to reduce potential recreation conflicts.

2. Areas could be closed to restrict public access for public safety reasons during the actual implementation of prescribed fire.

3. To prevent a short-term increase in illegal off-road travel, screening vegetation would be left along the edges of collector roads to the degree feasible. Signs would be posted asking for cooperation in enforcing the Forest Travel Plan and off-road travel restrictions, and increased patrolling during the period needed to re-establish vegetation cover would be conducted. Monitoring of off-road vehicle use would occur.

4. It is preferred that burning take place outside the primary hunting season (October/November) and the nesting, calving and fawning peak season. However, these restrictions cover a wide range of time and is often the only time to burn. A wildlife biologist would be consulted on site-specific burn units and the timing of each burn. Multi-media attempt would be made to notify hunters prior to the burn.

Vegetation

5. Little to no seeding is anticipated, however, if seeding is warranted, native plant species would be used. Seeding would likely occur where the threat of cheatgrass invasion exists.

Fire Environment

6. All burning would follow a prescription (detailed burn plan) that, generally, would maintain slow, controlled burning when fuel conditions are dry but soil conditions are moist, to protect soils and reduce heat penetration below the ground. Patches of intense fire that kills trees would be allowed depending on the vegetation community, fuel type, and objectives. Burned patch sizes would not

exceed a natural range of appearance. Maintaining fire fighter safety would be the most important consideration during implementation of the burn plan.

7. Prescribed fire used for management purposes has an element of risk from unpredictable changes in burning conditions. If the fire should exceed the prescribed conditions, it would be contained and extinguished. Firefighter safety is always the most important factor in managing prescribed fires.

8. No fire line construction is planned; existing features and breaks in vegetation would be used to contain fire whereever possible.

Fish, Wildlife and Plants of Concern

9. All threatened, endangered, proposed, or sensitive plant and animal species and any nesting birds discovered during project implementation would be protected by avoiding their area as determined in the event of discovery.

10. To conserve wildlife habitat, a minimum of 10 tons/acre of down wood would be maintained where possible. At least three large downed logs per acre, at least 12 inch diameter at the large end and eight feet in length, should be included in the down wood, if possible.

11. No adverse management activities (prolonged use of heavy equipment) during the nesting season would occur from March 1 through September 30 in post fledging areas (PFA) for goshawks. This would also protect Flammulated owls (May-July) and Three-toed woodpecker (May-June) during their nesting periods. Burning would avoid nest areas but may be conducted within the PFA if proper burn prescription occurs.

12. Small openings should be interspersed through-out the forest for goshawks and Merriam's turkeys and should average two acres in size with irregularly shaped edges and size no greater than 200 feet from side to side.

13. An adequate number (and size) of snags (based on Goshawk Mgmt. Recommendations, USDA Forest Service 1992b) should be maintained as habitat for goshawks, flammulated owls, three-toed woodpeckers and general cavity nesters where possible. Snags should contain a variety of diverse characteristics and locations such as dbh/heights, intermixed with live trees, clumped and singular as well as different stages of decay. At least 2 large (>20" dbh) snags/acre would be left where possible in addition to large live (reserve or replacement snag) trees. Snags protected during vegetation treatment activities should receive special protection from firewood cutters.

14. Since implementation of this project is expected to cover many years, areas would be re-surveyed for threatened, endangerd or sensitive species immediately prior to treatment.

Soils and Watershed Resources

15. Rehabilitation would take place in treatment units with more than 15% of the unit in high fire severity. Rehabilitation would include revegetation with native species, slope erosion control measures and/or other appropriate rehabilitation treatments.

16. Slopes greater than 70% are excluded from burning.

17. Soils with depths of less than 10 inches would be avoided.

18. No more than 5% of each treatment unit is currently in detrimental soil condition. This number includes past and current actions such as grazing management and recreational use. The 5% assumption was not verified by treatment unit but represents an estimate representing the worse case condition expected based upon limited visits to the project area.

19. Equipment used would not be traditional logging equipment. Equipment may include brush hogs, chippers or other equipment that has low ground pressure and would not subject soils to severe compaction.

20. Any burning would be small slash piles that represent less than 15% of the area burned. Pile burning would be limited to within the Regional Soil Quality direction for detrimental disturbance utilizing the definition of high burn severity described in this document. All piles would be limited to the smallest size possible to limit the extent of soil heating.

21. The amount of ground cover removed would be less than 50%. This assumption is based upon mitigation requirement to leave surface cover at levels no less than 50% of pre treatment levels.

22. Establish non-ignition buffers of a minimum of 100 feet around intermittent and perennial streams, 100 feet around wetlands, and 50 feet around ephemeral streams. Extend these buffers to include steep canyon walls where the streams are located in sheer- or steep-walled canyons, i.e., Brumley Canyon in Unit 16, Hell Canyon in Unit 8.
23. Establish non-ignition buffers of 300 feet around culinary water sources. This expanded buffer zone would minimize the risk of burning water system facilities and provide a more secure depositional area for any ash or sediment that moves out of a burned area.
24. When scheduling implementation of the prescribed burn units, plan not to burn a large number of acres in the same watershed in the same year – optimally, allow several years of recovery between implementation of units 6 and 7. This will minimize the potential for cumulative watershed effects.
25. Consider burning units with more than 1000 ac in the same watershed (units 3, 4, 6, 7,and 8) in phases. This would minimize the potential for cumulative watershed effects.

26. Based on soils and watershed concerns, schedule Unit 4 last and evaluate our ability to mitigate for the steep slopes and high soil risk factors based on our experience implementing all other units and monitoring the results.
27. Unit 12 – The gated road that drops below Coyote Spring from Rd 128 has a steep grade and shows evidence of erosion. Existing waterbars have been filled and overtopped in many places. The road at the bottom of the slope is in close proximity to the channel and could contribute a large amount of water and sediment in a large runoff event. This appears to be a private road. Attempts should be made to improve road drainage and halt this erosion – if it continues, the waterbars become less and less effective until they are basically non-existent. This could occur as soon as next runoff season. Any increases in overland flow that result from the proposed treatment and reach the road would exacerbate this problem.
28. At sites with private water interests, have a rehabilitation plan in place in case post-treatment effects (higher burn severity than anticipated, etc.) require rehabilitation work. Attempt to have these funded ahead of time; at least have a plan for funding sources.
30. Establish buffers where equipment is excluded around stream channels in mechanical treatment units. The minimum widths of these buffers should follow the guidelines above for non-ignition buffer widths.
30. Ensure that in mechanically treated units, no debris is left in channels or within the adjacent flood prone areas. When left in channels, debris can create jams that result in bank erosion, and may also plug downstream culverts and irrigation structures.

31. Any surface disturbance caused by equipment shall be restored to be within the Regional Soil Quality direction of no more than 15% of an activity area with detrimental soil conditions. Monitoring shall be performed during operations to limit soil disturbance.

<u>Livestock Operations</u>

31. Unless predetermined with the grazing permittee, no more than one pasture per allotment would be burned within any recovery period. This would assure that no more than one pasture in any given allotment would be rested at a single time. Livestock would be removed from a burn unit until aspen suckers reach five-six feet in height and a density of between 2,000-5,000 healthy sprouts per acre. To be healthy, the sprouts must have a strong terminal leader and no grazing hits (Ferguson, unknown date). This may take one growing season or as long as 5-6 years depending on site conditions, but usually occurs within 2-3 years. The area would be monitored to determine if these time frames are appropriate.

33. All structural improvements in the treatment area, including fence lines and water troughs, would be protected.

Cultural/Heritage Resources

34. National Register eligible archaeological sites will be identified and demarcated on the ground to facilitate protection through avoidance or by constructing fire line, wrapping, or other measures to protect vulnerable resources.

35. Fire line construction areas shall be surveyed prior to construction. If cultural resources are identified, fire lines shall be reconfigured to avoid those properties.

36. If unanticipated discoveries of cultural resources are found during implementation, activities will cease in the vicinity until the site is evaluated by a professional archaeologist, and the SHPO and appropriate Tribes are consulted on the results.

2.7 Comparison of Alternatives

Issue Element Evaluation Criteria	***Alternative A: No Action***	***Alternative B: Combination Treatment***
Air Quality Smoke emission or particulate matter	769.33 tons total emissions	457.8 tons total emissions
Visual Quality # acres visual quality objectives will not be met	0 acres not meeting visual quality objectives	0 acres not meeting visual quality objectives
Forest Users Length of time, amount of area, & type of forest user impacted	No Impact	Temporary impact during fire implementation. Only areas immediate to treatment units would be impacted. Impact would include smokeand travel restrictions. One year impact on forest users using burned site.
Vegetation # acres treated by fire # WUI acres where fuel loads are reduced.	 0 acres 0 acres	 6530 acres 4884 acres
Fire Environment Fire behavior	Mid Flame wind speed 3.2 Rate of spread 8.3-40.9 ch/hr Heat per unit area 259-1630 btu/sq ft Fire Line Intensity 12-502 btu/sq ft Flame Length 1.4-7.9 ft	Mid Flame wind speed 0.8 Rate of spread 1.8-11.3 ch/hr Heat per unit area 216-1317 btu/sq ft Fire Line Intensity 3-112 btu/sq ft Flame Length 0.8-3.9 ft
Fish, Wildlife & Plants *Goshawk-* % foraging area treated *3-Toed Woodpecker-* # acres suitable habitat impacted *Deer/Elk-* # acres of aspen regeneration Cover:forage ratio (Desired- 50:50)	 0 acres 0 acres 0 acres deer fawn- 79:21 elk calve- 86:14 cumulative- 60:40	 25% short term- 893 neg. 677 pos. long term- 570 neg. 5600 acres deer fawn- 72:28 elk calve- 74:26 cumulative- 55:45
Inventoried Roadless Area Values # acres IRA impacted	 0 acres	 0 acres
Vegetation # acres treated by fire	 0 acres	 6530 acres

# WUI acres where fuel loads are reduced.	0 acres	4884 acres
Cultural/Heritage Resources # cultural resources eligible to National Register of Historic Places registration protected	0 National Register eligible sites protected	42 National Register eligible sites protected
Soils and Watershed Detrimental disturbance estimates (15% threshold)	No detrimental disturbance	Potentially 5% of total area = within Regional Guidelines
Qualitative comparison of erosion potential (based on soil type)	No soil loss expected	Units 3,4 & 6 may exceed tolerance rating for potential soil loss
Affects to Water Quality	No direct effects. Indirect effects would be greater than Alt. B due to unmanaged wildfire	Slight affect/short-term
Flood Potential and Channel Stability	No direct effects. No direct effects. Indirect effects would be greater than Alt. B due to unmanaged wildfire	No detectable change in watershed response or runoff is expected
Livestock Operations: # head months impacted	0 head months	3527 over 10 years

Chapter 3: Affected Environment

3.1 Introduction

In order to best describe the effects of the alternatives (Chapter IV); the landscape needs to be more clearly defined. Resource specialists submitted reports that were used as the basis for the following summaries. This information is part of the project record located at the Moab Ranger District office and posted on the Manti-La Sal National Forest website. This chapter describes the existing environmental conditions that may or may not be directly or indirectly changed or affected by the alternatives described in Chapter 2.

The Moab Face project area consists of rolling to steep hills with elevations between 7,000 and 10,000 feet. The prevailing wind and moisture patterns are from the southwest. Most precipitation (approximately 23" annually) comes in the form of snow, but summers are characterized by frequent high intensity thunderstorms which contribute to precipitation and runoff. Nearly all soils in the project area are derived from sandstone parent materials. Soil depth varies from shallow to moderately deep.

3.2 Air Quality

Smoke can be a health concern especially among elderly people and asthmatics. Under the 1977 Clean Air Act Amendment, areas of the country were designated as Class I, II, and III airsheds. Class I areas include national parks and some wilderness areas. Class I provides protection to pristine lands by severely limiting the amount of additional human-caused air pollution that can be added to these areas. There are five Class I areas in Utah: Bryce Canyon, Zion, Arches, Capitol Reef and Canyonlands National Parks. Canyonlands and Arches National Parks airsheds could be affected by the Moab Face Project. The rest of the state, including Forest Service wilderness areas, are classified as Class II airsheds.

The nearest large city downwind of the Moab Face project is Grand Junction, Colorado; north-east approximately 70 air miles. Moab is within 15 air miles of project units, however, Moab is not likely to be impacted by smoke. Moab is down slope from the project sites; usually smoke will sink and flow down slope during the night time and morning hours. As required by the Utah Smoke Management Plan, this night-time air flow of smoke would be documented with maps and would be included in the burn plan. There are various county and Forest Service dirt and gravel roads; however, these roads experience low traffic and are not likely to be impacted. Highway 191 travels through Moab and experiences regular traffic. However, like Moab, it is not likely to be impacted. Hwy 46, which travels through the town of Old La Sal is the closest to the project site but is not likely to be impacted since it is up wind of project sites. The towns of La Sal and Old La Sal will need to be considered sensitive smoke receptors and be avoided.

The Forest Service controls prescribed burning effects, including pile burning, by complying with the State of Utah's burn approval process under the Utah Smoke Management plan. The Forest Service would follow smoke management practices described in the Utah Smoke Management Plan that apply to the proposed project. The State of Utah Smoke Management Plan (March 2000) defines procedures that mitigate the impacts of prescribed fire on public health, public safety and visibility. The Utah Division of Air Quality and the Forest Service coordinate procedures that mitigate the impacts of prescribed fire. A State Smoke Program Coordinator acts as the decision-making authority when the possibility of violations may occur. This may include denying prescribed burn implementation due to poor smoke dispersal conditions until dispersal improves.

As required for each burn plan, smoke production will be modeled with a smoke model. Simple Approach Smoke Estimation Model (SASEM) is the model the Manti-La Sal has typically used for prescribed fires.

The state of Utah is divided into 16 Airsheds. These Airsheds follow various land features and are also based on proximity to towns and cities. Airshed 16 is inclusive of all land above 6,500 feet elevation. Fifteen of the sixteen Moab Face project sites are in Airshed 16. This is a more favorable Airshed that will have fewer restrictions due to its higher elevation which assists in smoke dispersal. Polygon 13 is the only project site that is located in Airshed 12. Mitigation measures will need to be applied so the community of Castle Valley is not impacted by prescribed fire smoke from this site.

Wildfires and fire use fires may impact the Airshed, however if there are fires producing "significant" smoke this will be communicated to the Interagency Smoke Coordinator, and if he determines that the Airshed will be negatively impacted, smoke approval will be denied or delayed. Many considerations are factored into whether an Airshed will be negatively impacted. Some considerations include population density in the surrounding area, and down wind, and proximity to class 1 Airsheds (National Parks). Arches National Park is down wind of the project sites however since the prevailing wind is from the southwest and Arches National Park is with in 20 air miles to the north-northeast it is not likely to be impacted. Other considerations that can change daily or more frequently include: atmospheric stability, clearing indices, and the number of other prescribed fires that are taking place or are planned for the same time a smoke approval is requested. Although no project sites are located in Colorado, the smoke will likely drift into Colorado. Even though a Colorado smoke permit will not be required, coordination with the Colorado Air Pollution Control Division will be necessary to ensure the Airshed in Colorado is not negatively impacted.

The SASEM model was used to model smoke particulate matter in two scenarios: Alternative 1 where 11,975 vegetated acres burn and Alternative 2 where 50% of the area would be burned and an estimate of 2,420 acres would be mechanically treated. In comparing Alternative 1 and 2 the assumption is made that 100% of the area (excluding barren ground or rock) would burn in a wildfire if no action is taken. Since approximately 50% of the area is targeted for treatment in Alternative 2, half of these acres would produce emissions. The SASEM model inputs include: 24 hours of burning per 1000 acres burned and; the default fuel loading that corresponds to each Fuel Model. As displayed in Tables 5 and 6. SASEM uses NFDRS (National Fire Danger Rating System) fuel models so both the13 fuel models and corresponding NFDRS fuel models are listed in the first column on Table 5 and 6.

3.3 Visual Quality

The La Sal Mountains rise steeply from the Colorado River basin and surrounding areas to over 12,000 feet in elevation. The picturesque Castle Valley, (elevation 6500') with huge monolithic red rock formations, sits at the foot of the La Sal Mountains, below the Forest Boundary on the north. Vegetation is diverse with mixed conifers, gamble oak, aspen, pinyon and juniper, various forbs, shrubs and bushes. Openings vary in size and shape from small to several acres. The mountains are steep and pointed at the top. Broad valleys reach across from one peak to another. The area is very scenic, because of the diversity in landform, slope and vegetative patterns.

The variety class in the Manti-La Sal National Forest Plan is designated as "Class B, Common." Much of the proposed treatment area is viewed as background from Moab (about 15 miles). The La Sal Mountain Loop Scenic Backway begins at Highway 191, south of Moab and extends up the side of the mountain, across the slope to the north and down again through Castle Valley. The proposed treatment area is viewed from this scenic backway as middleground to the east. The Warner Lake Campground is within a half-mile or so of some of the treatment areas. The Miner's Basin-Warner Lake trail is a part of the Trans-mountain trail system. This trail goes through some of the treatment area.

The sensitivity level (peoples' concern for scenic quality) as viewed by people from Moab and those using the designated scenic backway, the summer homes and the Trans-mountain trail system is rated as high.

The Visual Quality Objective for the project area falls into three categories. The majority of the area (9260 Acres or 74%) is defined in the forest plan as Partial Retention. In areas designated for *Partial Retention*, management activities should remain visually subordinate to the characteristic landscape, but can introduce additional form, line, color and texture. *Modification* occurs along a short stretch of the Geyser Pass Road and covers approximately 1747 acres (14%) within the project area. Modification is defined as allowing changes to form, line, color and texture and not having to be subordinate to the characteristic landscape. *Retention* is the Visual Quality Objective surrounding South Mountain, along the road going to Pack Creek campground, and the area between Bald Mesa and Oowah Lake. Approximately 1214 acres (12%) are classified as Retention. Areas designated for *Retention* require management activities to repeat the form, line, color and textures that are frequently found in the characteristic landscape. Changes should not be evident to the casual Forest visitor. A summary of Visual Quality Objectives (VQO) according to the Forest Plan (1986) for each project unit is as follows:

Project Unit Acres	Vegetative Types	VQO/Acres	Proposed Treatment
Unit 1 765a	Mountain Brush Pinion/Juniper Ponderosa Pine Sagebrush	Partial Retention/428a Modification/310a Private/27a	Mechanical Thinning
Unit 2 418 a	Aspen Mountain Brush Pinion/Juniper Ponderosa Pine Sagebrush	Partial Retention/235a Modification/136a Private/47a	Mechanical Thinning
Unit 3 1673 a	Aspen Aspen/Mixed Conifer Barren Mountain Brush Perennial Forbs Sagebrush Spruce/Fir	Retention/27a Partial Retention/621a Modification/944a Private/81a	Fire
Unit 4 1487 a	Aspen Barren Mountain Brush Perennial Forbs	Partial Retention/1484a Private/3a	Fire
Unit 5 395 a	Aspen Mountain Brush Riparian Wetlands	Retention/12a Partial Retention/383a	Fire
Unit 6 1113 a	Aspen Barren Mountain Brush Perennial Forbs Sagebrush	Retention/238a Partial Retention/875a	Fire
Unit 7 999 a	Aspen Barren Mountain Brush Riparian Wetlands Spruce/Fir	Retention/64a Partial Retention/578a Modification/357a	Fire
Unit 8 1224 a	Aspen Barren Mountain Brush Perennial Forbs Spruce/Fir	Retention/151a Partial Retention/1073a	Fire
Unit 9	Aspen Grassland Spruce/Fir	Retention/ 165a	Fire

Unit 10 219 a	Aspen Mountain Brush Riparian Wetlands Grasslands	Retention/219a	Fire
Unit 11 136 a	Aspen Barren Mountain Brush Spruce/Fir	Retention/136a	Fire
Unit 12 2028 a	Barren Mountain Brush Sagebrush Spruce/Fir	Retention/203a Partial Retention/1740a	Fire
Unit 13 218 a	Mountain Brush Barren Pinyon/Juniper Sagebrush Desert Shrub	Partial Retention/215a	Mechanical Thinning
Unit 14 509 a	Aspen Mountain Brush Sagebrush Riparian Wetlands	Partial Retention/509a	Mechanical Thinning
Unit 15 615 a	Mountain Brush Pinyon/Juniper Sagebrush	Partial Retention/615a	Mechanical Thinning
Unit 16 501 a	Mountain Brush Pinyon/Juniper Barren Riparian Wetlands	Partial Retention/501a	Mechanical Thinning
Unit 17 1703 a	Mountain Brush Pinyon/Juniper Barren Sagebrush Riparian Wetlands	Retention/376a Partial Retention/1325a	Mechanical Thinning & Fire

3.4 Forest Users

Smoke can cause vehicle accidents and deaths from decreased visibility on roads and in rare cases has caused airports to shut down from decreased visibility. Smoke is a nuisance and can cause concern from the public. For more on smoke, see the Air Quality section above.

The Recreation Opportunity Spectrum is a way of classifying land so that a variety of recreation opportunities are available ranging from modern and developed to primitive and undeveloped. The Recreation Opportunity Spectrum (ROS) can be defined as a recreation opportunity setting composed of physical, biological, social, and managerial conditions that give value to a place.

ROS is defined using a variety of factors, each having a range of possibilities. The following outlines the factors and the range for each:

FACTOR **RANGE OF POSSIBLITIES**

Access Cross-country travel
Non-motorized
Motorized trails & primitive roads
Controlled Full Access

Remoteness Out of sight and sound
Distant sight and/or Sounds & >½ hour walk from any motorized travel
Distant sight and/or sounds & > ½ hour walk from any better than primitive road Remoteness of little relevance

Social Encounters 6 parties or less met per day/less than 3 visible campsites
6-15 parties met per day/6 or less visible campsites
Moderate to high contact in developed sites on roads and trails
Large number of users on site and in nearby areas

Visitor Management Low regimentation/no one-site controls/no information facilities
Subtle on site regimentation & controls/very limited information facilities
On-site regimentation & controls are noticeable but harmonize with natural environment, simple information facilities.
Regimentation and controls obvious and numerous but harmonize/more complex information facilities
Regimentation and controls obvious and numerous sophisticated information facilities

On-site Development No facilities with possible rustic ones for site protection made of native materials
Factors Rustic facilities with no evidence of synthetic materials used
Rustic facilities using native materials with more refinement in design
Some facilities designed for user comfort, use of synthetics, complex design
Facilities for user comfort, synthetic materials common, complex design

Visitor Impacts Unnoticeable impacts, no site hardening
Subordinate impacts, no site hardening
Subordinate impacts limited site hardening
Subtle site hardening
Site hardening may dominate but be in harmony

Naturalness or Preservation
Visual Quality Objective Retention
(VQO) Partial Retention
Modification
Maximum modification

The ROS of an area is ranked according to the above criteria. The following describes each ROS class using the above definitions:

Primitive: Each factor would tend to the top of the list such as cross-country travel, out of site and sound of people, no facilities, unnoticeable impacts and preservation.

Semi-Primitive Non-Motorized: Cross-country travel or non-motorized trails, distant sight and sounds, subtle on-site regimentation, rustic facilities, preservation or retention VQOs.

Semi-Primitive Motorized: Can have motorized trails and primitive roads, distant sights and sounds, 6-15 parties met per day, rustic facilities, partial retention VQO.

Roaded Natural: Motorized roads and trails of higher quality, remoteness of little relevance, moderate to high human contact on roads, on-site regimentation noticeable, rustic facilities, VQO can range up to modification.

Rural: Full access, remoteness of little relevance, moderate numbers of users, regimentation obvious, Some facilities designed for user comfort, site hardening dominant, VQOs modification.

Urban: Full access, remoteness of little relevance, high numbers of users, regimentation obvious, Facilities typically designed for user comfort, site hardening dominant, VQOs modification.

Roaded Natural appearing (5276 acres or 42% of the project area) occurs along the La Sal pass, Geyser pass, Warner lake, Oowah Lake and Loop roads. A little over 6820 acres or 55% of the area is classified as *Semi-Primitive Motorized*. Only 11 acres near the rim of the Mill Creek Gorge is rated as *Semi-Primitive Non-motorized* which amounts to just a trace. The remaining acres are private land and not rated.

The types of activities that occur in the analysis area are: driving for pleasure, gathering forest products, hunting, fishing, camping, picnicking, hiking, biking, horseback riding, skiing, snowmobile riding, OHV use, and other. Recreationists congregate in several areas adjacent to treatment areas. Medicine and Beaver lakes lie between units 8, 9 and 10 in the La Sal Pass area. Oowah Lake and campground is located near unit 7 proposed for treatment. Some treatment is planned within the campground. Warner Lake and campground are located near treatments proposed in unit 6. Mason Draw campground is directly below treatment unit 5. The following list describes the ROS Class identified in the Forest Plan (1986) for each project unit:

Project Unit Acres	Vegetative Types	ROS Class	Proposed Treatment
Unit 1 765a	Mountain Brush Pinion/Juniper Ponderosa Pine Sagebrush	RN SPM	Mechanical Thinning
Unit 2 418 a	Aspen Mountain Brush Pinion/Juniper Ponderosa Pine Sagebrush	RN SPM	Mechanical Thinning

Unit 3 1673 a	Aspen Aspen/Mixed Conifer Barren Mountain Brush Perennial Forbs Sagebrush Spruce/Fir	SPM	Fire
Unit 4 1487 a	Aspen Barren Mountain Brush Perennial Forbs	RN SPM	Fire
Unit 5 395 a	Aspen Mountain Brush Riparian Wetlands	RN SPM	Fire
Unit 6 1113 a	Aspen Barren Mountain Brush Perennial Forbs Sagebrush	RN SPM	Fire
Unit 7 999 a	Aspen Barren Mountain Brush Riparian Wetlands Spruce/Fir	RN SPM	Fire
Unit 8 1224 a	Aspen Barren Mountain Brush Perennial Forbs Spruce/Fir	RN SPM	Fire
Unit 9	Aspen Grassland Spruce/Fir	SPM	Fire
Unit 10 219 a	Aspen Mountain Brush Riparian Wetlands Grasslands	SPM	Fire
Unit 11 136 a	Aspen Barren Mountain Brush Spruce/Fir	SPM	Fire
Unit 12 2028 a	Barren Mountain Brush Sagebrush Spruce/Fir	RN SPM	Fire
Unit 13 218 a	Mountain Brush Barren Pinyon/Juniper Sagebrush Desert Shrub	SPM	Mechanical Thinning

Unit 14 509 a	Aspen Mountain Brush Sagebrush Riparian Wetlands	RN SPM	Mechanical Thinning
Unit 15 615 a	Mountain Brush Pinyon/Juniper Sagebrush	RN SPM	Mechanical Thinning
Unit 16 501 a	Mountain Brush Pinyon/Juniper Barren Riparian Wetlands	RN SPM SPNM	Mechanical Thinning
Unit 17 1703 a	Mountain Brush Pinyon/Juniper Barren Sagebrush Riparian Wetlands	RN SPM	Mechanical Thinning & Fire

RN=Roaded Natural
SPM= Semi-Primitive Motorized
SPNM= Semi-Primitive Non-Motorized

Table 1. Points of interest and recommendations for each project unit

Project Unit	General Description	Interest	Recommendation of mechanized and/or prescribed burning
1	Vicinity of Fisher Mesa/Bull Canyon	No concerns.	Either
2	Vicinity of Fisher Mesa/Bull Canyon	No concerns.	Either
3	Willow Basin area	TheTrans La Sal trail goes through this polygon.	Within this polygon, for a defined corridor either side of the trail, we recommend mechanized treatment.
4	Miner's Basin area	There is a developed recreation site at the end of the open Miner's Basin road, which includes a toilet, bulleting board, trailhead signs, and a parking lot. There is also a pond within the vicinity that is used for fishing, hiking around, and for viewing.	An area including these recreation features and a buffer around them needs to be designated for mechanical or no treatment to minimize impacts to recreation features.
5	Mason Draw	Illegal user-created Hazard County trail.	Either
6	Upper Warner Lake drainage	Trans La Sal trail to Miner's Basin, near Burro Pass trail and Warner Lake	An area including these recreation features needs a buffer around them to be

		Campground.	treated using mechanized treatments or no treatment.
7	Oowah Lake & Clark Lake vicinity	Recreation features include Oowah Lake Campground, parking lot, toilet, trailhead, and trailhead bulletin board. Clark Lake Trail. The polygon contains two segments of the Boren Mesa section of the Trans La Sal trail.	Mechanized treatment or no treatment along trail corridors and around recreation features.
8	Trans La Sal Trail, South Mountain Trail, and La Sal Pass Road	Sections of the Trans La Sal Trail, the South Mountain Trail, and the La Sal Pass Road pass through this polygon. The La Sal Road provides access to a variety of recreational features.	Mechanized treatment along trail corridors
9	South Mountain	South Mountain Trail # 029.	Mechanized treatments along the trail corridor.
10	South Mountain	No concerns	Mechanized treatments near the trail.
11	Near Pole Canyon & Doe Canyon Trails	No concerns	Either
12	Near Pole Canyon & Doe Canyon Trails	No concerns	Either
13	Near Pinhook Valley	No concerns	Either
14	Bald Mesa area	No concerns	Either
15	South Mesa Lake area	No concerns	Either
16	Brumley Ridge area	Minimal concerns. There is some rock climbing that occurs in the Brumley Ridge area, both private climbing and outfitter/guide provided services.	Either

3.5 Vegetation

The Moab Face project area contains a complex of vegetation types. There are natural zones of vegetation based on elevation. Arranged from the highest elevation to the lowest, the vegetation across the Moab Face within the project area is as follows:

Mixed Conifer (Engelmann spruce-subalpine fir-quaking aspen)
Mountain brush (Predominantly Gamble oak)
Pinyon-Juniper

Each of these vegetation communities has a range of structure, function, pattern and disturbance regimes that characterize a healthy ecosystem, otherwise known as “Properly Functioning Condition”. Past management practices including full suppression of fires, over-grazing during the late 1800s and early 1900s, high-grade timber harvest practices as well as the presence/absence of Pre-European Pueblo inhabitants, have direct influences on current vegetative conditions across the western United States and on Moab Face. In many areas these factors have impacted ecosystems so they are no longer in Properly Functioning Condition.

Unhealthy ecosystems are seen in areas where tree densities have increased by a factor of 10 to 100 times with large old trees replaced by small young stunted tree thickets. Other indications are the loss of sagebrush/grasslands from tree encroachment and the epidemic level of forest insects and diseases seen today.

Desired Future Condition for the vegetation types involved in Moab Face, according to the Manti-La Sal National Forest Land and Resources Management Plan (1986) is as follows:

Aspen: “The aspen vegetative type would be managed and maintained in a condition of high productivity” (Pg III-8).

Engelmann Spruce-Alpine Fir: “Approximtely 25 percent of this type is suitable for intensive management…The number of fir stands would be diminished as a result of some stands being converted back to aspen” (Pg III-8).

Gambel Oak and Mountain Shrub Types: “Intensive management practices would maintain structural diversity within the woody species in at least 25 percent of the area covered by the Gambel oak and Mountain shrub type. Vegetative diversity within the grass and forb ground cover would also be improved. In some cases, the Gambel oak would be encouraged to successionally develop as an open savannah or in a high seral stage” (Pg III-9).

Pinyon-Juniper: “Pinyon-juniper stands (about 10 percent of the total) on gentle slopes and on lands with good soils will be treated periodically to maintain early successional stages” (Pg III-8).

3.5.1 **Mixed Conifer**

Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*) and quaking aspen (*Populus tremuloides*) are the dominant tree species in Mixed Conifer forests on Moab Face. This vegetation type occurs between 8,000 and 10,500 feet elevation on the La Sal Mountains.

Properly Functioning Condition for mixed conifer forests on the Manti-La Sal National Forest according to a draft report (1998) is described as follows:

Grass/forb	10%
Seedling/Sapling	10%
Young Forest	20%
Mid Aged Forest	25%
Mature Forest	25%
Old Forest	10%

Spruce

Unlike subalpine fir, Engelmann spruce is often found in extensive pure stands. The average maximum age for Engelmann spruce appears to be around 400 years (William Harlow and Ellwood Harrar, 1969). Periodic outbreaks of the Engelmann spruce bark beetle have been active across the Moab Face but to date have not been at epidemic levels.

Seeds of conifers are very small and grow slowly. Spruce are shallow rooted and subject to severe windthrow. Soil moisture is a critical factor in the regeneration of spruce. Seeds become established on a variety of soil types from gravelly sandy loam to silty loam. Engelmann spruce reaches it's maximum height (100-120 feet) while on deep, rich, loamy soils of high moisture content. These trees are found in areas where rainfall exceeds 25 inches/year. The soil moisture regime is much more favorable for regeneration under a canopy rather than in open areas. Canopy cover holds moisture in the soil and encourages spruce seedlings to become established. It's this preference for shady conditions that allow spruce to grow under a canopy of aspen causing aspen to eventually diminish in the absence of disturbance (John W. Barrett, 1980 in Fire Effects).

Fir

Subalpine fir is largely restricted to high western forests. Although it can form in limited pure stands, it tends to prefer mixed forests with constant companionship with Engelmann spruce.

Subalpine fir may begin to produce cones when trees are 4 to 5 ft tall and 20 years old, but under shaded forest conditions, seed production is not significant until trees are older and taller (Silvics). Subalpine fir is a good seed producer in the Rocky Mountains, with good to heavy crops born every 3 years and light crops or failures in between. It is as good a seed producer as most associated true firs, but not as good as Engelmann spruce (Silvics).

Normally, fir seeds from cones lie dormant under winter snows germinating in the spring. Mineral soils and moist sites promote germination and early survival of subalpine fir, however, the species is adaptable and can tolerate less exact conditions than most of its common associates. Because it is so adaptable, subalpine fir is able to invade and establish on severe sites such as recent burns, lava flows, talus slopes, avalanche tracks, and climatically severe regions near timberline. Although subalpine fir grows under nearly all light intensities, in the Rocky Mountains where subalpine fir and Engelmann spruce form the spruce-fir type, subalpine fir is very shade-tolerant. It is much more tolerant than other common associates such as aspen, blue spruce, and interior Douglas-fir (Silvics). This is the primary reason it becomes well established under aspen canopies.

Seedling growth is slow; trees 10 to 20 inches in diameter are often 150 to 200 years old under shaded forest conditions (Silvics). Trees older than 250 years are not uncommon. But, because the species suffers severely from heartrot, many trees either die or are completely rotted at an early age.

Aspen

Quaking aspen is the most widespread deciduous tree in North America and is one of the most productive vegetation types on the Moab District. Locally, it is found at elevations ranging from 8000' to 10,000' and in precipitation zones ranging from 15-40 inches.

Wildlife and domestic livestock utilize young aspen sprouts for forage. The limited amounts of regeneration and understory sprouting that occurres in the landscape gets heavily grazed, lowering regeneration success and causing development of more even-age (mature and old) tree stands.

Although aspen produces abundant seed, seedling survival is low in the intermountain west. Most commonly, aspen regenerates by suckers that grow from the root system where major disturbances have occurred to disturb the parent clone. The number of suckers that are produced generally range from 15,000 to 30,000 per acre, depending on the condition of the parent stand at the time of disturbance. Under natural regimes, fire is the disturbing force that promotes aspen regeneration. Without regeneration, individual aspen clones can live for a maximum of approximately 200 years. The natural fire frequency in aspen/mixed conifer stands is approximately 70-200 years and 2-5 years in aspen/bunchgrass communities (Covington et al. 1983). These are often low-intensity and not stand replacing fires. Research indicates that fire frequencies of 100 to 300 years are necessary for the regeneration and maintenance of many aspen communities (DeByle et al.1987).

Because of fire suppression coupled with heavy grazing of young shoots, aspen has declined across the west. Bartos and Campbell (2002) share the following table to emphasize this situation:

State	Historic Acres	Current Acres	Percent Decline
Utah	2,930,684	1,427,973	51%
Colorado	2,188,003	1,110,764	49%
Arizona	720,880	29,009	96%
Idaho	160,957	621,520	62%

Bartos and Campbell (1998) describe five factors that indicate a risk of loosing an aspen stand. The risk factors consist of the following:

1. Conifer understory and overstory greater than 25 percent.
2. Aspen canopy cover less than 40 percent.
3. Dominant aspen trees greater than 100 years old.
4. Aspen regeneration less than 500 stems per acre (5-15 feet tall).
5. Sagebrush cover greater than 10 percent.

Under natural disturbance regimes, aspen regeneration occurs from periodic fire not allowing large stands to become old and decadent. Aspen is extremely susceptible to decay. The loss of fire since the turn of the century has resulted in stands of large old decadent aspen void of regeneration. These old trees are extremely susceptible to attacks by fungi. False tinder fungus (*Fomes igniarius*) is evidenced by the presence of conks on the boles of live trees. This fungus generally infects aspen at dead branch stub sites or wound sites and results in extensive trunk rot (USDA GTR RM-119, Page 106, USDA Forest Insect and Disease Leaflet 149). These conks are evident throughout aspen stands on the La Sal Mountains.

Existing Condition

Spruce, fir, aspen and some combination of all three forest species accounts for 52% of the total Moab Face project area. An attempt at splitting out one species type from another may be futile since they are all deeply intermingled within the project area depending on the successional stage. This vegetation type accounts for 6,530 acres of the total 12,465 acre treatment area.

The Forest Service has examined the treatment of aspen across the Moab Face of the La Sal Mountains since 1982. Numerous field reviews, analyses and reports have been filed showing the long-standing desire to maintain and regenerate aspen. Field data collected in 1994 confirmed that aspen is declining across the Moab Face as spruce and fir continue to gain dominance, replacing aspen clones which are generally mature and over-mature. Aspen commonly persists on the fringes and as small unthrifty trees within spruce/fir stands. A total of 10,800 acres were assessed on the west-side of the La Sal Mountains in 1991. Results showed that 56% of the area had conifer trees already over-topping aspen, 27% of the area had dense conifer trees as an understory to aspen, and 17% of the area had few conifer trees in almost pure stands of aspen.

Another way to measure succession of aspen by spruce-fir is the percent stocking of each type in a given stand. The results of the 1991 assessment showed 3,963 acres or 37% of the area had conifer trees dominating aspen trees. Aspen trees dominated conifer trees on 5,039 acres or 47% of the area and 1,798 acres were considered pure aspen. Given the first two factors listed above by Bartos and Campbell (1998), 81% of the aspen stands surveyed in 1991 on the west side of the La Sal Mountains are at risk of being lost by conversion to spruce-fir.

Ground cover under mixed conifer forests dominated by aspen is largely vegetation (as opposed to litter). Bartos and Campbell (2002) have shown as spruce-fir take over, ground cover shifts from vegetation to litter, usually needle mats. Forage measured under healthy aspen stands is often between 3,000-4,000 pounds/acre where as stands dominated by conifers only produce up to 200 pounds/acre.

During a 1990 reconnaissance of mixed conifer stands in the Geyser Pass and Willow Basin areas of Moab Face, the following plants were found to associate with the aspen-spruce-fir vegetation type:

Grasses or grass-like:

Bromus ciliatus	Fringed Brome
Carex rossii	Ross Carex

Forbs:

Geranium richardsonii	Richardson Geranium
Senecio serre	Butterweed Groundsel
Vicia americana minor	American Vetch
Pyrola secunda	Sidebells Pyrola
Arnica cordifolia	Heartleaf Arnica
Epilobium angustifolium	Fireweed
Viola canadensis	Canada Violet
Thalictrum fendleri	Fendler Meadowrue
Lupinus sericeus	Silky Lupine
Lomatium dissectum	Carrotleaf Lomatium
Osmorhiza chilensis	Sweetroot

Shrubs:

Berberis repens	Creeping Barberry
Ribes montigenum	Gooseberry Current

Fire is regarded as the most important mechanism that drives vegetation dynamics in western forest ecosystems (Jenkins et al. 1998). Due to the rarity of extreme burning conditions and slow decomposition rates that allow fuels to accumulate at high elevations, fires that occur in the spruce/fir zone generally have long-return intervals, are of high-intensity, and result in stand-replacing crown fires. Between catastrophic events, low-intensity surface fires, spruce beetle (*Dendroctonus rufipennis*) outbreaks and other disturbances may have occurred (Jenkins et al. 1998).

The following is a list of fires recorded for the Moab District in the spruce/fir community type (From 1971-2002 district and Moab Fire Center records).

Cause	Affected Vegetation	Size of Fire (Acres)	Date Occurred
Human-caused	spruce/fir	.1	7/27/71

Human-caused	spruce/fir	.1	0/20/73
Lightning	spruce/fir	.1	7/18/76
Lightning	spruce/fir	.1	7/19/77
Lightning	spruce/fir	.1	8/8/79
Lightning	spruce/fir	9	6/9/81
Human-caused	spruce/fir	65	7/2/82
Lightning	spruce/fir	.2	7/17/86
Lightning	spruce/fir	.2	7/29/86
Human-caused	spruce/fir	.1	11/1/88
Lightning	aspen	1.5	7/21/89
Lightning	aspen	.1	7/4/90
Lightning	aspen	.1	7/30/91
Lightning	spruce/fir	25	7/3/94
Lightning	aspen	.1	7/22/94
Lightning	aspen	.1	7/22/94
Lightning	aspen	.1	7/23/94
Lightning	aspen	3.0	9/1/94
Lightning	aspen	.1	8/23/97
Lightning	aspen	.1	8/13/00
Lightning	aspen	.2	8/16/00
Lightning	aspen	.1	8/24/00
Lightning	spruce/fir	.2	9/28/00
Lightning	aspen	.2	6/22/01
Lightning	spruce/fir	.2	8/18/02
Lightning	aspen	.1	9/2/02

Total Acres: 106.2
Length of Period: 31 years

This community currently shows a lack of fire and inadequate disturbance regime. Based on the average fire interval of 40 years (30-50) in the Properly Functioning Condition guidelines for spruce/fir/aspen in the Manti-La Sal National Forest (1998), the number of acres that should burn within the 6530 acre area on an annual basis is a minimum of 163 acres/year (6530/40). This is much more than the recorded occurrences which *totaled 106*.2 acres over 31 years or 3.4 acres/year. It is appropriate to note that fire occurrence can be highly variable in this vegetation however, burning hundreds or thousands of acres in a drought cycle or small patches in wetter years.

3.5.2 **Mountain Brush**

The mountain brush community consists primarily of five shrub species. Gambel oak *(Quercus gambelii*) and serviceberry (*Amelanchier alnifolia*) make up most of the stands, with smaller amounts of mountain mahogany (*Cercocarpus sp.*), snowberry (*Symphoricarpos albus*) and big sagebrush (*Artemesia tridentata*). Combinations of these species vary in dominance from one area to another and an important subtype of the brush community is the sagebrush/grassland that fills the small open spaces among the shrubs. Overall, the Moab Face area has historically been a highly variable, highly mixed vegetation community with natural disturbances to maintain a mosaic of early successional plant communities and mixes of plant species. As such, it is a valuable ecotone system with transitional range for many species of wildlife.

The Properly Functioning Condition for the mountain brush community is multiple vegetation layers with well-developed herbaceous layers and bare ground less than 25% (Manti-La Sal National Forest 1998). Gambel oak often dominates with a balanced range of:

Grass/forb	15%
Early successional vegetation	15%
Mid-successional vegetation	35%
Late successional species	35%

The natural disturbance regime for mountain brush communities includes insect epidemics, disease and fire cycles of 20-50 years. Fire intensity and severity can be mixed depending on fuel loads at the time.

Gambel Oak

Oakbrush comprises a major portion of the vegetation between 7,000 and 9,000 feet elevation. While it can grow as trees, it typically occurs in Utah and on the Moab Face as clones of shrubs in dense patches 3 to 20 feet tall.

A study in west-central Colorado showed that about half the oak stems in a normal stand are less than 10 years old (Brown 1958). The remainder were distributed uniformly through the 10 to 80 year old classes. Stems older than 80 years are relatively scarce, indicating a natural early mortality. The average mature stem is 13 feet tall and 3 inches in diameter (Brown 1958). This seems indicative of eastern Utah. Oak savannas where there are small groves of large old trees are not abundant therefore the desire is to manage for these woodlands.

Brown (1958) found that oak stands did not appear to be spreading in west-central Colorado and estimated the extent of these woodlands were similar to those found in the late 1800's. Christensen (1955) found that seedlings started by acorn sprouting were rare and that resprouting from established root sources was the main way oak reproduced. The survival ability of Gamble oak lies in its extensive root system. It's root system is described as a shallow network of largely rhizomatous wide-spreading roots (Engle et al. 1983). This root system allows an increased longevity of the individual plant and the multiplication of individuals under conditions which are too severe for seedling establishment (Engle et al. 1983). Gambel oak can be either a climax species or successionally transitional to conifers. In areas where pinyon and juniper are climax species, oak has the competitive advantage over reestablishing after fire since it sprouts from existing roots rather than relying on seed germination (Fire Effects Database).

Oak is often defoliated by an insect known as a looper, *Lambdina punctata* (Brown 1958) and larvae of Lepidoptera and Coleoptera that can cause mortality of over 85 percent of acorns (Christensen 1955). Witches' broom formations in Gambel oak across Utah, Arizona and New Mexico are prevalent and have been found to be caused by the fungus *Articularia quercina var. minor* (Hawksworth and Mielke 1962). Because it is typically found younger than 10 years of age, oak is thought to be susceptible to killing agents (insects, freeze, drought) and in a “constant” state of regeneration.

Serviceberry

Serviceberry is an adaptable shrub ranging from near sea level to subalpine. In Utah, it occurs at elevations between 4,000 and 10,000 feet. Serviceberry does not tolerate shade and is often used in open areas to stabilize loose disturbed and erodable soils. It is tolerant of a variety of moisture and soil regimes. Regeneration of serviceberry from seed is rare being limited by moisture, disease and low spring temperatures. Vegetative reproduction by sprouting is most common. Studies show that almost all of the new stems sampled were sprouts from previously existing plants (Fire Effects Database).

Because serviceberry roots are rhizomatous and occur at varying depths below the soil surface, it is able to sprout following any intensity of fire (Fire Effects Database). It actually requires fire or some disturbance to rejuvenate decadent shrubs, declining in the absence of fire. It also requires disturbance to remove canopies above it. Serviceberry will eventually die under canopy closure (Fire Effects Database). The historical fire regime where serviceberry occurs at low elevations in the Rocky Mountains is generally a frequency of 2-50 years (Fire Effects Database).

Mahogany

Mahoganies are in the Rosacea family and like other members of their group develop seeds on mature (second year) stems. These seeds, however, are not strong competitors with other associated species. If terminal stems are browsed every year, no production can take place. The mahoganies are good browse for all types of livestock and extremely valuable winter browse for deer. There is general agreement that mahogany can withstand yearly browsing up to about 50%, however, long-term survival of mahogany stands may require less utilization (Winward note to file).

Many insects damage mahogany seeds, sometimes to the point of elimination of an entire years crop. Wildlife consumption of seeds is high and those few seeds that do germinate are usually nipped off by rabbits or larger herbivores.

Two primary types of mahogany exist within the Moab Face project area: Birchleaf mountain mahogany (also known as alderleaf or true mountain mahogany *Cercocarpus montanus) and* Curlleaf Mountain Mahogany (*C. ledifolius*). Birchleaf mahogany readily sprouts following fire while Curlleaf mahogany is usually killed.

Snowberry

Common snowberry are shrubs characterized by survival through rhizomes. If it is on a site prior to disturbance, it will be reestablished in the initial stages of postdisturbance succession (Fire Effects Database). Snowberry can regenerate by seeds, however, nutlets are extremely difficult to germinate because of a hard tough impermeable covering and only a partially developed embryo (Fire Effects Database).

Snowberry occurs on a wide variety of soil types and can survive under low nutrient conditions. It does best on well-drained soils.

Sagebrush/Grass

Much of the area currently occupied by grass/sagebrush on Moab Face include big sagebrush (*Artemesia tridentata)*, smooth brome (*Bromus inermis*) and crested wheatgrass (*Agropyron crestatum*). Sagebrush/grasslands are believed to have diminished across the west through encroachment of pinyon-juniper and mountain brush species in the absence of natural disturbances. No treatment of grassland/sagebrush areas are planned for this project. However, mountain brush treatment sites may convert to sagebrush/grasslands as an early seral stage.

Existing Condition

The mountain brush community accounts for 32% of the total Moab Face project area. This vegetation type accounts for 3,936 acres of the total 12,465 acre analysis area

The following plants are associated with mountain brush communities:

Grasses:

Poa pretensis	Kentucky Bluegrass
Agropyron smithii	Western Wheatgrass

Forbs:

Vicia sp.	Vetch
Achillea millefolium	Yarrow

Shrubs:

Rosa sp.	Rose

Currently, the mountain brush community across Moab Face has a good mix of shrub, herbaceous and grass species. However, in the absence of natural disturbances, age class structure and pattern for these species are not in line with a healthy mountain brush community. New recruitment of plants is not occurring except in those areas that have received treatment in the past 30+ years; older plants are found where no recent disturbance to the vegetation has occurred. Serviceberry, for example, has reached 12 feet in height, with young palatable shoots out of reach of big game animals. Encroachment of pinyon-juniper at the lower elevation of its range is occurring. Fuel loads are accumulating and currently are at moderate levels.

Natural fires occurring in brush on Moab Face are typically started by summer lightning storms. Forest policy for aggressive fire suppression over the last 50 to 80 years has resulted in fires typically no larger than .1 acre.

The following is a list of fires recorded for the Moab Face area in the mountain brush community type since 1973 (From district and Moab Fire Center records).

Cause	Affected Vegetation	Size of Fire (Acres)	Date Occurred
Human-caused	oakbrush	.05	10/20/73
Human-caused	oakbrush	.1	10/21/73
Human-caused	grass	.1	8/3/78
Human-caused	grass	5.	8/4/79
Lightning	oakbrush	.1	8/8/79
Lightning	oakbrush	.1	7/22/80
Unknown	oakbrush	.1	8/21/80
Lightning	sagebrush	.1	8/9/81
Lightning	oakbrush	18.0	8/9/81
Lightning	oakbrush	.1	8/28/81
Campfire	oakbrush	65.0	7/3/82
Campfire	oakbrush	.1	10/24/82
Lightning	oakbrush	.1	6/8/84
Lightning	oakbrush	.1	6/19/84
Lightning	oakbrush	.1	6/27/84
Lightning	oakbrush	8.1	7/1/87
Human-caused	oakbrush	35.0	7/5/87
Lightning	oakbrush	.1	8/13/87
Human-caused	oakbrush	248.0	8/16/87
Lightning	mtn. brush	35.0	7/18/88
Lightning	sagebrush	.1	7/11/89
Lightning	oakbrush	.1	10/27/89
Lightning	mtn. brush	1.0	7/23/91
Lightning	mtn. brush	.2	7/30/91
Human-caused	oakbrush	.1	10/8/91
Lightning	oakbrush	.1	5/29/92
Unknown	mtn. brush	.1	6/25/92
Unknown	mtn. brush	.1	6/25/92
Human-caused	oakbrush	.1	10/8/92
Lightning	oakbrush	.5	6/17/93
Human-caused	oakbrush	.3	5/17/94
Lightning	mtn. brush	.1	7/2/94
Lightning	oakbrush	.3	7/13/94
Lightning	oakbrush	.3	7/13/94
Lightning	sagebrush	.1	8/1/94
Lightning	mtn. brush	.3	8/15/94
Lightning	mtn. brush	.5	9/12/94
Lightning	mtn. brush	.1	10/8/94

Lightning	sagebrush	5.0	7/30/95
Lightning	oakbrush	.3	8/11/95
Lightning	mtn. brush	.1	8/22/95
Lightning	oakbrush	.5	6/2/96
Lightning	mtn. brush	.8	6/21/96
Lightning	oakbrush	2.0	6/22/96
Lightning	mtn. brush	.1	6/30/96
Lightning	oakbrush	.5	7/20/96
Lightning	grass	.1	8/21/97
Lightning	sagebrush	2.0	6/21/99
Lightning	oakbrush	.2	10/4/00
Lightning	oakbrush	.1	7/14/00
Lightning	mtn. brush	.2	7/25/00
Lightning	oakbrush	4.0	8/5/00
Lightning	oakbrush	.1	8/9/00
Lightning	oakbrush	.1	10/3/00
Lightning	sagebrush	.1	7/4/01
Human-caused	mtn. brush	.1	6/10/02
Lightning	oakbrush	1.0	8/7/02
Lightning	oakbrush	.2	8/28/02
Lightning	sagebrush	.1	9/5/02
Lightning	mtn. brush	.1	9/17/02
Total Acres: 437.25			
Length of Period: 29 years			

This community currently shows a lack of fire and inadequate disturbance regime. Based on the average fire interval of 35 years (USDA Forest Service 1998), the average number of acres that should burn within the 3,936 acre mountain brush area on an annual basis is 113 acres/year (3936/35). This is much more than the recorded occurrences which *totals* 437 acres over the past 29 years or an average of 15 acres/year. It is appropriate to note that fire occurrence can be highly variable in this vegetation type, burning hundreds or thousands of acres in a drought cycle or small patches in wetter years.

3.5.3 **Pinyon-Juniper**

Juniper and pinyon trees in the intermountain west have expanded their range greatly since settlement, primarily in the last 100 years (Barney and Frischknecht 1974; Burkhardt and Tisdale 1976; Wright et al. 1979). Several factors have historically contributed to pinyon and juniper tree expansion all of which have impacted historic fire regimes. These factors include depletion of understory vegetation through grazing, increase in certain annual vegetation such as cheatgrass, the removal of ground fuels and woody overstory through post and fuelwood harvesting and fire suppression efforts. The expansion of pinyon and juniper trees has primarily occurred sagebrush-grass communities. Trees become dominant and eventually crowd out most herbaceous and shrub species that provide forage for livestock and big game.

The Properly Functioning Condition (Manti-La Sal National Forest 1998) for pinyon-juniper woodlands is as follows:

Grass/forb	20%
Early Seral	40%
Mid Seral	20%
Late Seral	20%

Shrub, forb and grass composition make up 0-30% of the total vegetation with bare ground ranging from 0 to 50%.

Pinyon Pine

The pinyon pine is a slow-growing long-lived tree that can survive up to 1,000 years. The root system of Colorado pinyon consists of a single large taproot reaching at least 20 feet deep with shallow lateral roots occurring more than an inch below ground surface (Fire Effects Database). The Colorado pinyon regenerates solely from seed and can start bearing cones at 25 years of age and seeds at 75 years. Maximum seed production occurs on trees from 160-200 years of age. Large seed crops are produced every 3 to 7 years and are adversely impacted by drought. Dead and dying pinyon pines currently seen throughout the southwest is largely caused by extended drought and associated infestations of *ips*, a wood-boring beetle that ultimately girdles the tree.

Colorado pinyon pine occurs on a wide range of soil types. Little grows under well-developed pinyon-juniper stands since their extensive lateral roots deplete the ground of water and nutrients. Reduced understory vegetation is also the result of shading and possible allelopathic effects (a toxic reaction from needles where other plants become excluded).

Utah and Mountain Juniper

Two species of juniper predominate the Moab Face project area: Utah juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*J. scopulorum*). Utah juniper is a short tree that may live as long as 650 years (Fire Effects Database). They have a large taproot and numerous lateral roots that allow them to thrive on very dry sites. A Utah study concluded that Utah junipers do not use soil moisture from summer precipitation and do not have active roots in shallow soils layers during the summer (Fire Effects Database). Utah junipers begin to produce seed when they are 30 years old. The seeds remain viable for a long time, with one Utah study showing germination after 45 years (Fire Effects Database). The Utah juniper is not shade tolerant and can exclude other plants through allelopathic effects of its litter. Cheatgrass (*Bromus tectorum*) does not seem to be affected by its allelopathic effects.

The Rocky Mountain juniper can start bearing seed at 10-20 years of age with optimum seed production between 50-200 years. It can produce seeds every year but large crops are produced every 2-5 years (Fire Effects Database). Rocky Mountain juniper seedlings are generally sparse since they require 14-16 months ripening before germinating and because they do not readily establish on dry sites. These junipers are slow growing reaching 30 feet at 300 years of age. These trees prefer sandy rocky drainage areas where moisture is available and soils are deep. Rocky Mountain junipers are considered hardy but don't react well to wind burns during winter. It can tolerate shade when young but grows intolerant with age. It is not as drought tolerant as the Utah juniper and tends to grow at higher elevations.

Sagebrush may act as a nurse plant for the establishment of juniper seedlings. Burning young woodlands results in slower reestablishment of pinyon and juniper trees than burns in mature woodlands. This is due to the lack of seed-producing trees in young stands. Factors that influence the rate of re-establishment include: seed source, seed dissemination, size, intensity and frequency of burn, and grazing. Grasslands should be burned every 20 to 40 years to prevent pinyon invasion. Fires that occur at intervals preventing pinyon trees from exceeding 4 feet in height are effective in preventing encroachment of trees into grasslands (Pieper and Wittie, 1988).

<u>Existing Condition</u>

Pinyon-juniper woodlands account for 8% of the total Moab Face project area. This vegetation type accounts for 948 acres of the total 12,465 analysis area. Pinyon-juniper woodlands have been treated across Moab Face since the 1960's. Originally large tracks were treated in an attempt to increase livestock forage. The most recent treatments have resulted in a mosaic of woodlands and shrub/grasslands to provide forage and cover for wildlife. These treatments were implemented using chaining, rollerchopping methods and manual removal with chainsaws. Please see cumulative effects to see where these treatments have occurred.

Other plants associated with pinyon-juniper trees on Moab Face are as follows:

Grasses:

Agropyron cristatum	Crested Wheatgrass
Agropyron smithii	Western Wheatgrass
Bromus tectorum	Cheatgrass

Forbs:

Castilleja chromosa.	Indian Paintbrush
Calochortus nuttallii	Segolily
Phlox longifolia	Longleaf Phlox
Achillea millefolium	Yarrow
Sphaeralcea coccinea	Scarlet Globemallow
Lupinus spp.	Lupine

Shrubs:

Artemesia tridentata	Big sagebrush

The following is a list of fires recorded for the Moab Face area in pinyon-juniper community type since 1958 (From district and Moab Fire Center records).

Cause	Affected Vegetation	Size of Fire (Acres)	Date Occurred
Lightning	p-j	.2	7/2/66
Lightning	p-j	.01	7/6/67
Lightning	p-j	.01	6/24/68
Lightning	p-j	.01	7/4/68
Lightning	p-j	.01	7/7/68
Lightning	p-j	.1	7/11/68
Lightning	p-j	.01	6/8/69
Lightning	p-j	.01	7/25/70
Lightning	p-j	.05	9/27/71
Lightning	p-j	.1	8/20/71
Lightning	p-j	.02	6/16/72
Lightning	p-j	.01	4/6/72
Lightning	p-j	.05	7/6/73
Lightning	p.-j	.1	5/16/75
Lightning	p-j	30	8/31/76
Lightning	p-j	.1	8/7/76
Lightning	p-j	.1	7/10/76
Lightning	p-j	.1	7/11/76
Lightning	p-j	.1	7/10/76
Lightning	p-j	.1	6/22/76
Lightning	p-j	.1	8/24/77
Lightning	p-j	20	6/9/77
Lightning	p-j	.1	8/22/78
Lightning	p-j	.1	8/3/78
Lightning	p-j	.1	8/7/79
Lightning	p-j	.1	8/7/79
Lightning	p-j	.1	9/26/79
Lightning	p-j	.1	7/29/80
Lightning	p-j	.1	7/26/80
Lightning	p-j	.1	6/27/81
Lightning	p-j	.1	6/29/81
Lightning	p-j	.1	7/1/81
Lightning	p-j	.1	7/23/81
Lightning	p-j	3.0	7/23/81
Lightning	p-j	.1	8/9/81
Lightning	p-j	.1	8/9/81
Lightning	p-j	.1	8/9/81
Lightning	p-j	.1	9/6/83L
Lightning	p-j	.1	7/26/84
Lightning	p-j	.1	6/19/84
Lightning	p-j	.1	5/13/84
Lightning	p-j	.25	4/18/85
Lightning	p-j	.25	6/16/85
Lightning	p-j	.1	7/16/85
Lightning	p-j	.1	5/18/87

Lightning	p-j	2.0	7/19/87
Lightning	p-j	.5	7/23/87
Lightning	p-j	.1	7/27/87
Lightning	p-j	125.0	6/11/88
Lightning	p-j	7.0	6/21/88
Lightning	p-j	.1	7/26/89
Lightning	p-j	.1	8/14/89
Lightning	p-j	.5	8/13/89
Lightning	p-j	.7	8/13/89
Lightning	p-j	.2	8/17/89
Lightning	p-j	3.5	5/16/90
Unknown	p-j	.5	5/26/90
Lightning	p-j	.1	7/25/90
Lightning	p-j	15.0	7/26/90
Lightning	p-j	.2	7/33/91
Lightning	p-j	.2	8/23/91
Lightning	p-j	.1	8/21/92
Lightning	p-j	.1	8/25/92
Lightning	p-j	.1	8/25/92
Lightning	p-j	.1	7/2/94
Lightning	p-j	120.0	7/16/94
Lightning	p-j	.1	7/27/94
Lightning	p-j	.1	8/2/94
Lightning	p-j	.1	8/2/94
Lightning	p-j	.3	8/11/94
Lightning	p-j	.1	8/14/94
Lightning	p-j	.1	7/13/95
Lightning	p-j	.1	9/29/95
Lightning	p-j	.1	6/20/96
Lightning	p-j	.1	6/20/96
Lightning	p-j	.1	7/15/96
Lightning	p-j	.1	8/21/96
Lightning	p-j	.1	7/8/97
Lightning	p-j	.4	6/10/98
Human-caused	p-j	5.0	3/29/99
Lightning	p-j	.1	7/6/99
Lightning	p-j	.1	6/22/00
Lightning	p-j	.1	7/26/00
Lightning	p-j	.2	6/8/01
Lightning	p-j	.1	7/10/01
Lightning	p-j	6000.0	7/14/02
Lightning	p-j	.1	7/14/02
Lightning	p-j	.2	7/14/02
Lightning	p-j	.1	8/5/02
Human-caused	p-j	.1	11/8/03

Total Acres: 6337.7
Length of Period: 37 years

Based on the average fire interval of 20 years (10-30) in the Properly Functioning Condition guidelines for pinyon-juniper in the Manti-La Sal National Forest (USDA Forest Service 1998), the number of acres that should burn within the 948 acre area on an annual basis is a minimum of 47 acres/year (948/20). Removing the 6,000 acre wildfire would give us the best look at the average number of acres that burn annually. In this case, 337.7 acres divided by 37 years would show the average fire occurrence is more like 9 acres/year, rather than the 47 acres/year considered PFC. This shows the community currently lacks fire and an adequate disturbance regime.

While fire occurrence can be highly variable in this vegetation burning hundreds or thousands of acres in a drought cycle or small patches in wetter years, more fires at shorter intervals would result in smaller fires that are less severe. If we consider including the large wildfire of 2002, the *total acres are* 6337 over 37 years or 171 acres/year burned. This appears to exceed properly functioning condition. However, while the acres including the wildfire show the area within (or exceeding) PFC, the pattern and intensity of the burn is considered outside PFC (hydrophobic soils, large acreage, complete removal of vegetation rather than a mosaic).

Pinyon pine nuts are gathered as a food source and availability would be reduced in this area. Other uses that affect this vegetation type are the post and pole permits, issued primarily for juniper tree trunks. Firewood gathering is a primary use of pinyon and juniper trees and this would be reduced within the treatment areas. In each vegetation type, wildlife species would likely shift from those dependant on dense hiding cover to those adaptable to more open habitats.

3.6 Fire Environment

Ecologists and resource managers commonly accept the role that fire plays in different ecosystems. Fire's role is complicated because it influences and controls many ecosystem processes and characteristics such as nutrient cycling, species composition, community structure, and fuel accumulation. Ecologists classify the multi-faceted role of fire into fire regimes to aid in communicating its' function in ecosystem management. Fire regimes characterize disturbance by describing fire's intensity, frequency and effect on vegetation.

For the past 150 years, fire as a periodic modifying event has been excluded. The disruption of the historic pattern of frequent fires in short interval, low-intensity and mixed-severity has resulted in major ecological changes, including increasingly severe unwanted wildland fires and insect and disease epidemics. Fire exclusion has produced a fuels complex that makes high-intensity fires more likely while the benefits of periodic burning have been greatly diminished.

Fire suppression, past timber harvesting, and livestock grazing have altered fire regimes. The cumulative effect of these changes are found in the reduced frequency of burning in all plant communities and the increased potential for larger more intense fires when compared to historic patterns.

Another indication of forests operating outside Properly Functionning Condition is the fact that wildfires are increasing in number, size and intensity. Severe fire seasons have been noted in 1988, 1990, 1996, 1999, 2000 and 2002 (Gorte 2000). Each year of the past few years has been claimed “one of the worst” fire seasons. The Forest Service fire suppression policy appears to have been quite successful. Fewer than 600,000 acres of Forest Service administered land burned each year from 1935 through 1986. Prior to this policy, an average of 1.2 million acres burned annually during the 1910’s (Gorte 2000). Contrast this with the 8.5 million acres burned in wildfires during the 2000 fire season (Agee 2001). Gorte (2000) points out that only a small fraction of the total number of wildfires become catastrophic. For example, only 1% of the total number of fires in 2000 accounted for 93% of the acres burned. This emphasizes that unless fires are extinguished early, their rate of spread is rapid. The 2002 Rodeo fire in Arizona is a good example, as it grew from 800 acres to 46,000 acres in just one day (Healthy Forests Initiative 2002).

Natural fires occurring on Moab Face are typically started by summer lightning storms. Forest policy for aggressive fire suppression has resulted in fires typically no larger than .1 acre, often single trees. A Prescribed Natural Fire plan for this and adjacent areas is currently being developed to allow lightning ignited fires to burn their natural course when conditions indicate they are within prescription. This would help to reintroduce fire back into the ecosystem at or near historic intervals.

A recent fire history study on the neighboring Abajo mountains (Elk Ridge) showed that between 1609 and 1897, 55 fires occurred on Elk Ridge. The last major fire occurred in 1897. The study also showed the mean fire interval was 5 years (Ponderosa Pine plant community). Given the mean fire interval and the absence of fire for the past 100 years, data suggests approximately 20 fire cycles have been missed within the area.

Some of the negative consequences of uncharacteristic, high-intensity fires include:

- threat to lives and property
- reduced soil stability, leading to accelerated erosion and watershed degradation
- loss of wildlife habitat
- destruction of commercial wood products
- noxious weed invasion or species conversion (cheatgrass)
- high suppression costs
- large scale, high intensity smoke events
- loss of archaeological and historic structures

The fire environment consists of fuels, weather, and topography. A change in any of the three will result in a change in the fire behavior. Therefore, an in-depth look at each is warranted.

Fuels

According to Graham et. al. 2004, fuelbeds are classified in six strata: 1-tree canopy, 2-shrubs/small trees, 3-low vegetation, 4- woody fuels, 5- moss, lichens, litter and 6- ground fuels (duff). Each of these can be placed into one of three locations. *Ground fuels* consist of roots, buried woody material, decaying needles and duff within the soil. *Surface fuels* consist of grasses, shrubs, litter and woody material lying on the ground surface. *Crown fuels* refer to tree canopies or aerial fuels which can be any vegetation or woody material suspended above the ground surface. You often hear the type of fire described according to the location of the fuels carrying it- ground fire, surface fire or crown fire.

The probability of a fire igniting is directly related to fine fuel moisture, air temperature, the amount of shading of surface fuels, and the occurrence of an ignition source. Fuel (composition, structure, moisture content), weather (temperature, relative humidity, wind), and the physical setting (elevation, slope, aspect) are all critical elements in determining fire behavior (severity, intensity).

Amount, arrangement, continuity and chemical composition of fuels will affect fire behavior. Large accumulations of surface fuels coinciding with “ladder fuels” (small trees, shrubs, and low hanging limbs), and topographic factors contribute to increased fire intensity and flames that could initiate crown fire development in forest ecosystems (Rothermel 1991). Chemical composition of vegetation can assist in fire intensity and growth. For example, dense conifer trees will burn hotter than a dense stand of Aspen trees, this is in part due to the chemical differences of these two trees.

Fuel is considered anything that will burn, both live plants and woody debris. Surface fuel is considered all dead and downed material and live plants within six feet off the ground.

As stands of brush and trees become mature without fire disturbance, the amount of dead surface material will accumulate and live fuels will become denser which will aid in fire growth and intensity.

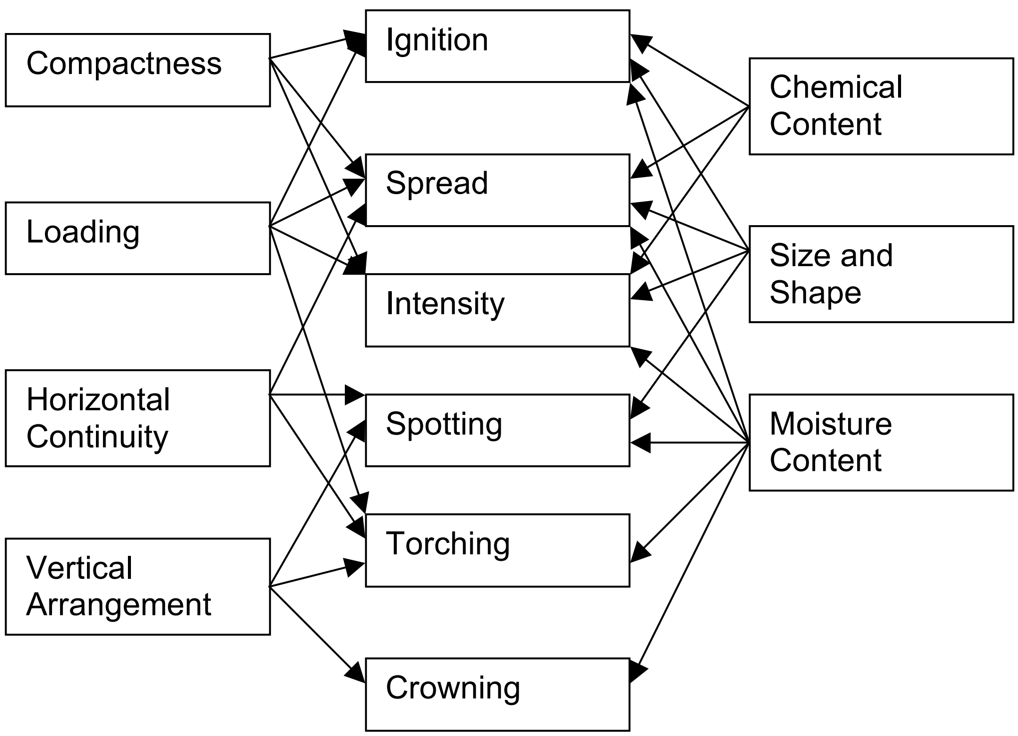
Dead-down surface fuel is divided into different size classes labeled 1, 10, 100 and 1000 hour fuels. If there is a large amount of 0-1/4 inch material, (1-hour fuels, commonly referred to as fine fuels), and ¼ to 1 inch diameter size material, (10-hour fuels), fire is expected to grow faster.

Time Lag	Size Diameter Inches
1 Hour	0 - 1/4
10 Hour	1/4 - 1"
100 Hour	1" - 3"
1000 Hour	3" - 9"

The 1-9 inch materials (100-hour and 1000 hour fuels), also contribute to fire behavior but will have more of an influence on flame duration. The 9- inch and larger material will especially contribute to a fires residence time or duration of flames and smoke. However, the mathematical model (BEHAVE +) used to predict fire behavior does not factor in woody debris larger than 3 inches.

Figure 2 lists a fuel characteristics and what affect they can have on fire behavior. The project proposal targets changing fuel characteristics that will change fire behavior.

Figure 2. Various Fuel Characteristics Affect Fire Behavior



The US Forest Service developed 13 fuel models to assist Fire Managers and Fuels Management Specialists to predict fire behavior for controlling fire and assessing potential fire damage to resources. The 13 fuel models are inputs into mathematical fire behavior models. The 13 Fuel Models are grouped into 4 categories, Grass, Brush, Timber Litter and Slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution among the fuel particle sizes (Anderson 1982).

Fuel loading is often expressed in tons per acre and refers to the dead and down woody debris. Fuel loading is helpful in predicting the susceptibility and intensity of a surface fire or fires that stay on the forest surface and do not involve the trees. Generally the larger the amount of surface fuel, the higher intensity a fire can be expected. Receptive fuel beds are often a concern when fires have the potential for spotting or grow from lofted embers. Rotten logs often serve as this receptive fuel bed.

The criteria for choosing a fuel model includes the fuel stratum best conditioned to support the fire, or as is commonly asked when selecting a fuel model: “what is the primary carrier of the fire?” I used GIS data including digital ortho photos to identify and correlate the fuel models to the vegetation on the site. I also used my knowledge of how the fire would burn in the vegetation on site and visited the sites to confirm the fuel and vegetative conditions amongst the 16 project sites on the Moab Face project.

The proposed action would change the vegetation composition and structure. This would affect which stratum would carry the fire. In other words, the fuel model representing the project site can be changed from management actions. Some Fuel Models can be converted to others, for example Fuel Model 6 (Gambel oak) can be converted to Fuel Model 5 for some years following a fire, and this conversion would be less susceptible to intense wildfires. Another example would be Fuel Model 10 (Aspen encroached Conifer stand) could be converted to Fuel Model 8 (pure Aspen stand) which would result in reduced fire intensity. The Pinyon/Juniper or Fuel Model 6 could be converted to Sage grass lands or Fuel Model 2. These conversions would be a desired affect from the proposed action.

Table 2 is a break down of the fuel model by percent of area in each project site.

Table 2. Fuel model by percent of area

Polygon	Acres	Vegetation Composition	Fuel Model by Percent of Area						
			10	9	8	6 Oak	6 PJ	2	Barren
1*	765	Majority - Gambel Oak	0	.52%	0	77%	14%	9%	0
2*	418	Oak and Pinyon Juniper	0	6%	15%	67%	0	12%	0
3	1673	Aspen	76%	0	11%	6%	0	1%	6%
4	1487	Spruce/ Fir	46%	0	34%	6%	0	0	14%
5	395	Aspen	0	0	78%	21%	0	1%	0
6	1113	Aspen	0	0	76%	6%	0	11%	0
7	999	Aspen/ Aspen Mix Conifer	49%	0	43%	0	0	5%	2%
8	1224	Aspen	5%	0	92%	0	0	1%	1%
9	165	Aspen/Grassland	12%	0	60%	0	0	27%	1%
10	219	Aspen	2%	0	67%	8%	0	20%	2%
11	136	Aspen	0	0	90%	3%	0	0	7%
12	2028	Gambel Oak	0	0	0	98%	0	1%	1%
13*	218	Pinyon Juniper	0	0	0	14%	69%	12%	4%
14*	509	Gambel Oak	0	0	15%	81%	0	4%	0
15*	615	Oak/ PJ/ Sage	0	0		39%	34%	27%	0
16*	501	Pinyon Juniper	0	0		2%	96%		2%

Assumptions: Aspen Mixed conifer is indicative of Fuel Model (FM) 10, Aspen vegetation is represented by FM 8, Riparian vegetation, desert shrubs and sage are represented by FM 2. Mountain brush and Pinyon/ Juniper are represented by FM 6. * indicates WUI

Fire Behavior

The fuel loads categorized by Fuel Models will affect fire susceptibility and fire behavior. Four indicators are used to evaluate fire behavior as displayed in Tables 3 and 4:

Rate of spread expressed in chains (66') per hour
Heat per unit area, expressed in BTUs per square foot at the flaming front
Fire line intensity, expressed in BTUs per foot per second at the flaming front
Flame length measured in feet

When comparing Table 3 and 4 it is evident fire behavior can be more easily controlled under prescribed conditions and have less detrimental effects than wildfires burning with more extreme conditions. Also, prescribed fire can be applied where treatment is needed rather than risking the chance of a wildfire spreading in areas where fire could have detrimental affects.

An indicator for consideration when comparing alternatives is flame length larger than 4 feet. Firefighters can directly attack flame lengths of 4 feet at the head or flanks by using hand tools, and handline should hold the fire. Flame lengths greater than 4 feet are too intense for direct attack and handline cannot be relied on to hold the fire (Wildland Fire Suppression Tactics Reference Guide).

Weather

Weather elements are important to fire behavior, specifically temperature, relative humidity and wind. Relative humidity and temperature can dry out and warm the surrounding air and fuels. Wind delivers oxygen and causes flames to lengthen; wind could also assist in fire growth by lofting embers ahead of the main fire.

The BEHAVE+ model allows the user to input weather and environmental factors such as air temperature, relative humidity and fuel moistures. I gathered weather from the Carpenter Ridge Remote Automated Weather Station (RAWS) to determine the percentile weather indicative of prescribed fire conditions (50^{th} percentile), and conditions where a wildfire is likely to escape initial attack capabilities (97^{th} percentile). These two percentiles were gathered from Firefamily Plus software, which organizes and interprets the history of weather and fuel moistures. Table 3 gives these percentile conditions.

Carpenter Ridge RAWS is located on the La Sal Mountains on Carpenter Ridge, north of Buckeye Reservoir, at 8,188 feet elevation, on the upper end of the slope, on a south-west aspect. It receives an average of 15 inches of precipitation annually and is located in short needle conifer.

Table 3. Percentile weather parameters from the Carpenter Ridge RAWS 1999 to 2004.

Percentile weather	50th	97th
Type of Fire	Prescribed	Wildfire
1 Hour Fuel Moisture %	3.6	1.2

10 Hour Fuel Moisture %	4.5	1.5
100 Hour Fuel Moisture %	7.9	2.3
1000 hour Fuel Moisture %	11.3	4.1
Herb Fuel Moisture %	20	30
Woody Fuels Moisture %	200%	100%
Air Temperature °F	72	90
Relative Humidity %	20%	4%
Wind 20 Foot level MPH	2	8
Midflame Wind 0.4 reduction	0.8	3.2
Duff Moisture %	50%	25%
Energy Release Component	37	63

Assumption is that woody moisture is representative of percentile weather; these moistures were taken from Guidelines for Estimating Live Fuel Moisture Content in the BEHAVE+ computer program. Duff moistures were taken from actual oven dry weights.

Topography

Topography affects the rate of spread and intensity of wildfires; the steeper the slope the faster a fire will tend to move. Slope will also assist in crown fire initiation. Aspect will influence the time of day when heating of fuels are greatest and will also influence vegetative species composition and density. Slope steepness was entered into the BEHAVE Plus model at 30% for all models for the sake of consistency. No management action will change the topography; it is more an element fire personnel need to be aware of from a project implementation and safety perspective.

3.7 Fish, Wildlife and Plants of Concern

To comply with the Endangered Species Act and USFS policy, A Biological Assessment (federally listed species)/Biological Evaluation (USFS sensitive species) was completed. The wildlife specialist report also includes an analysis of management indicator and special interest species. The following tables list the species examined and a summary of the findings:

3.7.1 Federally Listed Wildlife and Fish Species

The following table are federally listed wildlife and fish species that could occur in Grand or San Juan County, UT (USFWS; Utah Field Office, May 2004), their potential occurrence in the proposed project area and consideration in the Biological Assessment.

SPECIES	SPECIES STATUS	SPECIES OCCURRENCE IN THE PROJECT AREA AND CONSIDERATION IN THIS BA
Bald eagle *Haliaeetus*	Threatened	**Considered.** May occur incidentally in or near the proposed project area. The nearest known nest area is along the

leucocephalus		Colorado River north of Moab, a distance of 20 miles. Winter use may occur along the Colorado River, or at Ken's Lake or Buckeye Reservoir. May Effect, not likely to adversely effect.
Mexican spotted owl *Strix occidentalis lucida*	Threatened	**Considered.** MSO are not known to breed on the La Sal Mountains, but there is suitable breeding/roosting habitat, as predicted by the 1997 and 2000 MSO Utah habitat models, adjacent to treatment areas. Comprehensive surveys of the area were conducted in 1990-1993, and suitable habitat within 0.5 mi of treatment areas was surveyed in 2004. No spotted owls have been detected on the Moab Face. May Effect, not likely to adversely effect.
California condor *Gymnogyps californianus*	Endangered - Nonessential experimental population	**Not Considered.** Unlikely to occur in the proposed project area. The project area is 150 miles from the release site. Nesting has not occurred in Utah. The project area is outside the designated experimental population area, where all released condors and their progeny are expected to remain [50CFR17.84(j)]. No Effect.
Southwestern willow flycatcher *Empidonax traillii extimus*	Endangered	**Considered.** The southwestern willow flycatcher is a riparian obligate species, nesting in dense clumps of willow or shrubs with similar structure (alder, some tamarisk) along low-gradient streams, wetlands, beaver ponds, wet meadows and rivers. There are perennial streams in the project area, and limited potentially suitable riparian habitat. No Effect.
Black-footed ferret *Mustela negripes*	Endangered (historical range)	**Not Considered.** The black-footed ferret depends exclusively on prairie dog colonies for food and shelter. No prairie dogs or their habitat exist in the project area. The project area does not support black-footed ferrets or their habitat. No Effect.
Bonytail *Gila elegans*	Endangered	**Not Considered[1].** Historically, bonytails existed throughout the larger channels of the Colorado River drainage. Bonytails do not occur on the Manti-La Sal National Forest (MLNF), but are present in drainages that receive water originating on the MLNF. The treatment areas are located a minimum of 7 miles from the Colorado River. There are no water depletions associated with this project. It would not adversely affect the quantity or quality of water in these drainages. No Effect.
Humpback chub *Gila cypha*	Endangered	**Not Considered[1].** The humpback chub once ranged throughout the whitewater canyons of the Colorado River basin. Presently, the species can be located in and above the Grand Canyon (Arizona) and in major tributaries to the Colorado River. The humpback chub does not occur on the MLNF, but it is present in drainages that receive water originating on the MLNF. The proposed project would not adversely affect any of these drainages. No Effect.
Colorado pikeminnow *Ptychocheilus lucius*	Endangered	**Not Considered[1].** The Colorado pikeminnow had a historic range from the Green River in Wyoming, to the Gulf of California, but the species is now confined to the upper Colorado River Basin mainstem and larger tributaries. Colorado pikeminnow do not occur on the MLNF, but they are present in drainages that receive water originating on the MLNF. The proposed project would not adversely affect any of these drainages. No Effect.
Razorback sucker *Xyrauchen texanus*	Endangered	**Not Considered[1].** Historic distribution of the razorback sucker was throughout the large river portions of the Colorado River and it's major tributaries. It presently occurs in only a portion of the former range in these rivers. Razorback suckers have never been reported from headwater streams, and do not occur on the MLNF. They are present in drainages that receive water originating on the MLNF. The proposed project would not adversely affect any

		of these drainages. No Effect.
Gunnison sage-grouse *Centrocercus minimus*	Candidate	**Not Considered.** This species uses a variety of habitats, but needs a primary component of big sagebrush (Artemisia tridentata spp.) for hiding and thermal cover year-round, as well as food in the winter. The (noncontiguous) 320 acres of big sagebrush in the treatment area (Map #3) are not occupied by sage-grouse. No Effect.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Candidate	**Not Considered.** This neotropical migrant requires dense, deciduous riparian forest for breeding, generally in tall cottonwoods and willows in at least 25-acre patches. Suitable habitat is not avail.able in the project area. No Effect.

[1] Because threats and effects are similar for all listed fishes, only one "Determination Statement" was written for these species.

3.7.2 Federally Listed Plants

The following table are federally listed plants that could occur in Grand or San Juan County, UT and site-specific occurrence of their habitat within the project area.

SPECIES	STATUS	HABITAT DESCRIPTION & DISTRIBUTION IN GRAND COUNTY OR SAN JUAN COUNTY	HABITAT PRESENT IN PROJECT AREA?
Navajo sedge *Carex specuicola*	Threatened	This sedge grows in seeps and springs on vertical cliffs of Navajo sandstone at elevations between 5,000 and 5,900 feet. Critical habitat is on the Navajo reservation. No known populations exist on the Moab-Monticello Ranger District. No Effect.	No
Jones cycladenia *Cycladenia humilis var. jonesii*	Threatened	This desert wildflower is restricted to the canyonlands of the Colorado Plateau in Utah and adjacent Coconino County in Arizona. Jones' cycladenia grows in gypsiferous soils that are derived from the Summerville, Cutler and Chinle formations, at elevations of 4400 – 6000 feet. This plant has not been located on the Moab-Monticello Ranger District, or adjacent to the Forest boundary in Castle Valley. No Effect.	No

3.7.3 Sensitive Wildlife and Fish Species

The following table are sensitive wildlife and fish species that could occur on the Manti-La Sal National Forest (12/2003 R4 sensitive species list), their potential occurrence in the proposed project area and consideration in the Biological Evaluation.

SPECIES	SPECIES OCCURRENCE IN THE PROJECT AREA AND CONSIDERATION IN THIS BE
Spotted bat *Euderma maculatum*	**Considered.** The spotted bat uses a variety of vegetation types from approximately 2500 to 9500 feet in elevation, including riparian, desert shrub, ponderosa pine, montane forests and meadows. Spotted bats roost in rock crevices high up on steep cliff faces. Spotted bats may roost and forage in the project area. May Impact Individuals, not Likely to lead towards listing.
Western big-eared bat	**Considered.** Western big-eared bats roost and hibernate in complex

Corynorhinus townsendii pallescens	caves and mines. There is no suitable roosting habitat known in the treatment areas. Western big-eared bats may forage over the area. May Impact Individuals, not Likely to lead towards listing.
Northern goshawk *Accipiter gentilis*	**Considered.** Goshawks occur in mixed conifer, spruce/fir, aspen and ponderosa pine vegetative communities on the La Sal Mountains. May Impact Individuals, not Likely to lead towards listing.
Peregrine falcon *Falco peregrinus anatum*	**Considered.** Suitable nesting/roosting cliffs and associated canyon riparian foraging habitat do not occur in the treatment areas. There are potential nesting areas within 1.0 mile [the recommended spatial buffer (Romin and Muck 1999)] of treatment areas. The closest known territories are approximately 10 miles away along the Colorado River. No Impact.
Flammulated owl *Otus flammeolus*	**Considered.** This small owl inhabits mature mixed pine, aspen and second growth ponderosa pine forests. It may occur in forested portions of the project area. May Impact Individuals, not Likely to lead towards listing.
Boreal owl *Aegolius funereus*	**Not Considered.** Boreal owls are not known to occupy the Manti-La Sal National Forest. Boreal owls are closely associated with high elevation spruce-fir forests due to their dependence on this forest type for foraging year round. A few owls have been located on the neighboring Uncompahgre, Grand Mesa and Gunnison National Forest in Colorado as a result of a nesting survey. They have also been located in northern Utah. A nest box survey has been conducted since 1995 on the Moab portion of the Moab/Monticello District with no boreal owls located to date. No Impact.
Three-toed woodpecker *Picoides tridactylus*	**Considered.** Three-toed woodpeckers occur in the project area, predominately in mature spruce/fir forests. May Impact Individuals, not Likely to lead towards listing.
Greater sage-grouse *Centrocercus urophasianus*	**Not Considered.** The range of the greater sage-grouse is north and west of the Colorado River in Utah, so this species did not occur historically on the Colorado Plateau or the Moab district. A population was introduced in the Canyonlands area 25 miles west of the proposed project area and would not be affected by this project. No Impact.
Columbia spotted frog *Rana luteiventris*	**Not Considered.** In Utah, the spotted frog occurs in isolated populations in the Bonneville Basin in the western portion of the state, in association with aquatic habitat with perennial sources of water. No spotted frogs are known to occur on the south zone of the Manti-La Sal National Forest. No Impact.
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	**Considered.** There are perennial streams within the analysis area, and CRCT are known to occur in several streams in the upper and lower Dolores River watershed (see Map #2). No Impact.

3.7.4 Sensitive plants

The following table are sensitive plants that occur on the Moab District and site-specific occurrence of their habitat within the project area.

SPECIES	HABITAT DESCRIPTION AND DISTRIBUTION	HABITAT PRESENT IN PROJECT AREA?
Sweet-flowered rock-jasmine *Androsace chamaejasme carinata*	This mat-forming perennial species is found in alpine tundra communities on the top of the La Sal Mountains at elevations of 10,000-12,600 feet. No Impact.	No

La Sal daisy *Erigeron mancus*	This alpine daisy is endemic to the La Sal Mountains. It occurs on the peaks above timberline in grass-sedge and forb communities at elevations of 9150-10,500 feet. No Impact.	No
Canyonlands lomatium *Lomatium latilobum*	Canyonlands lomatium occurs in association with Entrada sandstone, and may be found in pinyon/juniper and desert shrub communities in the Meloy Park area on the northwest side of the La Sal Mountains. No Impact.	No

In addition to the above listed species, the Manti-La Sal National Forest Land and Resource Management Plan (USDA Forest Service 1986) designates six Management Indicator Species that are used to indicate potential impacts to other wildlife species that occur in the same habitat types. These species include: mule deer, elk, Abert's squirrel, golden eagle, northern goshawk and macroinvertebrates.

Finally, several special interest species were analyzed in the wildlife specialist report as well. These species include the Merriam's turkey, spineless hedgehog cactus, La Sal groundsel, and migratory birds.

To summarize the analysis and compare alternatives, four primary species most affected by the proposed project were chosen to be carried through this environmental assessment in greater detail. These species include: northern goshawk, three-toed woodpecker, deer and elk.

Northern goshawks inhabit mixed deciduous and coniferous forests in temperate and boreal regions, from sea level to tree line. Nesting territories have been located in a variety of forest ecosystems including lodgepole pine (*Pinus contorta*), ponderosa pine, Douglas- fir, mixed conifer and aspen (*Populus tremuloides*). Aspen trees are an important habitat component for nesting on the Moab District. These large accipiters prey upon small mammals and birds (e.g., squirrels, rabbits, grouse, woodpeckers, jays, robins). In winter, radio-tracked goshawks remained on their breeding territories or similar habitat or migrated to pinyon/juniper habitats up to 190 miles away (Graham et al. 1999).

Goshawks utilize extensive stands of mature and old trees for nesting and foraging, although they can reproduce and hunt successfully in a variety of forest types and structures. They do seem to prefer open understories to facilitate the detection and capture of prey. In addition to changes from timber harvest and livestock grazing, large-scale fire suppression activities have resulted in modification to forest structure over large areas. These activities have often led to dense forest thickets and a declining aspen component in many western forests. Many of these forests are outside of properly functioning condition. In all vegetation types, treatments should ideally open the understory without opening too much of the canopy. To maintain suitable habitat over time, there should be a diversity of forest structures and age classes over the landscape to provide resiliency to natural disturbances. The current conditions also may lead to an increased risk of catastrophic fire, which could cause extensive damage to goshawk habitat over large areas.

A goal outlined in the goshawk habitat assessment (Graham et al. 1999) is to restore or maintain forested landscapes in a properly functioning condition (PFC). Functioning forested landscapes provide habitat for the northern goshawk and its prey to support a viable population of goshawks in Utah. Goshawk habitat areas rated as high or optimum quality (per the process in Graham et al. 1999), and that are functioning-at-risk are a priority for treatment. The Northern Goshawk Forest Plan amendment (USDA Forest Service 1986, amended 2000) has an objective of treatment on at least 1000 acres to maintain habitat at high quality, with reasonable assurance that areas will not drop to low to moderate value. While treating these large areas, activities must avoid disturbance that may lead to nest abandonment. Habitat disturbances may not result in territory abandonment, but timing restrictions and active nest area buffers (30 acres) to avoid nest disturbance are necessary. Due to their high territory fidelity and the direct correlation of fecundity to prey abundance (Salafsky et al. 2004), changes around the nest area are not as important as what happens to prey availability in foraging areas. However, rather than try to manage individual or groups of territories, which are too small to contain all ecosystem processes, habitat should be managed on a landscape scale (Graham et al 1994).

On the Manti-La Sal National Forest, and on a region-wide scale (Amundson 1996), a high percentage of the aspen and spruce/fir forests are old, outside PFC. Vegetation treatments, as proposed, would move areas toward PFC as described in guidelines. *Guideline e*. allows treatment as we are above desired percentage of mature and old. The proposed treatments would meet all guidelines for snags and down logs. Fire is an appropriate tool to manage species composition and age class structure in these forest types.

The proposed project would treat approximately 3000 acres of area rated as optimum goshawk habitat that is functioning-at-risk due to loss of aspen. The prescribed burning, with mitigation measures to avoid active nest areas, provide snags and downed woody debris and other features as described in the amendment, should maintain goshawk habitat in the long-term.

There are goshawk territories within and adjacent to the project area. Of 9 active and historic territories on Moab Face, 5 nest areas are in treatment units. All of the nests are in aspen trees, in aspen or aspen-spruce/fir communities.

The criteria used to evaluate affects on goshawks from each alternative are:

-% of foraging areas (territories) treated
-Acres of habitat meeting guidelines
-Impact Determination

The **three-toed woodpecker** (TTWO), a circumboreal species, inhabits mixed conifer and pine forests, generally above 8,000 feet in elevation. These primary excavators rely on mature forests and disturbance events, foraging in areas with abundant dead and/or diseased trees infested with wood-boring insects. Seventy-five percent of their diet is bark/wood-boring insect larvae, mainly beetles (Scolytidae). Finch and others (1997) concluded that woodpecker abundance often peaks in the first ten years after a fire, then gradually declines. Severe burns represent potentially critical, but ephemeral, habitat for this species (Stepnisky 2003, Kotliar et al 2002, Morissette et al 2002, Saab and Dudley 1998). Three-toed woodpeckers stay on their territories year-round, though insect outbreaks may cause irregular movements. Territory size for three-toed woodpeckers varies according to the density of dead or beetle-infested trees, averaging 106 acres in Utah (Parrish et al. 2002).

On the Moab/Monticello district, three-toed woodpeckers have been found in spruce/fir and pine beetle-infested or burned ponderosa pine habitat types. Three-toed woodpeckers are most commonly observed in mature spruce/fir forests with pockets of spruce beetle activity. Documented breeding territories have been found from 9,500 to 10,600 feet on the mountain. Monitoring on the La Sal Mountains (1994-2004) has shown a trend of stable occupancy of known three-toed woodpecker territories (Figure 3).

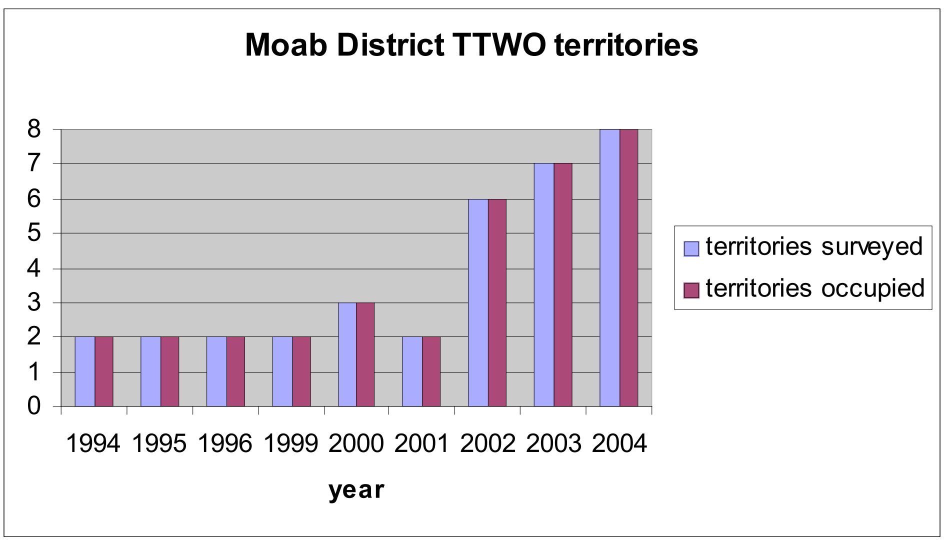


Figure 3. Moab District three-toed woodpecker territory occupancy trends.

Criteria used to evaluate effects from the two alternatives are:

-Acres of suitable habitat impacted
-Impact determination

Mule deer (<u>Odocoileus hemionus</u>) and **Rocky Mountain elk** (<u>Cervus canadensis</u>) are management indicator species (MIS) that occur in the project area. There is summer range in the higher elevations, and winter range on the benches and foothills of the La Sal Mountains. Summer range has been considered the limiting factor for big game animals on the La Sal Mountains due to a limited availability of high elevation range in proportion to the quantity of low elevation winter ranges available to the herds in this part of the state. However, recent declines in big sagebrush on winter range in southeastern Utah, largely from drought, have led to concern for the deer herd due to the potential for increased winter mortality resulting from a lack of forage on traditional winter range. This analysis focuses on the availability of, and impacts to, critical deer winter range and the identified critical fawning areas for deer and calving areas used by elk (Table 4). Acres affected and the ratio of cover to forage on summer range are analyzed in this report.

DEER	La Sal Mountains (acres)	Treatment units (acres)	% impacted
Critical winter range	115,900	1,170	1%
Critical fawning habitat	101,900	7,280	7%
ELK			
Critical winter range	57,700	840	1.5%
Critical calving habitat	49,300	2,500	5%

Table 4. Acreages of critical deer and elk ranges on the La Sal Mountains

The current status of the deer and elk population in southeast Utah is determined through herd composition counts (i.e. buck:doe, calf:cow ratios), harvest records, pellet counts and winter aerial surveys.

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The post-hunting season status of the La Sal Mountain deer herd (unit 13) is:*

	OBJECTIVE	CURRENT STATUS (2002)
Deer Population	13,000	5,600
Buck:Doe Ratio	15:100	11:100

*From the 2001 Utah Big Game Annual Report and 2002 DWR data.

Deer population trends: Mule deer populations are currently below the management objective. Factors affecting deer populations include the quantity and quality of habitat, habitat fragmentation from roads and other development, a widespread change in vegetative types to later seral stages (fire exclusion, pinyon-juniper encroachment, loss of aspen), hunting management, disease, predators, competition among other big-game species and livestock, and the spread of noxious weeds. The state-wide drought, with severe to extreme drought conditions in southeastern Utah since 1999 (USGS 2003) has had a negative impact on the quantity and quality of forage available to deer and elk on summer and winter ranges. The drought-related sagebrush die-off in many areas of the state has negatively impacted critical deer winter ranges.

Fawn production is closely tied to the abundance of succulent, green forage during the spring and summer months. Fawn production is chronically low, and has shown a downward trend over the last 5 years. The La Sal herd had a post-season ratio of 29 fawns:100 does in 2002, low compared to the 10-year average of 43:100, but higher than other southeastern Utah herds.

Trends in the deer population (statewide and for the La Sal herd unit) have been downward over the last several years (Figure 4). The La Sal unit and other general season areas in southeast Utah have been reduced to a 5-day hunting season and few antlerless permits have been issued. Deer population trends cannot be related to any specific vegetation management actions on the Manti-La Sal National Forest.

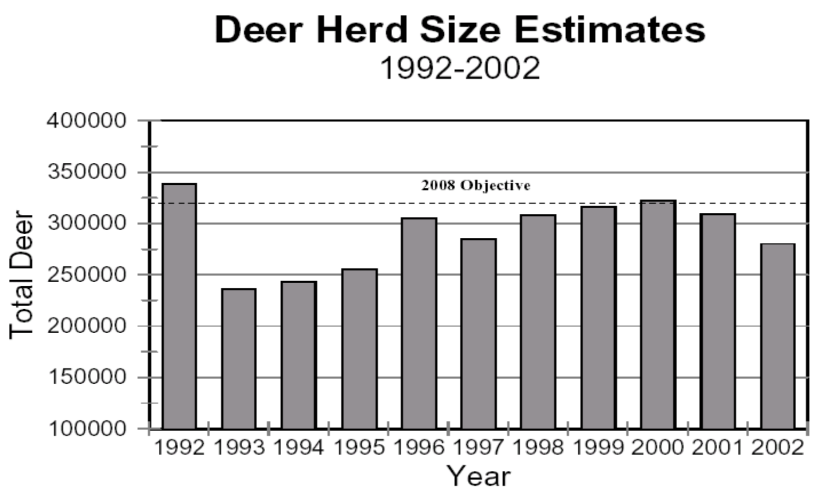

Figure 4. Utah Statewide Mule Deer Population Trend (UDWR 2003).

Elk population trends: The elk population has been stable to increasing. As the population is near the herd unit management objective, elk numbers are controlled by the number of antlerless permits issued. In 2004, 500 antlerless permits were issued for public lands in the unit. Trends in the elk population are not related to any specific habitat management actions on the Manti-La Sal National Forest.

Elk Population (post-season) Summary (UDWR data)

	Plan Popln Objective	Popln estimate post- 2000	Popln estimate post- 2001	Popln estimate post-2002
La Sal Unit	2,650	2,650	2,575	2,650
Statewide Totals	67,225	62,635	60,150	60,595

UDWR big game range trend (vegetative composition changes) studies are not located in any of the treatment units. In general, studies on the winter range on the Forest found stable vegetative trends except where old treatments (mostly chainings) were showing a decrease in the browse component with a concurrent increase in pinyon and juniper density. The studies on summer range on the

MLNF have stable vegetative and soil trends, and show relatively little use by big game (UDWR 2000a). The importance of a diverse, productive herbaceous understory is emphasized in the UDWR report.

The criteria used in this report to evaluate effects on deer and elk from the two alternatives are:

-Acres of aspen regeneration
-Cover:forage ratio

Deer and elk are generally considered species that need early successional communities, created by some type of disturbance, for optimum habitat (Toweill and Thomas 2002). A measurable factor that affects big game use of the project area is the availability of cover and forage. Forest Plan direction for deer and elk is to maintain adequate hiding cover around fawning/calving areas. Small trees, shrubs and down logs provide security to newborn fawns and calves. The guidelines describe optimum habitat as 25% hiding cover, 15% thermal cover, 10% hiding or thermal cover and 50% foraging area. Hiding cover is vegetation, generally between the ground and 6 feet in height, which can hide 90% of an adult deer or elk from a distance of 200 feet. Thermal cover is vegetative structure that shields the animal from the effects of weather. For deer this may include sapling trees, shrubs or trees at least 5 feet tall with 75% crown closure. For elk, this necessitates trees 40 feet or more in height with 70% or more crown closure. Foraging areas are all areas that provide food for deer and elk, which may include hiding/thermal cover but would also include openings with grass/shrub ground cover (Thomas 1979). Potential impacts are discussed in the following analysis.

3.8 Inventoried Roadless Area Values

Inventoried Roadless Areas (IRA) are areas that have been surveyed for characteristics that are predominantly natural, similar to wilderness. Roadless areas have significant ecological values as well as social values both at a local and national level. They are often aquatic strongholds for fish; provide critical habitat and migration routes for many wildlife species especially those that require large home ranges; and key watershed areas for both proper hydrologic system functioning and sources of public drinking water for communities. Roadless areas may provide connectivity or biologically important linkages between otherwise fragmented wildlands. These undeveloped areas provide opportunities for potential wilderness designation, primitive, semi-primitive non-motorized recreation, protection of traditional cultural properties and sacred sites, and scenic integrity. Roadless areas may also provide reference landscapes for study and comparison with developed landscapes to better understand effects of human development.

Roadless Area Policy Update: In November 2000, the Forest Service Roadless Area Conservation Final Rule and Record of Decision was issued. The final rule established prohibitions on road construction, road reconstruction, and timber harvesting in Inventoried Roadless Areas on National Forest System Lands in order to provide lasting protection of these areas in the context of multiple-use management.

In July of 2001 Forest Service Chief Dale Bosworth issued two interim directives (FSM 7710-2001-2 and 2400-2001-3) to guide planning and actions related to inventoried roadless areas during the period of the injunction/adjunction. Given that this project proposes no road construction, the 7710 directive on road construction is not applicable. The 2400 directive states that the Chief reserves the authority to approve or disapprove timber harvest in Inventoried Roadless Areas with a list of exceptions. The proposed hand cutting (mechanical treatment) in this project falls within the listed exceptions as follows: 2404.15a. "The timber is generally small-diameter material and the removal of timber is needed for one of the following purposes: (2) To maintain or restore the desirable characteristics of ecosystem composition and structure, for example to reduce the risk of uncharacteristic wildfire effects." Or "The cutting, sale, or removal of timber is incidental to the implementation of a management activity and not otherwise prohibited under the land and resource management plan." Therefore, normal delegation of authority for this action applies (i.e. Moab/Monticello District Ranger is the responsible official).

In May 2005, the Department of Agriculture announced the adoption of a final rule that establishes a process for governors to propose locally supported regulations for conserving inventoried roadless areas within their states. Until this process is complete, current mandates will stand.

There are three roadless areas identified in the project area. Portions of units 8 through 12 fall within the *South Mountain IRA,* a portion of unit 8 falls within the *Mount Peale IRA,* and portions of treatment units 3,4,6 and 7 fall within the *Horse Mountain/Manns Peak IRA.*

3.9 Cultural/Heritage Resources

Human use of these areas on the Moab Ranger District has been long and varied. Site and project atlases available at the Moab/Monticello District and cultural resource survey conducted as part of project planning efforts indicate 68 sites are located within the Moab Face treatment units (Table 5). Of the sites found within treatment units, 19 are Historic period sites including cabins, irrigation ditches, mining-related features, aspen art, and a USFS administrative site. The remaining 49 sites are prehistoric and include artifact scatters representing seasonal camps and resource procurement/processing localities, a hunting blind, two rock shelters, and a probable pit house. Twelve of the historic sites are eligible for listing in the National Register Historic Places and warrant protection during the implementation of the proposed project. Of the remaining historic sites, seven are not eligible for listing in the National Register of Historic Places. Thirty of the prehistoric sites are eligible for listing in the National Register Historic Places and warrant protection during the implementation of the proposed project. Of the remaining prehistoric sites, warranting protection, and 19 are not eligible for listing in the National Register of Historic Places.

Table 5: Archaeological Sites Present within Moab Face Treatment Units.

Unit #	Smithsonian Number	Forest Number	Site Type	National Register Status
1	42GR3589	4293	Lithic Scatter	Eligible
1	42GR3590	4294	Lithic Procurement	Not Eligible
1	42GR3591	4295	Lithic Scatter	Eligible
2	42GR3515	4218	Lithic Scatter	Not Eligible
3	42GR2962	3478	Historic Cabin with Mining Features	Not Eligible
4	42GR3522	4192	Hunting Blind	Eligible
4	42GR2759	3305	Historic District-Miner's Basin	Eligible
6	42GR2961	3477	Historic Cabin	Eligible
6	42GR3276	3624	Historic Cabin	Eligible
6	42GR3278	3626	Historic Cabin	Eligible
6	42GR3283	3717	Lithic Scatter	Eligible
6	42GR3279	3627	Historic Cabin	Eligible
6	42GR3280	3628	Historic Aspen Art	Not Eligible
6	42GR3275	3623	Historic Cabin/Adit	Eligible
6	42GR3277	3625	Historic Cabin	Eligible
6	42GR3281	3646	Lithic Scatter	Eligible
6	42GR3282	3647	Lithic Scatter	Eligible
7	42SA25955	4196	Lithic Scatter	Not Eligible
7	42SA25948	4207	Lithic Scatter	Eligible
7	42SA22132	3134	Historic Trash dump	Not Eligible
7	42SA22552	3294	Lithic Scatter	Eligible
7	42SA22551	3293	Lithic Scatter	Eligible
10	42SA25956	4198	Historic Aspen Art	Eligible
10	42SA25957	4199	Mining Complex	Eligible
12	42SA25951	4223	Lithic Scatter with Historic Component (Cans; fencing)	Not Eligible
12	42SA25949	4221	Lithic Scatter	Not Eligible
13	42GR3511	4214	Historic Habitation	Not Eligible
13	42GR3513	4216	Lithic Scatter	Eligible
13	42GR3514	4217	Rock Shelter	Eligible
13	42GR3523	4194	Lithic Scatter	Not Eligible
13	42GR3524	4195	Lithic Scatter with Historic Component (glass and can scatter)	Eligible
13	42GR3525	4197	Rock Shelter	Eligible
14	42GR2582	3244	Historic-Mesa Guard Station	Eligible
14	42GR3507	4210	Lithic Scatter/Source Area	Eligible
14	42GR3506	4209	Lithic Scatter/Source Area	Not Eligible
14	42GR3505	4208	Lithic Scatter	Not Eligible
14	42GR3510	4213	Prehistoric Open Camp	Eligible
14	42GR3509	4212	Prehistoric Open Camp	Eligible
14	42GR3558	4189	Lithic Scatter	Not Eligible
14	42GR3508	4211	Prehistoric Open Camp	Eligible
15	42SA25953	4226	Lithic Scatter	Eligible

15	42SA25954	4296	Lithic Scatter	Not Eligible
15	42SA21418	3056	Lithic Scatter	Not Eligible
15	42SA21421	3051	Lithic Scatter	Not Eligible
15	42SA21422	3052	Lithic Scatter	Eligible
15	42SA21423	3053	Historic Brush Structure	Not Eligible
15	42SA21417	3054	Historic Brush Structure	Not Eligible
15	42SA21423	3049	Lithic Scatter	Eligible
15	42SA21227	3037	Lithic Scatter	Not Eligible
15	42SA21419	3048	Lithic Scatter	Not Eligible
15	42GR3521	4191	Prehistoric Open Camp	Eligible
15	42GR3520	4190	Lithic Scatter	Eligible
15	42GR3557	4188	Lithic Scatter/Historic Trash	Eligible
15	42GR3381	4228	Historic Irrigation Ditch	Eligible
15	42GR3517	4220	Lithic Scatter	Eligible
16	42SA14921	2693	Lithic Scatter	Not Eligible
16	42SA25944	4203	Lithic Scatter	Eligible
16	42SA25945	4204	Lithic Scatter with Feature	Eligible
16	42SA25943	4202	Lithic Scatter	Eligible
16	42SA25947	4206	Prehistoric Open Camp with Feature	Eligible
16	42SA25941	4200	Lithic Scatter	Eligible
16	42SA25942	4201	Lithic Scatter	Not Eligible
16	42SA25865	4297	Historic Homestead	Not Eligible
16	42SA26094	4193	Lithic Scatter	Eligible
16	42SA14920	2692	Lithic Scatter	Not Eligible
16	42SA25946	4205	Lithic Scatter	Not Eligible
16	42SA25864	4258	Lithic Scatter	Not Eligible
16	42SA25867	4260	Historic Irrigation Ditch	Eligible

*Sites are located immediately outside polygon boundary within 100 to 200 feet

Archaeological surveys of the La Sal Mountain area indicate a preponderance of prehistoric seasonal camps, artifact scatters, and lithic procurement sites, although more permanent prehistoric sites are known at lower altitude canyon settings. Prehistoric sites are most abundant in the lower altitude treatment units where piñon/juniper or mountain brush dominates; however, prehistoric sites have been identified in high altitude meadow, ridge top, and saddle localities as well. Prehistoric resources span from the Archaic Period (6000 to 1000 B.C.) into the Protohistoric period (ca. A.D. 1300-1600).

Prehistoric sites are particularly well represented in Units 13-16. The availability of lithic raw materials from local geologic strata, as well as the proximity to major transportation routes and subsistence resources, results in the occurrence of a moderate density of prehistoric sites in these lower elevation treatment units. Many of these prehistoric sites lack evidence of features or cultural deposits and tend to be comprised primarily of surface lithic scatters; however, two rock shelters, six open camps, and a possible pit house site are also present and have evidence of buried cultural deposits. Although prehistoric lithic scatters occur within mechanical and prescribed fire treatment areas within the lower altitude treatment areas, all of the sites with evidence of buried cultural deposits occur within proposed mechanical treatment areas where avoidance ensures protection from impacts during the project. Additionally, National Register eligible surface lithic scatters will be flagged and avoided during mechanical treatments and may be burned over with prescribed fire with little to no impact to these resources.

Historic European American activities within the Moab Face project area include logging, mining, grazing, recreation, and other activities. Historic resources have been identified in a variety of locations, but the majority of these sites are found in the steep mountainous terrain where hand or aerial ignition is proposed. Documented historic resources include mining features, cabins, trash dumps, brush structures, irrigation ditches, aspen art, and a USFS administrative site.

Of the historic sites in the project area, 12 are located within higher elevation units while six are found in the lower elevation settings. The higher altitude historic sites include cabins, mining features, a trash dump, and aspen art; those at lower altitude settings include two temporary brush structures, two irrigation ditches, one historic habitation, and one USFS administrative facility (Mesa Guard Station). With the exception of the Mesa Guard Station, no National Register eligible, fire vulnerable historic sites are found in the lower altitude. The Mesa Guard Station, located within Unit 14, will be flagged and protected during mechanical and prescribed fire activities. Conversely, Unit 6, a higher altitude unit with primarily aspen and mixed conifer vegetation, contains the largest number of fire vulnerable historic sites. Of the 10 sites located in Unit 6, seven are historic, including one aspen art site and six historic cabins. Of these sites, the six historic cabins are eligible to the National Register and will be protected during prescribed burning activities through use of control lines or other tactics, avoiding impacts. Additionally, the Miner's Basin Historic District is partially contained within Unit 4 and a mining complex located in Unit 10 are eligible for listing in the National Register and warrant protection from prescribed fire activities.

3.10 Soils and Watershed Resources

3.10.1 Soils

There are 48 soil components mapped within the project area within 38 map units. A soils map can be found in the project record showing inventoried map units within the project area and within each proposed treatment unit boundary. All soil descriptions can be found in the Soil Survey of Canyonlands Area, Utah (USDA 1991). The descriptions are not repeated in this document.

The existing soils are generally well protected by existing ground cover. Forest user access routes, recreational use, and grazing management are current potential management impacts to the soil resources. Limited site visits to the project area qualitatively show soils are properly functioning. Visual observations of accelerated erosion appear to be limited to areas with improper road or trail drainage, or recreational use in areas where the surface cover has been removed.

<u>Suitability of the Soils for Prescribed Fire Management (Treatment Units 3-12)</u>

The suitability of the prescribe fire treatment units for prescribed fire was qualitatively estimated using existing soil survey information and modeled physical characteristics of the treatment units. Two suitability ratings for prescribed fire based upon soil and landscape shape and position were performed. Each is described below. The ratings that are shown represent a qualitative classification of suitability based upon soil, land shape, land position, and vegetation properties and do not represent where fire management can or cannot be implemented.

1. Prescribed Fire Suitability based upon Slope and Aspect.

Soil development is highly correlated with land shape and direction. Slope and aspect are important criteria used to determine the suitability of many land management activities. The use of soil inventory information can be used for identifying slope and aspect criteria for making qualitative determinations of suitability. However, the soil map units for the project area are not spatially explicit to slope and aspect and therefore cannot be shown as to the location within a map unit or within the treatment units. Digital elevation models (DEM) based upon 3 dimensional remote sensing media can be used to spatially identify and classify slope and aspect values. Within the Moab Project area all proposed prescribe fire treatment units were analyzed for suitability based upon slope and aspect using a digital elevation model. Three classes of degree of limitation were developed for both slope and aspect. The classes are called slight, moderate and severe. These classes represent a qualitative approach to determining the degree of limitation for prescribed fire but do not identify areas where prescribed fire should or should not be used.

The ratings for slope and aspect were developed from the class breaks identified in Table 6 below. These class breaks were obtained from the prescribed fire rating table found in the 1995 Region 4 Soil Interpretive Guide.

Table 6. Slope and Aspect Criteria for Prescribed Fire Suitability Rating

	Slight	*Moderate*	*Severe*
Slope	< 25%	26-55%	>55%
Aspect	North	West, East	South, Southwest

The DEM information was grouped into the three classes for both slope and aspect. The location of each of the three classes for both slope and aspect were determined for each map unit. The result is a map of each proposed treatment unit showing the locations of the slight, moderate and severe classes for both slope and aspect. All maps are located in the project record. A summary table of the amount of each rating class is provided in the project record. This information is to be used to assist in determining locations for prescribed fire and identification of any specific management needs for each treatment unit.

The amount of area (acres and percent) within each treatment unit that was rated as severe for either slope or aspect is summarized in Table 7 below. The far right columns show the amount of areas where both slope and aspect were rated as severe. These areas within a treatment unit would have the greatest limitations for prescribed fire due to soils that are generally low in organic matter content, high erosion potential following surface cover removal, or are shallow in depth. The units that have more than 15% of the unit rated as severe for soil limitations using slope and aspect are treatment units 4, 6 and 9. The 15% threshold value was used to be consistent with Regional Soil Handbook direction of maintaining post project conditions to less than 15% detrimental disturbance. It was assumed that severely rated areas would be burned and they would have the highest potential for post fire detrimental soil conditions. However, this is assuming the worse case scenario and no mitigation to reduce fire effects. Actual conditions would be variable across treatment units.

Table 7. Summary Severely Rated Prescribe Fire Treatment Units Based Upon Slope and Aspect

	Slope rating Severe > 55%		Aspect rating severe South or Southwest		Slope and aspect both rated severe >55% slope and Aspect South or Southwest	
Unit ID	**Acres**	**% of Treatment Unit**	**Acres**	**% of Treatment Unit**	**Acres**	**% of Treatment Unit**
3	176	11	519	31	21	<1
4	751	51	754	51	322	22
5	0	0	125	32	0	0
6	420	38	1011	91	386	35
7	12	1	415	42	7	1
8	43	4	520	42	5	<1
9	78	47	149	90	66	40
10	26	12	144	66	11	5
11	1	1	18	13	0	0
12	3	<1	1402	69	3	<1

2. Prescribed Fire Suitability based upon Soil Types.

A rating of the suitability of inventoried soils for prescribed fire management was completed for areas within the proposed treatment units. Soil type information was obtained from the Soil Survey of Canyonlands Area, Utah (USDA 1991). The soil information from the soil survey was not verified on the ground as to the accuracy of locations of individual soil map units or components as described in the soil survey. Vegetation composition information was obtained from the vegetative coverage map used by the Moab project. This suitability rating for soils is to be used as a planning tool to assist in meeting proposed objectives and to identify potential areas that may need additional field verification before final treatment recommendations are made. It should not be used to identify effects of prescribe fire because soil components are not identified spatially within activity areas (treatment units).

The suitability rating used several soil and vegetative criteria to rate each soil component found within the prescribe fire treatment units. The rating criteria were derived from the 1995 Intermountain Region Soil Interpretation Guide and professional knowledge of fire effects to soils. A summary of the criteria that were used is shown in Table 8 below. Greater detail and descriptions of the criteria used is found in the project record.

Table 8. Soil and Vegetative Criteria to Rate Soil Map Units for Prescribe Fire Use

Soil Property	Slight = 1	Moderate = 2	Severe = 3
Aspect	315 - 45 degrees	45 - 135 degrees	135 - 315 degrees
Slope	0 - 25 percent	25 - 50 percent	50+ percent
Organic Matter Thickness	4+ inches	2-4 inches	<2 inches
Organic Matter Percentage	4 + percent	2 - 4 percent	< 2 percent
Soil Texture	Low erodibility	Moderate erodibility	High erodibility
Hydrophobic Soils	All others	Conifers	Ponderosa Pine,Pinyon Juniper

Three classes of degree of limitation were developed for each of the criteria. The classes are called slight, moderate and severe. These classes represent a qualitative approach to determining the degree of limitation for prescribed fire but do not identify areas where prescribed fire should not be used. Each soil map unit found within a proposed treatment unit was rated as slight, moderate or severe based upon the criteria found in Table 8. Several map units contained more than one component or soil type within the map unit and therefore more than one rating. The most dominant component was used to rate the map unit. The locations of soil components are not spatially identified in the soil survey. Therefore the actual soil map unit may contain several suitability ratings which are not spatially identified within the proposed treatment units. All suitability maps showing the rating of soil map units by proposed treatment units can be found in the project record. Table 9 below is a summary of the soil ratings for prescribe fire by prescribe fire treatment unit. The number of acres and percent of each rating by treatment unit is displayed.

Table 9. Summary of Prescribe Fire Treatment Unit Suitability Ratings Based Upon Soil and Vegetation Criteria

Unit	Slight		Moderate		Severe	
	Acres	% of unit	Acres	% of unit	Acres	% of unit
3	536	32	833	50	301	18
4	16	1	694	47	777	52
5	343	87	52	13	0	0
6	67	6	933	84	113	10
7	686	69	305	30	9	1
8	1178	96	43	4	3	0
9	51	31	22	13	92	56
10	193	89	23	10	2	1
11	126	93	10	7	0	0
12	284	14	1744	86	0	0

Discussion of Prescribe Fire Suitability Ratings by Treatment Unit

The two methods of soil suitability ratings for prescribe fire are to be used to identify treatment units that may need additional consideration or mitigation for soil resources if prescribed fire management is used. The soil suitability rating methods have some common results. Treatment units 4 and 9 have rated severe for soil limitations with both methods based upon a percentage of more than 15% of the proposed unit rated as severe. The rating based upon slope and aspect also identified treatment unit 6 as having more than 15% of the unit rated as severe. The suitability based upon soil map units and vegetation also identified unit 3 with 15% or more of the unit rated as severe. However, as stated above these areas are based upon the dominant component within a map unit and the ratings are not spatially identified within a proposed treatment unit. The actual amount and location of the severe ratings based upon soil properties would need to be verified prior to planning actual burning locations within a proposed treatment unit. The verification would assist in developing specific locations to meet treatment objectives while reducing risk to soil resources from prescribed fire.

Soil Suitability for Prescribe Fire Project Area

Soil and vegetative criteria used above for determining soil suitability for prescribe fire management was also completed for the entire project area. The suitability ratings were made by soil map unit polygon. A map of the qualitative ratings for each soil polygon within the project area boundary can be found in the project record. The soil polygons were not field verified as to the accuracy of the original soil survey mapping. This project area suitability rating is used to assess risk levels of effects of escaped prescribe fire.

Suitability of the Soils for Mechanical Treatments (Treatment units 1-2, 13-16)

Specific types of equipment have not been identified for the mechanical treatment units. Several types of equipment may be used including chainsaws, brush hog equipment, tree chippers and reduction of slash through pile burning. Treatment conditions will determine the type of equipment and methods that are used. In order to determine the suitability of the soils the most restrictive equipment was assumed to be used on each treatment unit. The most restrictive equipment for removal of vegetation was assumed to be a crawler tractor similar in size used for logging operations. Two suitability ratings were assessed for the mechanical treatment units. The first rating is the potential for compaction. The second rating is the degree of hazard for timber harvest and slash disposal using crawler tractor equipment.

1. Potential for Soil Compaction from Mechanical Treatment
The Intermountain Soil Interpretation Guide (1995) provided rating criteria for the potential for soil compaction. The rating criterion includes soil texture and the amount of rock fragments to determine soil compaction potential. It is important to note that soil moisture and organic matter also determine the degree of compaction potential. These properties were not used because of the seasonal and yearly changes across the treatment units. The most dominant component in each treatment unit was used to rate the entire treatment unit. A summary of the potential for compaction is shown in Table 10. None of the units rated as severe for compaction potential.

Table 10. Soil Compaction Potential of Treatment Units 1-2, 13-16

Treatment Unit	Dominant Soil Type	Texture	Rock Content Upper Horizon	Compaction Potential
1	Herm	Stony Loam	5	Medium
2	Herm	Stony Loam	5	Medium
13	Sedillo	Very Stony Fine Sandy Loam	35	Low
14	Herm	Stony Loam	5	Medium
15		Stony Loam	5	Medium
16	Herm	Stony Loam	5	Medium

2. Degree of Hazard for Equipment Use and Slash Disposal
The rating for equipment use was based upon the Intermountain Soil Interpretation Guide (1995) table for Equipment Use for Timber Harvest and Slash Disposal. Ratings for equipment uses are made according to the expected response with regard to maintaining the qualities and productivity of the soil resource. The use of a rubber tired tractor was assumed for the rating. The ratings provided are a qualitative degree of hazard by soil type. Soil criteria used in the rating include soil texture, surface rock content, depth to bedrock, drainage class, erosion factor, and slope. The most dominant soil component in each treatment unit was used to rate the entire treatment unit. A summary of the degree of hazard for equipment use and slash disposal is shown in Table 11. Treatment unit 16 was rated as severe due to high rock content. This does not preclude this unit from use of mechanized equipment. Use of equipment similar to rubber tired tractors may be restricted. Other types of equipment may be required.

Table 11. Degree of Hazard for Equipment Use and Slash Disposal for Treatment Units 1-2, 13-16

Treatment Unit	Dominant Soil Type	Degree Of Hazard
1	Herm	Moderate
2	Herm	Moderate
13	Sedillo	Moderate
14	Herm	Moderate
15	Herm	Moderate
16	Herm	Severe

3.10.2 **Watershed**

<u>Designated Beneficial Uses of Analysis Area Waters</u>

The entire project area lies within the state of Utah, but two of the HUCs drain into Colorado. Therefore, designated beneficial uses of both states are pertinent to the analysis.

The State of Utah has identified the following beneficial uses for waters within and downstream of the project area:

- 1C – protected for domestic purposes with prior treatment processes as required by the Utah Division of Drinking Water;
- 2B – protected for secondary contact recreation, such as boating, wading, or similar uses;
- 3A – protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain;
- 3B - protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain;
- 3C - protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain;
- 4 – protected for agricultural uses, including irrigation of crops and stockwatering.

Colorado's designations include:

- Aquatic Life Cold 1 – These are waters that (1) are capable of sustaining a wide variety of cold-water biota, including sensitive species, or (2) could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.

- Aquatic Life Warm 2 – These waters are not capable of sustaining a wide variety of cold or warm-water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species.

- Recreation 1a – These surface waters are suitable or intended to become suitable for recreational activities in or on the water when the ingestion of small quantities of water is likely to occur. Such waters include but are not limited to those used for swimming, rafting, kayaking, tubing, windsurfing, and water-skiing….
- Agriculture – These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado, and are not hazardous as drinking water for livestock.
- Water Supply - These surface waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent), these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto.

The beneficial uses assigned to each stream system are shown in Table 12.

Table 12. Beneficial Use Designations for Analysis Area Waters

State Description	*HUC6 (Description Used in Analysis)*	*Utah Designated Use Classes*	*Colorado Designated Use Classes*
Colorado River and tributaries from Lake Powell to State Line (except as listed below)	Castle Cr Placer Cr Professor Cr	1C, 2B, 3B, 4	
Mill Creek and tributaries, from confluence with Colorado River to headwaters	Horse Cr – Mill Cr North Fork Mill Cr Upper Pack Cr	1C, 2B, 3A, 4	
Kane Canyon Creek, from confluence with Colorado River to headwaters	Kane Springs Cr West Coyote Cr	2B, 3C, 4	
La Sal Cr and tributaries from state line to headwaters	Deer Cr – La Sal Cr	2B, 3A, 4	Aq Life Cold 1 Recreation 1a Water Supply Agriculture
All tributaries to the Dolores River… from the bridge at Bradfield Ranch to the CO / UT border, except for specific listings…	East Coyote Wash		Aq Life Warm 2 Recreation 1a Agriculture
Lower Dolores River	Fisher Cr Headwaters Beaver Cr	2B, 3C, 4	

Impaired Waters and/or TMDLs

One stream segment within the project area and one downstream segment are listed on the 303(d) list (Table 13).

Table 13. 303(d) Listed Segments Downstream of Project Area

303(d) Listed Waterbody	*Pollutant(s)*	*Contributing Waters from Project Area*	*Use Classes Impaired*	*TMDL completed?*
Castle Creek	Salinity; Total Dissolved Solids (TDS); chlorides	Castle Cr Placer Cr	4	No
Mill Creek	Total Dissolved Solids (TDS); Temperature	Upper Pack Cr N. Fk Mill Cr Horse Cr – Mill Cr	3A, 4	Yes

Sole Source Aquifer

Castle and Placer Creeks have been identified as major recharge sources for the unconsolidated aquifer that provides domestic water to the residents of Castle Valley (Snyder 1996), which is a designated Sole Source Aquifer. Snyder also concludes that in the unconsolidated aquifer, the groundwater with the best water quality occurs along these streams. Poorer water quality elsewhere in the aquifer is attributed to contributions from the Cutler and Paradox Formations rather than from fertilizers, septic systems, or animal wastes in the valley. However, Snyder's report characterizes these sources, as well as increases in the number of residents and domestic wells, as the primary threats to the water quality of the aquifer.

3.11 Livestock Operations

Livestock grazing began on the La Sal Mountains about 1877. The large livestock operations arrived later in the early to middle 1880s. Large corporations, usually consisting of multiple operators, soon bought out smaller operations. Both sheep and cattle were grazed across southeast Utah. During the 1880s, it is estimated that all of San Juan County supported nearly 81,000 cattle and 120,000 sheep. In addition, horses grazed the county with one large operator bringing 1,500 head. After the mid 1890's, however, herd sizes dropped due to drought, market price reductions, poor range conditions and the associated loss in capacity. Large operators were going out of business at this time and by the late 1890's individual operators dominated the livestock industry. Concern for the health of the land brought about the National Forest Reserves which were created on the La Sal Mountains in 1906. The Taylor Grazing Act in 1934 initiated government management control over "unallocated" tracts of land, known as public lands (USDA 1999).

Range capacity estimates were established in 1960 when each vegetation type was mapped for each allotment. The acres of the various vegetation types were multiplied by pounds of forage/acre typically produced by that vegetation type to determine range capacity. "Suitable range" was defined as forage producing land which can be grazed on a sustained-yield basis. Since that time, proper use standards have been established in the Forest Plan and annual adjustments have been and continue to be made to meet those standards. In many cases, 1960 estimated range capacities have been lowered to meet proper use standards. In addition, the definition of suitable range now includes "appropriateness" which may result in the exclusion of livestock from campgrounds, culinary watersheds, wilderness areas or other areas where livestock grazing may be inappropriate.

An important component of the Moab Face project is the regeneration of aspen ecosystems. Bartos and Campbell (1998) state that pure aspen stands can produce 3,000-4,000 pounds of forage per acre. As conifers encroach, forage is reduced to less than 300 pounds per acre where spruce and fir dominate over aspen. While livestock numbers are not planned to increase as a result of this project, overall range conditions may improve with increased forage and better livestock distribution.

Six grazing allotments and six permittees would be involved in the Moab Face vegetation treatment project as follows:

Allotment	*Head Months*	*# cattle or horses*	*Dates on the forest*	*# of permittees*
Castle Valley	1055	217 cattle	6/1-10/30	1
Mason Springs	285	71 cattle	6/15-10/15	2
Bald Mesa	1367	291 cattle/8 horses	6/1-10/21	1
Brumley	954	212 cattle	6/6-10/19	1
Dorry Canyon	928	232 cattle	6/1-9/30	1
La Sal	2283 (Average)	1000 cattle	5/1-11/20	1
TOTAL	6872 head months	2023 cattle/8 horses	5/1-11/20	6

Grazing systems in these allotments are either deferred or rest rotation. Because the La Sal Mountains have a range of elevation from 5,000 to 12,000 feet, pastures in each allotment are generally set up to allow livestock to move up the mountain as snow melts and grasses cure. The size and number of pastures vary among the different allotments. For example, the Mason Springs allotment has only two pastures while the La Sal allotment has seven. Removing any one pasture from annual rotation results in either higher use of other pastures or a reduction in over-all use. Since Forest Plan standards for utilization must not be exceeded, reductions in either the number of livestock or time they are allowed to graze would result from resting a pasture for a prolonged period of time. This is a primary consideration when determining the time and place to burn.

Since urban-interface units are planned primarily for mechanical treatment with only slash pile burning, little disturbance to ground surface vegetation is anticipated. Therefore, these units would not require additional rest from livestock grazing. Higher elevation treatment units where burning is the primary treatment with the objective of aspen regeneration would need rest from livestock grazing following treatment. The pastures affected by these treatments with the number of head months each pasture supports is as follows:

Allotment	*Pastures Affected*	*# of Head Months possibly Affected over a 10-year period*
Castle Valley	East Andy West Andy Willow Basin Bachelor Basin	268 275 (1079) 268 268
Mason Draw	Upper Mason Draw	142
Bald Mesa	Wilcox Flat	310
Brumley	Upper Brumley Mill Creek	240 (410) 170
Dorry Canyon	Moores Range	186
La Sal	Buck Hollow Coyote	867 (1400) 533
	TOTAL	3527

In some instances, resting an entire pasture would not be necessary to protect the portion that has been treated. In addition, the objective during treatment is to treat no more than one pasture per allotment at any one time.

Chapter 4: Environmental Consequences

4.1 Introduction

This chapter provides information concerning the potential environmental consequences from implementing the Moab Face project known as the "proposed action" and the consequences of continuing the status quo approach under the "no action" alternative. Effects are disclosed including direct, indirect and cumulative effects of past, present and foreseeable future actions. Effects are quantified where possible using evaluation criteria (Chpt. II Section 2.3), and qualitative discussions are included. The means by which potential adverse effects would be reduced or mitigated are described.

Mechanical treatment methods are highly predictable in terms of implementation and results. However, weather conditions, ground conditions, burn logistics, operations, and safety ultimately determine the exact timing and number of acres attempted to be treated at any one time when treating with prescribed fire. Due to the nature of fire, an exact prediction of the resultant number of treated acres, shape, size, and burn severity is not possible. Fire behavior is modeled based on the prescription for burning. With that in mind, the environmental consequences are based on the best predictions available as to what would happen. In addition, the exact timing of the prescribed burns would not be known because of the unpredictable window of opportunity (proper weather conditions). The scheduling of these areas and more detailed information regarding the prescribed burns would be described in the associated burn plans and prescriptions.

In addition, since we do not have a crystal ball to show us exactly what the future of an area is if a project is not implemented, then we must speculate or at best, predict, an outcome for the "no action" alternative. In this case, the "no action" alternative is analyzed using two scenarios: long term continuance of no disturbance and with a catastrophic disturbance (i.e. wildfire).

4.2 Air Quality

Direct and Indirect Effects

Alternative A
Under Alternative A, the "no action" alternative, the chance of catastrophic fire would definitely be increased due to the fact that no fuel treatments would occur. Due to this, Alternative A may actually have the greatest amount of air quality impacts, since wildland fires generally produce a massive amount of emissions over a period of time that can neither be predicted or controlled. Keane et. al. (2002) gathered research that noted that smoke produced from uncontrolled wildfires occurring on fire-excluded landscapes may actually exceed historic levels and the emissions from these fires can be more harmful to people than smoke released from prescribed burning. Many of the factors listed under Alternative B below may apply to this alternative. However, since the conditions when a wildfire

occur are uncertain, controlling these factors is not predictable. However, modeling smoke emissions from a wildfire given the fuel conditions in the Moab Face project area can be estimated and shows the following:

Particulate Matter PM10		
Fuel Model	Acres	Total Emissions in Tons
10/ G	2,530	405.6
9/ U	29	1.3
8/ H	3911	76.2
6/ F	4840	268.5
2/ T	665	17.7
	Total Emissions	769.33

Alternative B

Impacts to air quality under the "proposed action" alternative would differ because the amount of emissions would vary as would the duration and frequency of emissions. Emission rates are based on how much fuel is consumed by the fire and how much emissions each type of fuel emits. Consequently, as the amount of fuel consumed varies, so does the amount of emissions. Fuel consumption is directly related to the amount of moisture in the vegetation.

The season of the year that the prescribed burns are conducted also affects the amount of fuel consumed due to the moisture content of the fuel. Fuel is anything that will burn, but it has to be dry enough to burn. If fuel moisture is high, the fuel will not ignite or it will just smolder and not have clean, efficient combustion. Fuels have higher moisture levels in the spring, tend to dry out as the summer months progress, and are drier as they cure in the fall months. Prescribed fires conducted in the spring months would not burn as intensely because combustion of the greener, wetter fuels is not as efficient. These conditions could produce more emissions due to the longer "residence" time of the burn because of the elevated fuel moistures. Fall and summer burns may burn more cleanly, with less emissions, because fuels burn more in the combustion phase as more of the fuels are readily available to ignite at lower moistures.

The amount of emissions differs among the treatment areas based on the number of acres burned. Emissions would increase as more area is burned and more fuel consumed. As the number of acres treated increases, the duration and frequency of smoke will also increase. This scenario would occur over a ten year period (the proposed project completion date).

There are sensitive areas downwind (north) of the treatment areas that may be impacted by smoke and reduced visibility. They include Arches National Park and

Castle Valley, Utah; Gateway, Colorado; several Forest Service and BLM campgrounds, dispersed recreation sites, trails; Scenic Byways through the National Forests and Forest roads.

A computer model (SASEM) would be used to predict emissions from each area that may be treated with prescribed fire. Due to the prevailing winds, Arches National Park would be used as the primary receptor of pollutants from all the treatment areas. Calculations show no violation of standards for amount of particulate matter (PM10) in the area, nor for total suspended particulates (Table 14).

Approximately 1,420 acres of the 2,500 acres of Fuel Model 6 near WUI would be mechanically treated with no follow up pile burning. The action alternative would have the benefit of producing fewer emissions than a wildfire. Especially in areas where the treatment consists of mulching with no follow up burning.

In areas where piles would be burned, smoke production would be less than broadcast burning. Piles produce less smoke because they are concentrations of cured out material where the flames and smoke production is short lived and the material burns clean. The area burned could be controlled and piles produce less smoke than broadcast burning and there would be area where chipping and mulching would be applied and would not produce any smoke.

Table 14 Smoke Emissions from Alternative 2.

Particulate Matter PM10			
Fuel Model	Acres	Total Emissions in Tons	Mechanical treatment Acres
10/ G	1265	203	0
9/ U	15	0.65	0
8/ H	1956	38.1	0
6/ F	2420	134	2420
2/ T	333	8.85	0
Hand piled	1000	73.2	0
Total Emissions		457.8	

PM10 is the particulate matter that is less than 10 microns in diameter.

Cumulative Effects

Alternative A

Cumulative effects from smoke are hard to predict for this alternative. If no wildfires occur then not implementing the action alternative would have no cumulative effects. If a wildfire does occur that pre-treatment through the Moab Face project could have prevented, then a variety of cumulative effects could be accounted for. For example, a wildfire on the La Sal Mountains at the same time as multiple other wildfires are occurring across the west could diminish air quality significantly, both locally and over a much broader area. This in turn would diminish visibility for recreation/aesthetic purposes, particularly in nearby national parks. This could also aggravate lung conditions particularly in the elderly, promoting other precautions for health sake. Other activities negatively affecting air quality would compound the problem such as pollution emissions from various industrial plants, dust from windstorms, etc.

Alternative B
Cumulative effects from smoke would not be a factor under Alternative B, since according to 40 CFR 1508.7 the effects must overlap in time and space and this is not a foreseeable occurrence. Although there are multiple units where prescribed fire is proposed, no more than one unit would be burned at one time. If there is an ongoing wildfire or fire use fire, a prescribed fire would not likely take place due to possible smoke impacts.

4.3 Visual Quality

Direct and Indirect Effects

Alternative A
There would be no change to the overall character of the landscape since no treatments would occur. Should a wildfire occur, it would likely consume a larger area than planned for treatment under Alternative B. Due to this, Alternative A would have the greatest impacts on visual quality, since wildland fires are not as predictable or controllable as prescribed burns. Also, wildland fires usually burn hotter and consume fuels more fully than prescribed burns. This means that vegetation recovers more slowly extending visual impacts over a longer period of time.

Because of the diversity in vegetation and landform, it is expected that occasional burns, up to 20 acres or more would easily blend in with the surrounding landscape and vegetative patterns.

Alternative B
Visual Quality Objectives, according to the 1986 Manti-la Sal National Forest Land and Resource Management Plan would continue to be met. One objective of the vegetation treatments is to create a mosaic of both plant species and age classes. We also want to create a fuels mosaic that would help to slow down or even stop wildland fires when they occur. Both objectives would maintain or enhance visual quality. Creating a mosaic of fuel conditions would mean burns would cause patches where the overstory is killed and all fuels removed, as well as areas where very little fuel is removed and some green vegetation remains. These mosaics are possible because of the present fuel loads that vary from very light to

very heavy. Where there are only light surface fuels such as in the grass/aspen vegetation type the area would have a charred surface where fuels burned and remain green where they did not. Aspen tree stems would range from undamaged to blackened.

Where conifer fuels exist under the aspen or in pure pockets, torching of individual trees would occur, meaning the low-lying branches of the conifer trees would carry fire into their top branches and whole trees would be consumed. Fire would be more intense in these pockets, killing conifer trees and making way for aspen regeneration. There would be a charred appearance where ground fuels are consumed and where they are lacking the ground would show little charring.

Immediately after implementation of a prescribed burn, a visitor traveling on the La Sal Loop road would see there has been a change in the foreground. However, after 1-4 years of regeneration, the typical visitor may not notice any change other than burnt or dead snags. In other areas where treatments are planned adjacent to secondary travel routes, frequent users along these roads would be able to observe the regeneration process as it occurs. Casual visitors would notice little change in the landscape character because of a lush undergrowth, except for burnt or dead snags. There would be more diversity in the vegetative cover of the landscape. The treatment areas would be evident to the casual visitor because of the size of the area, though the areas would be concentrated. Eventually, the natural vegetative patterns found in the landscape would return.

The total burned area within the middleground view zone would not be more than one or two percent of the total view of the mountain, and much less in any given year. Any treatment areas that would be adjacent to roadways, viewpoints or a trail would be noticed for about a year until grasses and forbs return across the landscape.

Cumulative Effects

Alternative A
No cumulative effects would result from this alternative.

Alternative B
No cumulative effects would result from this alternative. Because of the diversity in landscape, timing schedule of treatments and proposed treatment methods, implementation of this project does not pose a major concern for visual resources.

4.4 Forest Users

Direct and Indirect Effects

Alternative A
Forest users would not be affected by air and visual quality or changes in vegetation screening and setting of dispersed camp sites. Under this alternative, the risk of a catastrophic fire is highest, potentially impacting many of the

dispersed and/or developed sites to a greater extent and affecting forest users by traffic restrictions and smoke concerns from the wildfire.

Alternative B

The proposed treatment activities, as well as pre-treatment activities, would affect all recreational experiences located in the vicinity of units being treated. Forest visitors may find themselves temporarily impacted by smoke and, reduced visibility and inconvenienced by temporary closed roads during the actual ignition phase. In addition, noise, crews, and general activities associated with these treatments would impact dispersed and developed site campers as well as those using the area for pleasure driving, mountain biking, hiking, and horseback riding.

Air and visual quality, from a forest users perspective, would be temporarily negatively affected during and immediately following treatment. Blackened areas would temporarily affect usability of some dispersed camp sites. Location, timing, and size of treatments, plus speed of natural regeneration would determine the long-term effects on dispersed and developed recreation. Some camp sites would be more exposed for various lengths of time followed by new vegetative growth. The new vegetation may improve screening and/or limit visibility.

The major activity that would be affected by treating vegetation in the fall is the annual big game hunt. Hunters often use dispersed campsites, trails and forest roads to access areas for hunting. Access may be temporarily restricted in specific areas. The quiet atmosphere desired for quality hunting would be reduced at specific locations during treatment.

High use areas such as Miner’s Basin, Warner Lake and Oowah Lake would be affected. While burning treatments would not occur within developed campgrounds, the close proximity would still impact campers. However, the timing of the treatments in these areas is recommended to occur during the fall months which is past the peak camping season. Keep in mind not all areas would be treated the same year so not all forest users in these areas would be affected at the same time.

Many positive effects would occur in the long term. Vegetation composition and diversity would be enhanced and the risk of catastrophic fire reduced. The regeneration of aspen on the landscape would maintain the beauty this tree provides, particularly during the fall. In addition, wildlife forage would increase as soon as new shoots develop after treatment. These areas would draw big game into them, improving big game populations and hunter success.

Cumulative Effects

Alternative A

No cumulative effects would result from this alternative.

Alternative B
No cumulative effects would result from this alternative. Because of the diversity in landscape, timing schedule of treatments and proposed treatment methods, implementation of this project does not pose a major concern for forest users.

4.5 Vegetation

Note: Many of the effects associated with fire would be the same whether it is a wildfire (Alternative A) or a prescribed fire (Alternative B). The intensity, duration, severity and extent of the burn is likely to be greater in wildfires and therefore affects would be more extreme. Effects of the No Action Alternative could range from the absence of fire to the effects from catastrophic wildfires.

Direct and Indirect Effects

Alternative A
Mixed Conifer: Under the No Action Alternative, productivity of existing aspen stands would continue to decline. This would occur more rapidly in stands farther along in succession to spruce/fir than others. Unless some natural disturbance occured, aspen stands within the project area would be greatly reduced or eliminated. Elimination would occur from conifer encroachment and eventual replacement by spruce and fir trees. This would eliminate a component of diversity in vegetation and consequently wildlife habitat, reduce forage production for both wildlife and livestock and reduce watershed values in the immediate area. Aspen would continue to grow decadent without being replaced by young aspen trees. Herbaceous ground species would remain at current levels of abundance and diversity, declining in areas where aspen becomes eliminated. Keane et. al. (2002) describes the most documented and studied effect of fire exclusion as follows, "forest composition has gone from early seral, shade-intolerant tree species to late seral, shade-tolerant species, while stand structure has gone from single-layer canopies to multiple-layer canopies with fire exclusion. It is this fundamental change in vegetation composition and structure that cascades downward to impact a myriad of other ecosystem characteristics.

Zero acres of land would be treated by mechanical means or fire under this alternative, unless a wildfire occurs. In that case, we would suppress any fire as soon as possible which has been standard operating procedures. Some fires would escape suppression efforts. Catastropic wildfires burn at much higher temperatures than normal fires, causing long-lasting and severe environmental damage (Healthy Forest Initiative 2002). Large trees normally resilient to fire often succum to wildfire on landscapes where fire has been excluded. The accumulation of litter on the forest floor can be particularly thick under large trees where fire has not been allowed to clean the duff. Consequently, intense fires that burn hot and long at the base of large trees often kills a tree that would otherwise have survived fire.

Intense fires can sterilize soils and kill large fire-resistent trees. Soil organisms can be reduced by severe fires that occur in stands where fire has been removed for long periods of time (Keane et. al. 2002). Organic matter usually in the form of duff (leaves, needles) increases on the forest floor in the absence of fire. Increased organic matter results in greater soil pore space and water-holding capacity. When soils with thick duff layers burn at high intensities as in wildfires, the organic matter moves downward into the soil and condenses to form a water repellent layer that restricts water infiltration. This is called “hydrophobic soils” and the result can be massive soil erosion. Deep penetrating heat into the soil also kills microorganisms that would normally survive low intensity fires.

Briefly examining nutrient cycling in the unburned forest ties back to the ever-present and increasing closed tree canopy. The shaded moist conditions reduce duff decomposition which is needed to place nutrients into the soil. Reduced decomposition can result in delayed nutrien cycling and add to the accumulation of woody fueld accumulations. These fuels are what provides the catalyst for large catestrophic wildfires. Keane et. al. (2002) identifies fire as the primary control of decomposition and nutrient cycling in fire-prone ecosystems.

Mountain Brush: This vegetation community would not be moved closer to healthy, diverse conditions under the no action alternative.

The loss of grassland/sagebrush areas to shrub and tree invasion would continue. Fire dependent shrubs would grow decadent and possibly die without disturbance. Without disturbance frequencies similar to the natural disturbance regime, pinyon and juniper trees would continue to replace shrubs and grasses (Wright 1979). As a result, ground cover would diminish and soil erosion potential would increase. Because mechanical treatment and management-ignited fire are excluded from this alternative, the only disturbance that would occur within the area would be wildfires. These fires would continue to be suppressed by the Forest Service since they would likely exceed acceptable prescription conditions.

Pinyon/Juniper: This vegetation community would not be moved closer to healthy, diverse conditions. Because management-ignited fire and mechanical treatment is excluded from this alternative, only naturally ignited fires would occur with suppression efforts maintained at current levels. In order for a wildfire to burn under prescriptive conditions, fuels would need to be reduced. Since this is the "no action" alternative, no fires would be allowed to burn. The risk of a stand-replacing wildfire would continue to increase as down woody material and ladder fuels accumulate without treatment.

The area containing pinyon and juniper woodlands would hold the greatest risk of having a stand-replacing fire severe enough that suppression efforts would be difficult and costly. If a fire of such nature were to move through this portion of the analysis area, little vegetation would be left, exposing shallow soils on slopes to a high risk of soil erosion. Often weather conditions during such burns are such that little can be done to stop wildfires once they are underway, until they hit a natural barrier. Biodiversity would be impaired by having large blocks of continuous vegetation converted to early seral stages all at once. Since so little viable herbaceous seed exists in these communities, recovery in such burns is slow. Of all the vegetation types being treated across Moab Face, large extensive wildfires in pinyon-juniper poses the greatest threat of cheatgrass invasion.

Alternative B

Mixed Conifer: As a result of this alternative, 6,530 acres of fir/spruce/aspen would be treated by fire. Stands of aspen would be burned under a prescription of moderate to high intensity. Prescribed fire would move the area towards a more healthy condition as rapidly as any other method could.

Improving aspen stands through burning would result in aspen sprouting in patches. The response may vary depending on the percentage of the stand treated, the vigor of the stand and the site. Areas of mature aspen with little conifer over-story would likely sprout vigorously. Other areas where large conifer trees are present would sprout but if shaded, the sprouts may take longer to mature and may not be as dense.

Treating small pockets of aspen may result in greater browse damage to sprouts. V. Anderson and S. Walker (1995) recently documented the impacts of both domestic and wild ungulates on aspen regeneration. Treating a larger more extensive area over a short time would increase the short-term effects to wildlife but would spread out browsing damage and result in less impacts from wildlife.

Prescribed fire typically burns an area with a variety of intensities leaving a mosaic pattern of conditions ranging from complete removal of vegetation to areas not burned at all. Engelmann spruce and subalpine fir are very fire sensitive and are often killed by low-intensity fires. Large trees occasionally survive light fires. Long term effects would vary according to site characteristics. Moderate severity burns result in the greatest initial stimulation of suckering. High severity burns (which may include the overstory) are found to have less initial suckering and only produce about one half the total suckering of a moderate severity burn (Brown 1958). Light severity burns have been found to not kill a sufficient number of parent stems to stimulate aspen suckering (Horton and Hopkins 1966). In the long-term, only slight differences in aspen understory responses have been found between moderate and high severity burns.

Postfire reestablishment is via wind-dispersed seeds which readily germinate on burned seedbeds. In the subalpine zone, spruce and fir can escape fire since the climate is usually cool and damp and the fuels are discontinuous. Because of this climatic nature, fire intervals average 100-150 or more years. Because of ladder fuels, cool low intensity ground fires often climb to start crown fires resulting in stand-replacing fires.

The reasons Englemann spruce and Subalpine fir are susceptible to fire are as follows:

1. They have thin bark providing little insulation
2. They have a moderate amount of bark resin which ignites readily
3. They have shallow roots susceptible to soil heating,
4. They have low-growing branches
5. They have a tendency to grow in dense stands

6. They have moderately flammable foliage
7. Heavy lichen growth is often present
8. The moist cool climate slows decomposition of organic matter allowing fuels to accumulate

Large continuous crown fires in spruce and fir woodlands results in few surviving trees and little regeneration due to the loss of a seed source. On small burns, however, spruce and fir usually establish numerous seedlings within 5 to 10 years. When dead trees are left standing and down debris remains, seedlings are easily established due to the moisture and shade provided. Since Engelmann spruce requires a miineral soil seedbed and subalpine fir is less restrictive, fir seedlings usually outnumber spruce seedlings in the understory of spruce-fir stands and they are often the first of the two to reestablish after disturbance. In both cases, reinvasion into large burns is slow because much of the seed source for reestablishment of spruce and fir is destroyed.

Prescribed fire, which mimics all the beneficial aspects of wildfire without the inherent risks, has been found on most occasions to be the most economical and efficient method of rejuvenating aspen in a mixed conifer forest. By re-establishing fire into the mixed conifer ecosystem, our management efforts would more closely mimic a natural situation; thus more natural results and effects would be produced. These effects may include a mosaic of vegetation both in species and age classes, a healthy stand structure which would reduce the potential for insect and disease outbreaks, and ground fuels which more closely resemble historic levels.

Jenkins et al. (1998) studied the return of spruce-fir trees following fire in three plant associations: aspen, lodgepole pine, and spruce/fir. In each case, he found that both Engelmann spruce and subalpine fir trees were well established in large numbers within 30 years following fire. Tree establishment declined dramatically as trees grew, limiting available space. In the quaking aspen plant association, 55-60 years were required for germination of 50% of Engelmann spruce and subalpine fir. While it took longer for spruce-fir to be established under the aspen canopy, once established, the conifer trees grew faster than in any of the other plant associations. Jenkins suggests this may be due to higher organic matter and soil nutrients in the soil and lower transpiration rates of aspen sustaining more soil moisture. In addition, when subject to water stress, quaking aspen cease transpiration sooner extracting less water than many other tree species, leaving more moisture for associated trees (Jenkins et al.1998).

The major problem associated with using prescribed fire to treat aspen is getting the aspen community to burn. An intermix of conifers and ground fuels helps to maintain a burn hot enough to regenerate the aspen. Fuel classification in aspen communities is based primarily upon understory characteristics and to a lesser extent upon successional status, amount of downed woody fuels, and grazing use.

Many aspen stands, especially those with a grass and/or forb understory rather than a shrub understory, lack the flammable fuels needed to carry a fire which is hot enough to effectively stimulate aspen regeneration. Engelmann spruce and subalpine fir height growth analyses indicate that following their establishment beneath aspen, these species require 70-80 years to provide ladder fuels that would increase fire intensity and the potential for crown fires (Jenkins et al. 1998). Newly germinated conifer seedlings would reach the main aspen canopy in about 90 years according to Jenkins et al. (1998).

Although aspen communities do not readily burn, quaking aspen has adapted to fire in the following ways (Fire Effects Database):

1. Aspen bark is thin and green with no protective corky layers to insulate from fire and therefore little resistance to heat. Aspen is easily top-killed.

2. Root systems of top-killed stems send up a profusion of sprouts for several years after fire.

3. Sprouts grow rapidly from the water and nutrient extracting root system and can outcompete other woody vegetation.

4. A new even-aged stand of aspen can develop within a decade following fire.

5. Quaking aspen stands are self-thinning. Unlike most trees that require intervention to thin, open groves of large aspen trees can result from dense sprouts without intervention.

Studies have shown the following probability of a successful burn in aspen communities (Brown and Simmerman 1985):

Aspen/Shrub or trees	High probability
Aspen/Tall Forb	Moderate probability
Aspen/Low Forb	Low probability
Aspen/Mixed Shrub or trees	High probability
Aspen/Mixed Forbs	Moderate probability

Mature or overmature aspen stands with less than 500 suckers per acre may have regeneration problems; those having over 1,000 suckers per acre appear to reproduce successfully. Successful fire application requires waiting until live fuels are adequately cured and wind speed and dead fuel moistures enhance fire spread. The time a stand remains in prescription for fire is usually brief. Fire in aspen stands will not spread unless flame lengths are 1 to 1.5 feet, which requires at least 50 percent cured herbaceous vegetation in the aspen/shrub and aspen/tall forb types. Basically, the probability of conducting a successful prescribed fire in aspen stands with a relatively dense understory vegetation consisting either of shrubs or conifers is good.

Both hand and aerial ignition methods can be used successfully; however, aerial ignition using a helitorch and/or a Plastic Sphere Dispenser (PSD) permits burning at higher fine fuel moisture contents than is possible using hand ignition. Aerial ignition can also create larger flames to kill unwanted vegetation and get the fire to spread in marginal fuels, but fire behavior can be less predictive.

Mountain Brush: This alternative would treat 3936 acres of mountain brush vegetation. For fire to carry in mountain brush communities, burning conditions generally require hot summer days with high temperatures, low humidity, and wind speeds of 8 to 20 miles per hour. Fires carry better as shrub density increases. However, mountain brush areas within the Moab Face project area are being treated with the primary objective of protecting private in-holdings and structures. Therefore whether fire is used or not, mechanical treatment would need to be used first.

Mechanical control efforts to date have targeted short-term control rather than long-term control of Gambel oak. It has been recognized that to minimize sprouting even on a short-term basis, high initial root kill of oak stands must be attained (Engle et al. 1983). Chaining, a method used to remove top vegetation has resulted in prolific sprouting and increased density of oak stems. This too would be the expected results following treatment by a rollerchopper or a hydroax. A few herbicides such as Tordon have shown promising results. Goats have also been used, concentrating browsing over a period of several years and successfully knocking back oakbrush for long periods of time (Engle et al. 1983).

Single burns of oakbrush in any season generally results in prolific sprouting and consequently increases oak density and frequency. Evidence suggests that repeated, relatively high-severity fires may be necessary to reduce Gambel oak. The key is to burn oak during periods when carbohydrate reserves are low (Fire Effects Database). Repeated summer burning (not spring or fall) when rapid regrowth is consuming carbohydrate reserves, eventually may kill Gambel oak. Unfortunately, this is typically the time of extreme fire hazard conditions.

Baker (1949) studied soil characteristics of burned and unburned Gambel oak communities. Burned areas were found to have consistently less acidic soil and have greater amounts of available plant nutrients. Litter was essentially eliminated on the burned sites but increased up to or exceeding unburned levels within two to three years. Water infiltration rates were noticeably greater on unburned sites. Oak sprouting following the burn occurred rapidly with the greatest recovery the first year. First year growth averaged eighteen inches in height with root growth at depths of one to two inches below soil surface.

McKell (1950) showed similar results to Brown (1958). McKell compared Gambel oak plots one, two, nine and eighteen years following burn. The number of shoots was the most abundant the first year while the cover they provide was the least. This ratio slowly reversed over time so that by the eighteenth year, both were comparable. Annual plants showed the largest increases of any plant the first year. Grasses also increased the first year but stabilized by year nine. By the eighteenth year, most vegetation had returned to pre-burn conditions.

Oakbrush control is difficult since it responds to disturbance by prolific resprouting. Some studies show that repeat burning or quick planting of competitive herbs following knock down of oak top growth can help to control resprouting (Plummer et al. 1966). The most successful inhibitors of oak are intermediate wheatgrass

(*Thinopyrum intermedium*), smooth brome (*Bromus inermis*), mountain brome (*B. carinatus*), meadow brome *(B. erectus*), crested wheatgrass (*Agropyron cristatum*), orchardgrass (*Dactylis glomerata*), and tall oatgrass (*Arrhenatherum elatus)* (Plummer et al. 1966 and Fire Effects Database).

Serviceberry is a dominant species within the mountain brush zone of the Moab Face project area. It is disturbance tolerant and sprouts from existing plants. It is most vigorous in seral plant communities which prescribed fire and mechanical treatments can be used to promote. Disturbance is not likely to alter its frequency since it sprouts from existing roots rather than reseeding (Fire Effects Database). Serviceberry in forests is fire-dependent and declines with fire exclusion. Fire reduces shrub height, promotes growth of new twigs, and increases nutritional content. Mechanical disturbance that mimics fire would have the same results. Serviceberry may persist in the understory for decades, but eventually dies out with canopy closure. Fire frequency where serviceberry is a large component, typically runs between 2 and 50 years. Slow recovery after disturbance may be a factor of big game browsing pressure.

The season of burning can influence plant response following fire. Noste (1982) studied the response of a variety of shrubs to spring and fall burning. Serviceberry sprouted more vigorously the first year following a fall burn but by the second year, the area burned in the spring contained twice as many serviceberry stems.

While it may depend on fire to reduce conifer competition and produce favorable soil conditions for seedling establishment, Curlleaf Mountain Mahogany is usually killed by fire. Mechanical disturbance would promote resprouting, therefore it is believed that the intense heat of fire alone may cause mortality. Curlleaf mahogany can reestablish through seeds but establishment is slow.

Birchleaf Mountain Mahogany is usually temporarily damaged by fire (Fire Effects Database). While it burns less readily than other shrubs, it sprouts vigorously from the root crown. This would mean vigorous sprouting would be expected following mechanical treatment as well. True mahogany seedlings may establish after fire but it is usually very slow. Seedling mortality may be high based on studies taken 2, 3, 4, and 5 years postfire (Fire Effects Database).

Snowberry is top-killed by fire and mechanical treatments, but below ground parts are very resistant and will readily sprout. Light to moderate severity fires can increase stem density (Fire Effects Database). Snowberry can even survive severe fires but if fire intensity is severe enough, it can kill roots and the rhizome system. This does not occur using mechanical treatments. Loss of snowberry can occur if burning under very dry conditions or after repeated burning in consecutive years (Fire Effects Database). One study found planting grass seed to control erosion removed enough water and nutrients from the soil to reduce coverage of common snowberry and other native shrubs on several burned sites in Oregon (Fire Effects Database).

While no sagebrush/grassland areas are proposed for treatment in the Moab Face project area, this vegetation type does occur interspersed and on the fringes of mountain brush and pinyon-juniper ecosystems. Treatment of these woodlands may allow for the expansion of sagebrush/grasslands. Sagebrush can reinvade quickly following disturbance if a seed source is available, which is significant since sagebrush does not resprout following disturbance. A few small sagebrush plants become established from residual seed the first or second year following a burn. As these plants mature, they produce seeds which allow for more reestablishment.

To summarize, the direct effects of mechanical treatment and/or burning under prescription in mountain brush vegetation would be an increase in vegetative diversity both in species and age classes. The result would be greater horizontal and vertical structural diversity. Since the natural disturbance regime has been stopped due to fire suppression, the reintroduction of fire would be a step towards bringing the ecosystem back into Properly Functioning Condition. The reduction in fuels and the presence of a vegetation mosaic would reduce the hazard of wildfires around urban interface areas. A reduction in fire suppression costs would also result over time.

Pinyon/Juniper: Approximately 3,903 acres would be treated with mechanical means and possibly fire. The absence of understory plants lends itself to seeding following the treatment. These stands are often difficult to burn since they have little understory to carry a fire so pretreatment by mechanical methods may be required if fire is to be used. For fire to carry in such instances, burning conditions generally require hot summer days with high temperatures, low humidity, and wind speeds of 8 to 20 miles per hour. These conditions usually result in crown fires that carry better as tree density increases and as the proportion of pinyon to juniper trees increases. However, these areas are being treated across the Moab Face with the primary objective of protecting private inholdings and structures. Therefore fire without prior mechanical treatment would hold too great a risk. Pinyon pine has greater flammability and generally results in greater site potential for herbaceous plant response. Juniper trees are often killed when the crown and stem are scorched. Low, spreading branches act as ladder fuels carrying ground fires into tree canopies. Large, old juniper trees have been known to survive four to six low-intensity fires in areas where little ground fuels exist. The time interval for juniper trees to return after burning depends on seed sources, the size of the burn and the presence of dispersal agents. Juniper trees generally become reestablished on a site 20 to 30 years after the burn, with a well-developed woodland present from 85 to 90 years following fire.

According to the analysis of fuels by fuel specialists on the District, there is a natural risk of catastrophic fire on steep slopes with pinyon-juniper woodlands. Mechanical treatment would help reduce this risk. If small blocks of woodlands can be mechanically treated in a mosaic pattern, then soil loss during vegetation reestablishment could be minimized and overall soil stability and biodiversity would increase with the increase in litter on the ground.

Following fire, Colorado pinyon pines begin reestablishing in postfire year 25 (Fire Effects Database). Where pinyon trees have recently invaded grassland communities, young trees less than 4 feet tall are easily suppressed by fire. In fact, the best candidates for effective prescribed burning are ecotonal areas where trees have invaded sagebrush-grassland communities, with a shrub and tree cover ranging from 45 to 60 percent. Low-intensity spring burns which eliminate the tree overstory, in most cases, allows natural reseeding. Adult big sagebrush plants are generally killed by fire. If there is a prolific seed source nearby in unburned areas, seedlings can rapidly germinate. Wind, water and animal-carried seed contribute to regeneration on a site. Highly productive sagebrush sites have greater plant density and provide more fuel to carry a fire.

While fire can effectively reduce juniper competition and release understory species, the expansion of alien annual species (cheat grass) following fire can negate the benefits. The issue of cheat grass expansion in these units is the same as that discussed below in Section 4.12.1.

Although many different factors influence successional patterns in pinyon-juniper forests, fire effects are mostly a result of stand structure and understory composition. In mature woodlands where tree dominance is high and the understory is generally suppressed, there is little ability for the understory to carry fires intense enough to kill larger trees. Large crown fires are required to set back succession in mature pinyon-juniper woodlands. In most cases, pinyon pine and juniper trees reestablish from seed cached by rodents and birds the first or second year following fire. In many cases, residual seeds become established. However, after trees are established, their coverage and density remains relatively low until tree age approaches 60 years. At this point tree densities exceed understory species until trees completely dominate once again at about 100-150 years after burning.

The effect of fire on pinyon and juniper trees is influenced by the size of trees, amount of herbaceous fuel, wind speed, air temperature, stand density, vertical and horizontal fuel distribution and season. Canopy morphology also plays a role in susceptibility of trees to fire. Those trees with the canopy developed close to the ground are much more likely to have the crown catch on fire from fuels on the soil surface than those with an elevated canopy. In areas where historic fire is continually repeated, pinyon pine trees would likely dominate over juniper because junipers have a very low resistance to fire mortality.

In pinyon-juniper habitats where Rocky Mountain juniper originally existed, it would often be the first tree species to return following a disturbance and may invade sagebrush stands. Pinyon may follow and eventually replace it. Where large Rocky Mountain junipers exist, their thicker bark and more open crown enables them to survive low-intensity fires better than other juniper and pinyon trees. Therefore, their seeds may reestablish the area prior to other trees. The estimated mean fire interval for juniper woodlands is 10-30 years. These fires were typically low intensity ground fires and kept small seedlings at bay. The result was open woodlands with large pine and juniper trees. If large mature trees are left viable following disturbance whether fire or mechanical, then reestablishment through seed dispersal is prevalent.

Perennial forbs may increase in number following a fire, but do not account for much of the cover. Annual forbs, like annual grasses, may be abundant during the first 3 or 4 years following fire but slowly diminish. The percentage of bare ground is highest right after the burn and in older stands of pinyon and juniper. The grass stage reaches a peak from the fifth to seventh year following fire. Sagebrush, forbs and grasses predominate in intermediate age classes of pinyon and juniper woodlands. Litter, on the other hand, accumulates over time so generally, the older the burned area, the greater the percentage of litter.

The following diagram summarizes successional changes in vegetation following fire in pinyon/juniper woodlands:

Mature Pinyon-Juniper woodlands
↓ ← ***Stand Replacing Fire***
Dead trees and bare soil
↓
Annual stage*
↓
Perennial grass-forb stage
↓
Perennial grass-forb-shrub stage
↓
Perennial grass-forb-shrub-young pinyon-juniper stage
↓
Shrub-pinyon-juniper stage
↓
Pinyon-Juniper woodland

*This stage may be bypassed on areas having fair perennial cover present prior to burn

Repeat burning every 20-40 years may eventually replace pinyon-juniper woodlands with shrub communities while the absence of fire eventually allows pinyon to dominate (Fire Effects Database). The natural fire regime for pinyon-juniper-mountain brush communities is a 35-100 year return interval (Fire Effects Database).

The most effective treatment of pinyon-juniper stands depends on the density of trees. Broadcast burning requires densities of 200 to 400 trees per acre to achieve control, although an adequate understory of shrubs can help carry the fire in lower density woodlands (Fire Effects Database). Mechanical treatment such as chaining, rollerchopping and hydroax are effective in removing larger diameter trees but leave small seedling trees undisturbed. Follow-up burning in these situations are effective in the long-term set-back of succession but should probably take place once slash has dried and on-site seeds have germinated (2-3 years following mechanical treatment) (Fire Effects Database).

Other results from prescribed fire in pinyon and juniper woodlands include the loss of some wood products such as fire wood, posts and poles. Most of these products, however, can be recovered following the burn. The reduction of fuels following a prescribed burn would reduce the risk of a stand-replacing wildfire and its associated costs.

Cumulative Effects

Alternative A

Mixed Conifer: Under the No Action Alternative the landscape would remain in an unhealthy condition, not meeting Properly Functioning Condition. Continued and increased potential for spruce budworm outbreaks would occur. Fire hazards would continue to intensify, increasing the likelihood of stand-replacing fires. Costs for fire suppression would likely increase with the associated increase in fire hazard. The loss of viable aspen stands would continue with some becoming decadent beyond rejuvenation. The loss of benefits associated with aspen communities would occur. These benefits include such things as plant and wildlife diversity and their associated aesthetic values and excellent watershed quality and yield. Wildlife and livestock forage would continue to decline as aspen stands continue to convert to conifer woodlands. Specific wildlife species dependent on aspen trees and forests such as the Northern Goshawk, would decline over time as would populations of other wildlife such as deer, woodpeckers, and tall forb communities such as tall larkspur.

Mountain Brush: : Under the No Action Alternative the landscape would remain in an unhealthy condition, not meeting Properly Functioning Condition. Without disturbance, mountain brush vegetation will grow old and decadant, with few young plants present. While providing cover for many wildlife species, the potential to provide food would diminish with the loss of young plants. Many shrub species such as serviceberry will lack the ability to produce leaves and result in large masses of mostly woody branches. The potential for large hot wildfires in this type of vegetation will increase. Should a fire take place, the intensity of it would likely leave little or no vegetation untouched, deeply hydrophobic soils, prolonged recovery of plants that sprout and the high potential for soil erosion.

Pinyon-Juniper: Under the No Action Alternative the landscape would remain in an unhealthy condition, not meeting Properly Functioning Condition. Young pinyon and juniper trees will continue to grow larger and older. Areas where grass and shrubs remain interspersed with pinyon and juniper trees would diminish with the closure of tree canopy. While providing cover for many wildlife species, the potential to provide food would diminish with the loss of ground vegetation. Edges of pinyon and juniper woodlands would continue to expand into neighboring vegetation types. The result without disturbance would be a dense stand of large old pinyon and juniper trees with a lack of diversity in both vegetation species and age classes. Should a fire occur, it would need to be carried through the crown of trees resulting in large expanses of dead tree trunks. This situation is ideal for cheatgrass invasion which ultimately alters the ecological balance including natural fire cycles.

Alternative B

This alternative would treat the following in relation to the entire district:

Vegetation Type	Total Acres on Moab District	Amount of Vegetation Type Proposed for Treatment
Mixed Conifer	30,752 acres	6,530 acres or 21% of total
Mountain Brush	55,431 acres	3,936 acres or 7% of total
Pinyon-juniper	55,073 acres	948 acres or 2% of total

Reintroducing fire back into the ecosystem, both in this project and others would allow ecosystems to return to Properly Functioning Condition. Both prescribed fire and mechanical treatment projects reduces fire hazards by lowering the forest fuels and consequently the potential for intense wildfires. These projects help to maintain the forest in a variety of successional vegetation stages providing greater plant diversity and enhancing wildlife diversity as well. Vegetation treatments help sustain young age classes while at the same time developing the old growth component. This would provide for current and future habitat needs of TES wildlife and improve the visual landscape. Managing vegetation treatments at the landscape level should minimize concerns for fragmentation of habitats. Providing a mosaic of species and age classes in our vegetation communities should help to meet ecosystem objectives both currently and in the future.

This project would have the long-term affect of reducing the risk of wildfire, allowing fire to return back into ecosystems at or near historic levels, and reducing the high cost associated with wildfire suppression.

The following tables show past, present and foreseeable future actions in the various vegetation communities (past= 1974 through present; Foreseeable Future= approximately 10 years planned):

Mixed Conifer

Past & Present Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Aspen regeneration plot		Geyser Pass exclosure	1
Spruce budworm	ongoing	Scattered pockets of dead spruce across Moab Face	
House Log Removal		Geyser Pass	
State/Private Aspen Harvest	1995+	Geyser Pass	5000+

Foreseeable Future Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Moab Face	2005-2015	Across Moab Face of La Sal Mountains	6,530
Spruce budworm	ongoing	Scattered pockets of dead spruce across Moab Face	

Endemic spruce budworm populations would continue to exist. Treatments would reduce the risk of epidemic outbreaks. A reduction of firewood and house logs would result from the action alternative, however, the supply well exceeds the current demand. Increased sprouting of aspen would likely draw elk into these areas. With additional treatments on private and state land across the east side of the La Sal's however, elk should remain scattered with enough treated area that aspen could withstand browsing pressure.

Mountain Brush

Past & Present Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Burkholder Draw	1990	Rollerchop	195
Wilson Mesa	1990	Rollerchop	201
Amasa's Back	1974 1989	Chained, reseeded Rollerchopped	750 515

Foreseeable Future Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Moab Face	20054-2015	Mechanical and burn treatments across Moab Face of La Sal Mountains	3,936

Reduced risk from fire of property loss would occur. Once young plants resprout, an increase in deer, elk and other browsing wildlife would be likely. There may be a temporary loss of food for some wildlife species such as bears and turkeys. This may result in an increase in nuisance bears particularly should drought conditions continue in the area. Temporary displacement of wildlife and humans from treated areas would occur with their return over time as vegetation recovers from treatment. This project would likely increase momentum for additional treatment near private inholdings elsewhere on the La Sal Mountains in fire risk situations.

Pinyon-Juniper

Past & Present Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Brumley Ridge	1975	Chained and reseeded	276
Dorry Canyon	1974	Chained and reseeded	578
South Mesa	1965 1990	Chained and reseeded Rollerchopped	400 100

Slaughter Flat	1974 1987 1989	Chained and reseeded Burned Rollerchopped	940 148 758
Pack Creek	2004	Thinning, prescribed burn	2000

Foreseeable Future Actions

PROJECT	*YEAR*	*DESCRIPTION*	*ACRES*
Moab Face	2005-2015	Mechanical and burn treatments across Moab Face of La Sal Mountains	948

Ongoing across various vegetation types

Homes/cabins on South Mesa, Willow Basin, Blue Lake/Dark Canyon
Road maintenance, improvement, closure
Outdoor recreation activities
Permitted livestock grazing

Additional activities potentially in cumulative effects area

The Hang Dog wildfire/BAER/salvage (fire in 2002, BAER rehabilitation work in 2002-03, salvage planned for 2004-05) occurred in ponderosa pine and oakbrush (5188 acres) on the south side of the La Sal Mountains.

The proposed Pine Ridge 3D Oil and Gas exploration would encompass approximately 14,000 acres on the south side of the La Sal Mountains, largely in oakbrush, pinyon-juniper and ponderosa pine vegetation types.

Hazard County/Mason Draw trail construction (2005)

Rattlesnake Powerline (2005)

Pinyon pine nuts are gathered as a food source and availability would be reduced in this area. Other uses that affect this vegetation type are post and pole permits, issued primarily for juniper tree trunks. Firewood gathering is a primary use of pinyon and juniper trees and this would be reduced within treatment areas. In each vegetation type, wildlife species would likely shift from those dependant on dense hiding cover to those adaptable to more open habitats.

4.6 Fire Environment

Direct and Indirect Effects

Alternative A

Fuel loads categorized by fuel models would affect fire susceptibility and fire behavior. Four indicators are used to evaluate fire behavior as displayed in Tables 15 and 16:

•Rate of spread expressed in chains (66') per hour.
•Heat per unit area, expressed in BTUs per square foot at the flaming front.
•Fire line intensity, expressed in BTUs per foot per second at the flaming front.
•Flame length measured in feet.

An indicator for consideration when comparing alternatives is flame length larger than 4 feet. Firefighters can directly attack flame lengths of 4 feet at the head or flanks by using hand tools and handlines should hold the fire. Flame lengths greater than 4 feet are too intense for direct attack and handlines cannot be relied on to hold the fire (Wildland Fire Suppression Tactics Reference Guide*)*.

It is easy to see in the No Action Alternative that a fire behaves with greater volatility under wildfire conditions given the fuels that exist on the La Sal Mountains. Volatility includes greater flame wind speed, faster rate of fire spread, higher heat generated, much greater fire line intensity and longer flame lengths. The conditions resulting under the No Action wildfire scenario is much less predictable and more difficult for firefighters to control.

As fire risk and hazard increases, fire suppression costs are expected to climb with increased safety risks as well. Additional potential effects from wildfire at lower intensities are described under Alternative B.

Table 15. BEHAVE outputs for Alternative A- No Action

BEHAVE PLUS OUTPUTS NO ACTION ALTERNATIVE				
Weather Percentile Condition				
Mid Flame Wind speed	**Rate of Spread (ch/hr)**	**Heat per Unit area (btu/sq ft)**	**Fire Line Intensity (btu/ft/s)**	**Flame Length (ft)**
97th Fuel Model 10				
3.2	**8.3**	**1630**	***247***	**5.7**
97th Fuel Model 9				
3.2	**9.8**	**526**	***94***	**3.6**
97th Fuel Model 8				
3.2	**2.4**	**259**	**12**	**1.4**
97th Fuel Model 6				
3.2	**40.9**	**669**	**502**	**7.9**
97th Fuel Model 2				
3.2	**33.9**	**654**	**407**	**7.1**

Alternative B

When comparing Table 15 and 16 it is evident fire behavior can be more easily controlled under prescribed conditions and have less detrimental effects than wildfires burning with more extreme conditions. Also, prescribed fire can be applied where treatment is needed rather than risking the chance of a wildfire spreading in areas where fire could have detrimental affects.

Table 16. BEHAVE outputs for Alternative B- Proposed Action

BEHAVE PLUS OUTPUTS ACTION ALTERNATIVE				
Weather Percentile Condition				
Mid Flame Wind speed	**Rate of Spread (ch/hr)**	**Heat per Unit area (btu/sq ft)**	**Fire Line Intensity (btu/ft/s)**	**Flame Length (ft)**
50th Fuel Model 10				
0.8	**1.8**	**1317**	**43**	**2.5**
50th Fuel Model 9				
0.8	**3**	**428**	**24**	**1.9**
50th Fuel Model 8				
0.8	**0.8**	**216**	**3**	**0.8**
50th Fuel Model 6				
0.8	**11.3**	**541**	**112**	**3.9**
50th Fuel Model 2				
0.8	**7.3**	**505**	**68**	**3.1**

Cumulative Effects

Alternative A

The most noticeable effects to fuel resources involve incremental changes that occur in the absence of fire and other disturbances including:

- the gradual buildup of fuels, both standing and downed;
- an increase in ladder fuels as forest gaps and understories grow in with shade tolerant conifers and woody vegetation;
- an increase in the continuity of fuels and the connectivity of tree crowns;
- a gradual overall increase in the severity of wildfires that do occur; and
- a gradual overall increase in the size of wildfires that occur.

Each of these results in other effects that either individually or cumulatively can be devastating such as the complete loss of some resources during wildfires and the enormous cost of fighting wildfires, not only in financial terms but in terms of property and lives. Other activities that add to the cumulative potential for catastrophic wildfires includes other vegetation treatments which can diminish fuels such as thinning, firewood cutting and chaining or can alter the fuels by laying them on the ground. Livestock and wildlife grazing also alters fire regimes by removing ground fuels that could carry fires.

Alternative B
To cumulatively examine the effects of the Moab Face project on fire and fuels we must look at past, present and future projects across the La Sal Mountains. We must look at prescribed fire, wildfire and other fuel treatments such as timber sales and chainings. This has been outlined in great detail under the vegetation section. We must also look at livestock and wildlife grazing and their role in removing ground fuels.

It is safe to say, however, the more fuels are reduced in the various vegetation types on the forest, the less chance we would have of catastrophic wildfires. This equates to less devastation of property, less risk to lives, less cost to fight fires and less loss of resource values over the long term. In addition, the use of fire in a prescribed manner, over larger areas and repeatedly over time would help the forest mimic natural conditions including disturbance regimes. This would allow agencies to manage using natural ignition fires rather than continued intensive management using prescribed means.

4.7 Fish, Wildlife and Plants of Concern

Direct and Indirect Effects

Alternative A
Under this alternative, habitats functioning-at-risk and losing the aspen component would continue to move away from PFC. Suitable *northern goshawk* habitat would be available for the short-term, but is losing quality as conifers dominate aspen communities. There are 23,000 acres of forested habitat on the Moab Face. With the current high percentages of mature and old forest (see Table 17), this alternative does not meet guidelines for PFC.

As *three-toed woodpeckers* depend on the presence of both old-growth and recently burned coniferous forests, fire suppression is one management activity that has led to a loss of habitat for this species. This alternative would continue current management. It would have no immediate, direct impacts to existing three-toed woodpecker habitat. However, this alternative would not maintain habitat into the future or contribute to the restoration of forests to PFC.

The current ratios of cover to forage for *deer and elk* are imbalanced in favor of cover due to all the mature forested stands that currently provide cover and limited forage (Table 7). Hiding/thermal cover is the primary function of the mature mixed conifer/aspen stands in the project area. The treatment areas are dispersed across summer and winter range due to the range of elevations proposed for treatment.

Table 17. Cover:forage ratios in the analysis area.

	Acres analyzed	Current cover:forage ratio	Treatment acres	Post-treatment cover:forage ratio across acres analyzed
deer - critical fawning habitat	61,426	79:21	7,277	72:28
elk - critical calving habitat	17,373	86:14	2,532	74:26
Cumulative effects area	174,000	60:40	12,465 (8,000 ac classified as cover)	55:45

The current ratio of cover to forage is high, but areas dominated by cover may also provide some forage. The areas classified as cover, dominated by large trees and mature vegetation, are just not as productive of herbaceous forage for big game. In Alternative A, the ratio of cover to forage would remain high or continue to increase as conifers continue to encroach on formerly productive aspen stands.

Alternative B

The proposed project would affect northern goshawks and their habitat. Due to the way treatment units were selected, there is a high percentage of suitable northern goshawk habitat in the project area. The areas currently provide habitat, but are in real danger of losing the aspen component that is important for goshawk nesting, prey diversity and prey availability. The proposed project is part of a long-term strategy of maintaining goshawk habitat on a statewide scale. The recommendation for subalpine fir and Englemann spruce potential vegetation sites (Graham et al 1999) is treatment to encourage more early seral species (aspen) without totally losing mature forest structure.

In the treatment units, there are approximately 6600 acres of forested aspen, conifer and aspen/mixed conifer habitat. The goshawk territories known and potentially in these units would be surveyed and monitored and nest stands avoided in order to treat the area on a landscape level to provide habitat into the future. Seasonal restrictions on Forest Service management activities and permitted uses under the goshawk amendment would apply to the proposed project activities when active nest areas are located. Standards and guidelines for management of forested habitat apply and are included in the design features for this project. It may be desirable to thin conifers by hand in some areas, prescribed burns in the rest of foraging area would be patchy, with some crown fire to regenerate aspen and some understory, ground fire.

To evaluate potential effects to individuals, acres of each known foraging area to be treated are presented below. The foraging areas average 6000 acres of suitable habitat around the nest areas where northern goshawks have been observed. Treatment is not necessarily all in one year, and not all of the proposed acreage would actually be treated. Nest areas would be protected.

	Acres treated	% of foraging area potentially treated
Bear Park	1308	22%
Geyser Pass	1000	16%
Mason Draw	1111	18%
Miners Basin	2359	41%
Willow Basin	1745	29%

Due to limitations of the management of goshawk habitat on a scale of individual territories, the analysis examines impacts on a larger scale. A comparison of deviation from PFC before and after treatment provides a broader look at potential impacts to goshawk habitat. The proposed treatments would return mature and old structural stages to an earlier seral stage.

Table 18. Structural Stages by Vegetation Type (current conditions and PFC from the Manti-La Sal National Forest Assessment Properly Functioning Condition July 1998 Draft)

			---------------**%** by structural stage------------------		
	Acres on Moab Face	Treated acres	Current conditions * (Alt. A)	PFC	Post-treatment (Alt. B)
Aspen	13,434	4,981			
mature and old			80	30	43
mid-aged			15	30	15
early**			5	40	42
Aspen/mixed conifer	2,299	677			
mature and old			80	20	51
mid-aged			15	40	15
early			5	40	34
Spruce/fir	6,423	893			
mature and old			80	35	66
mid-aged			10	45	10
early			10	20	24

* current condition percentages are forest wide, but approximate conditions on the Moab Face
**early is grass/forb and seedling/sapling stages

There would be direct effects to *three-toed woodpeckers* spruce/fir and aspen/mixed conifer habitat on NFS lands on the Moab Face. The project would treat 893 acres out of approximately 6500 acres of spruce/fir available on the Moab Face (14%). Some of this habitat is already occupied, and it is expected that the proposed prescribed fire would not result in a net change in habitat suitability. The aspen/mixed conifer habitat proposed for treatment has an aspen overstory, with increasing young and mid-aged conifers, and is generally not occupied by TTWO. The 677 acres of aspen/mixed conifer treated by prescribed fire would add to the amount of habitat available for this species. In the short-term, the project would improve habitat quantity and quality, however the long-term conversion to earlier seral stages does not favor three-toed woodpeckers. To maintain a component of mature spruce/fir, no treatments are proposed for the oldest stands of spruce/fir around Geyser Pass and Gold Basin. Spreading the treatments out over 10 years would also prolong the availability of habitat.

Two proposed treatment units (4 and 7) contain TTWO nesting territories. Treatments in these units would be conducted after the nesting season. The project has been designed to reduce the potential impacts by retaining snag features across the landscape to meet the Forest Plan guideline for 200 snags ≥ 18" dbh/100 acres. There would be no tree harvest associated with this project.

The current ratios of *deer and elk* cover to forage are imbalanced in favor of cover due to all the mature forested stands that currently provide cover and limited forage (Table 17). Converting these types to an earlier seral stage with mechanical treatments or prescribed fire is necessary to provide more forage. Hiding/thermal cover is the primary function of the mature mixed conifer/aspen stands in the project area. Fire would reduce the amount of cover, but increase the amount of forage – generally a more important limiting factor on summer range. Deer and elk are often attracted to burned areas once the new growth sprouts. A mosaic of burned and unburned stands provides hiding and thermal cover interspersed with forage sources. The treatment areas are dispersed across summer and winter range due to the range of elevations proposed for treatment.

Under Alternative B, the cover:forage ratios for deer and elk would improve. Conversion would take place over 10 years, with treatments spread out over the landscape. There would be a juxtaposition of newly treated and mature habitat available. There would be 5,600 acres of aspen regeneration following the proposed treatment (Alternative B), compared to 0 acres for Alternative A.

Cumulative Effects

Alternative A

Continuing with current management on the Moab Face would add to the forest and region-wide declining trends for aspen. There would be a loss of optimum habitat in the long-term for *northern goshawks*. If allowed to continue without disturbance, both nesting and foraging areas would diminish. The aspen treatments on the east side of the La Sal Mountains on private and state lands would help to sustain goshawk populations on the mountain. There would be no cumulative effects to *three-toed woodpeckers.*

Across the cumulative effects area for *deer and elk*, the approximate cover to forage ratio is 60%:40% (calculated from general GAP vegetation type data). As chaining treatments in winter range revert to pinyon/juniper cover and conifers continue to encroach in aspen type, we are losing forage types across the landscape. This is compounded with prolonged drought and other uses such as livestock grazing that remove forage for these species. The increase in recreation use on the La Sal Mountains with an extensive road and trail system reduces habitat security that can also add to a loss in forage for impacting these large ungulates. . The aspen treatments on the east side of the La Sal Mountains on private and state lands would help to sustain goshawk populations on the mountain.

Alternative B

There would be impacts to optimum *northern goshawk* habitat on 3000 acres (6%) out of approximately 53,500 acres estimated on the La Sal Mountains in the Northern Goshawk Habitat Assessment (Graham et al. 1999). Conversion to younger age classes not currently suitable for northern goshawk nesting has previously occurred on state and private land on the east side of the La Sal Mountains. Overall, approximately 6400 acres (12%) of the habitat classified as optimum would be impacted. This impact, however, would be short term but would help to sustain suitable habitat over the long term.

Other factors (ie. recreation, livestock grazing, drought) may add to impacts from the proposed project by reducing habitat security and available forage.

Three-toed woodpeckers-There are approximately 32,000 acres of potentially suitable habitat (mature ponderosa pine, Douglas fir, spruce/fir and aspen/mixed conifer forest types) available in forested types on the La Sal Mountains. Total acres of occupied habitat are unknown, and change rapidly following disturbance events. Timber harvest over the last 20 years, largely on private and state forests, and other vegetative treatments may affect up to 30% of the potentially suitable habitat.

The 2002 Hang Dog wildfire created habitat for this species (2,250 acres) in mid-aged ponderosa pine that was not previously occupied, adding to the optimum habitat available in other mature forests across the La Sal Mountains, largely in spruce/fir forests affected by spruce beetles and areas of ponderosa pine with pine beetles. The total optimum habitat is approximately 5,625 acres. The Hang Dog timber salvage project (204 acres, 2005) and the ongoing Buckeye sanitation and thinning project (approximately 400 acres) would contribute to the impacts to optimum three-toed woodpecker habitat.

By simulating natural disturbance, the Moab Face project would increase the availability of optimal habitat for three-toed woodpeckers as follows:

CUMULATIVE EFFECTS AREA ANALYSIS	Acres	% TTWO habitat affected by all vegetative treatments past, present and future
La Sal Mountain cumulative effects area – Mature conifer and aspen/mixed conifer habitat	32,000	30%
Optimum habitat - recently burned areas and areas identified by the Aerial Insect and Disease Detection Survey for the Intermountain Region* (Forest Pest Management, Boise, Idaho; 1998 and 2000 data)]	5,625	21%
Moab Face project - addition to optimum habitat	677	

*No areas of spruce beetle infestation were identified on the La Sal Mountains in the recent aerial insect surveys, but small pockets of spruce beetle activity do occur and are utilized by three-toed woodpeckers.

Past, present and future actions that may impact cover:forage ratios in *elk* calving habitat on the La Sal Mountains, elk winter range and identified critical *deer* habitats on the north, south and west sides of the La Sal Mountains (cumulative effects area of approximately 174,000 acres, see map 7) include:

- Permitted livestock grazing (ongoing)
- Noxious weed control (ongoing)
- Old treatments in PJ
- Timber harvest on state and private
- Pack Creek thinning and prescribed burn in PJ and mountain brush
- BLM treatments in Pole Canyon (prescribed burn in old chaining, 2002)

The vegetative treatment projects are spread out in time, reducing the cumulative effects, as shrubs recover rapidly following fire and other treatments. Sufficient hiding and fawning cover may be provided in as little as 5 years, and continue to improve. Thermal cover takes longer to recover, as the forest moves from an open to a closed canopy. Livestock grazing has impacts to the short-term availability of forage to big game. The project Design Features include restrictions on permitted livestock grazing in the project area for several years post-fire to help mitigate impacts to the forage resource. Noxious weed control does not add cumulatively to impacts from the proposed vegetative treatments.

In the cumulative effects area, the changes to the cover:forage ratio as a result of this project are relatively minor, but moving in the right direction for deer and elk.

The treatment in approximately 8,000 acres of cover, converting it to higher forage availability changes overall cumulative effects area ratio to 55%:45% (Table 17). Another potential impact to deer and elk comes as temporary displacement during the proposed treatments. Treatments would occur after July 5 in identified critical calving/fawning areas.

Other past, present and future actions can affect wildlife use of habitat. Although not a direct impact to cover or forage availability, impacts to habitat security, via fragmentation include homes/cabins on South Mesa, Willow Basin, Blue Lake/Dark Canyon; road maintenance, improvement, closure; outdoor recreation activities including hunting, hiking and proposed mountain bike trail in Mason Draw.
Except for temporary displacement from treated areas, these activities are not cumulative to vegetative changes from the proposed project.

Road density is another factor that may affect big game use of an area. Roads and associated vehicular traffic are known to influence deer and especially elk use of areas adjacent to open roads. Decreased use of suitable habitat has been reported for distances of 0.25-0.50 miles from a road, and is influenced by the type of road, amount of traffic and density of available cover (Lyon 1979, Thomas 1979). The vegetative treatment project would have no effect on road density.

4.8 Inventoried Roadless Area Values

Direct and Indirect Effects

Alternative A
Alternative A would have no short or long-term effects on the character of the Inventoried Roadless Areas other than what is occurring from current conditions. Although there is no way of predicting such an event, a large-scale or catastrophic fire could have detrimental effects, however, that would be a natural event and would maintain natural character within the IRAs.

Alternative B
Their close proximity and visual connection with nearby communities compromise the remote integrity of each of the three Inventoried Roadless Areas to start with. None the less, the qualities that qualify them as IRAs would remain intact through the Moab Face project.

No road construction is proposed and no heavy equipment control lines are allowed within inventoried roadless areas. Therefore, no change is expected in the current undeveloped character and wilderness values tied specifically to roadless areas.

As part of the Moab Face project, handcutting would be the only mechanical treatment proposed within roadless areas. Other mechanical treatments are proposed outside of roadless areas. Specifically looking at characteristics of Inventoried Roadless Areas, soil and water resources would benefit in the long term from opening the tree canopy, increasing moisture and sunlight to the forest floor and increasing understory plant growth. Short-term movement of soil may result from high intensity storms during the period between the fire and vegetation recovery. This is usually short term and all precautions would be taken to avoid soil disturbance (See watershed section).

Air resources would be affected during the period of prescribed burning but would dissipate immediately after completion. Air quality management is a component of consideration and analysis for determining when to burn. The ability to meet air quality standards would be greater under controlled fire situations rather than with wildfires.

Opening the tree canopy would provide for more moisture and sunlight to reach the ground and understory vegetation. This would result in additional plant growth and diversity. While some animals would move out of the area during treatment the affects would be short term. Known nesting, fawning or calving areas would be avoided during critical periods of time. The character of large undisturbed areas of land for wildlife would return once treatment was complete and activities ended.

The opportunities for primitive and semi-primitive recreation would not be affected by this activity in the long-term. Prescribed burning, like wildfire, does not make an area desirable for recreating until plant growth becomes reestablished. All three IRAs can be used for research or interpretation like other similar areas. The project would not change this status.

There would not be a significant affect on landscape character and integrity. Affects of the burn would last for several years but this is also true in areas of natural fire. The character and integrity would be similar to areas burned by wildfire.

Cultural resources have been identified and would be avoided. Consultation with Native American tribes have also been conducted.

There would not be significant affects to the characteristics of the three IRAs from either hand treatment using chainsaws or from prescribed burning.

Cumulative Effects

Alternative A

Under Alternative A, uses of the IRAs would continue. Livestock grazing would be maintained at levels no more than currently exists based on this project. Recreation activities would continue and as the demand for semi-primitive experiences increase, so would the use of IRAs. Threats from illegal, user-created trails whether they be motorized or nonmotorized would continue. Increased law-enforcement efforts would be needed to manage IRAs. As vegetation thickens in the absence of fire, should fire suppression efforts continue and no prescribed fire used, extensive tree mortality may occur from bug epidemics such as spruce bud worm and bark beetle infestations.

Alternative B
Like Alternative A, uses of the IRAs would continue under Alternative B as well. Livestock grazing would be maintained at levels likely to be no more than currently exists. Recreation activities would continue and as the demand for semi-primitive experiences increase, so would the use of IRAs. Threats from illegal, user-created trails whether they be motorized or nonmotorized would continue. Increased law-enforcement efforts would be needed to manage IRAs. Where this alternative differs from Alternative A is in the health of the vegetation and the risk of stand-replacing wildfires. Extensive tree mortality would not be likely from bug epidemics or from extensive wildfire due to the reduction of fuels and the diversity in tree species and age classes and reduced tree density.

4.9 Cultural/Heritage Resources

Mechanical and prescribed fire treatments have the potential to directly or indirectly affect cultural resources. Generally, most cultural resources can be protected from impacts by applying the National Historic Preservation Act of 1966. The National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations found in 36 CFR 800 specify that Federal, Federally funded, Federally assisted, licensed or permitted undertakings will be considered for their potential to affect significant cultural resources. The effect is characterized in one of three kinds: No effect, No adverse effect, and Adverse effect.

An adverse effect is defined as one that changes to the characteristics that make a historic property eligible for listing in the National Register of Historic Places (National Register), as defined in 36 CFR 60.4 and Section 101 of the NHPA. This includes cases where an undertaking leads to the destruction or alteration of all or part of the property, isolation from its surrounding environment, introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting (36 CFR 800.9). Significant impacts are those where cultural resources that are eligible to the National Register of Historic Places are adversely affected. The potential impacts from mechanical and prescribed fire treatments are discussed below.

Direct and Indirect Effects

Alternative A

The effects of Alternative A, the No Action alternative, on cultural resources are to increase the risk of intense and severe wildfires. The effects of potential intense and severe wildfire may cause significant damage to cultural resources. Wild land fire is generally more destructive to cultural resources than prescribed fire because of uncontrolled fire effects, as well as the effects of fire suppression activities.

The effects of wild fire on cultural resources vary depending particularly on the temperature and duration of exposure to heat, as well as the kinds of cultural resources represented. Certain classes of cultural resources are vulnerable to significant damage or destruction from wild fire, primarily as a result of sites containing combustible materials or elements that susceptible to damage resulting from rapid, intense heating and cooling processes. These resources include European-American sites with standing structures or features (cabins, fences, carved trees, etc.) and prehistoric sites containing rock art, rock shelters, cliff structures, or hearths. In contrast, prehistoric sites consisting of surface artifact scatters and historic sites lacking combustible materials are not generally as susceptible to significant damage by fire, particularly under prescribed fire conditions where temperatures are lower than wild fire and control measures are in place. The direct and indirect effects of wild fire on cultural resources are discussed below.

Combustible Elements. Sites that contain combustible materials, such as historic structures and prehistoric sites containing old wood or organic materials, are particularly vulnerable to the effects of fire. These materials may be partially or wholly consumed by fire causing significant impacts that adversely affect the qualities of the site and it's National Register eligibility.

Buried Cultural Deposits. In general, buried cultural deposits are not adversely affected by fire. Buried cultural deposits are seldom affected below a depth of a few centimeters, even under circumstances where high levels of heat are involved (Duke 2002: 23-25; Eininger 1990: 37). Exceptions to this generalization may include conditions where heavy duff, surface logs, roots, and stumps may burn at high temperatures for an extended period of time or actually burn beneath the ground surface. These conditions are generally highly localized and may affect subsurface cultural deposits, but seldom compromise the totality of characteristics and National Register eligibility.

Artifact Assemblages. Surface artifacts may be affected by fire. The effects of fire on stone artifacts primarily include fracturing, crazing, changes in color and luster, and pot-lid fractures. Most of these effects require temperatures ranging between 300-600º C. Although alterations, such as color and luster changes, begin at 300ºC, destructive effects (e.g., fracturing) generally require temperatures in excess of 500º C for many materials (Duke 2002: 34-34). Effects on ceramic artifacts may include discoloring, blackening or sooting, spalling, alteration of painted designs, and breakage. Perhaps the most serious of these effects, the alteration of painted designs and changes in color, may lead to misidentification, but these alterations tend to be produced when temperatures exceed the original firing temperatures used in the manufacture of ceramics, generally in excess of 600º C (Eininger 1990: 41-42).

Historic artifacts such as ceramics, glass, and metal may also be affected by fire. Glass may be affected at temperatures above 500º C, while metal melts at temperatures between 327º C (lead) and 1516º C (steel); porcelain melts at 1550º C (Duke 2002: 39).

Recent observations from the Hammond wild fire on the Monticello District suggest that blackening is the most commonly observed alteration of surface artifacts although some fracturing, spalling, crazing, and color alterations were noted as well. Even under high intensity wild fire conditions, the amount or degree of impact to surface artifacts was not of sufficient magnitude and extent to alter surface assemblages contribution to National Register eligibility.

Inorganic Materials. Architectural stone, primarily sandstone in this region, and naturally occurring sandstone incorporated into cultural sites, such as rock shelters or rock art panels, may be altered by wild fire. Wild fire may cause oxidation, spalling, and fracturing of sandstone used in feature construction. This may result in the alteration or loss of constructed cultural features, such as structures, hearths, or cists, as well as the destruction of rock art panels and damage to rock shelter or alcove settings.

Suppression Activities. Another direct consequence of wild fire that may affect cultural resources is that of fire suppression activities. Fire suppression activities may damage cultural sites and materials through ground disturbing activities including fire line construction, establishment of fire suppression facilities like helicopter bases, or mop-up activities. Additionally, retardant drops may also impact cultural resources. Retardant drops may damage cultural resources through impacts, rapid cooling and temperature change, corrosion, and staining or color changes.

One consequence of wild fire that has potentially disastrous effects on cultural resources is the threat of accelerated erosion following a fire. A severe wild fire not only consumes vegetation that is vital to soil stability, but may create hydrophobic soil conditions. Hydrophobic soils repel water, inhibiting absorption and resulting in increased runoff, rilling, and gullying. These processes can impact and destroyed cultural deposits present at archaeological sites. Observations on sites present within the Hammond and Little Hammond wild fires of 2002 and 2003 on the Monticello District indicate that approximately 60 percent of the sites were affected by accelerated erosion within two months following the fires. Some sites lost as much as two to four inches of sediments from wind erosion, while rilling and sheetwash cut through and deflated cultural deposits at many of the sites.

In essence, the No Action alternative provides no protection for the eligible cultural resources found within the treatment units. Fuels would continue to accumulate and the risk of catastrophic wildfire will increase. Temperatures reached under wild fire conditions would cause effects to surface artifacts and features, potentially destroying fire vulnerable sites and affecting the surface components of all sites in the fire area. Consequently, Alternative A may likely increase the potential to adversely affect cultural resources in the project area and beyond.

Alternative B

Alternative B, and its design features, has the potential to affect cultural resources; however, the effects will be constrained by the design features and are not considered to be adverse or significant impacts. This determination is based on the kinds and distribution of archaeological sites found within the project area, as well as the proposed fire conditions, mechanical treatments, and design features that would protect cultural resources within the project area.

Prescribed fire is proposed as the sole treatments in Units 3-12 and in conjunction with mechanical treatments in Units 1, 2, 13-16. The upper elevation units, Units 3-11 contain primarily mixed conifer and aspen and Unit 12 is primarily Gambel oak; the remaining units are primarily a combination of piñon-juniper and mountain brush. As discussed above, site densities in the higher altitude units are relatively low, but include a variety of site types, some of which are vulnerable to fire. These vulnerable sites will be protected during the project through design features built into the proposed project, such as fire control lines and burn prescriptions. Although there is some potential that unpredictable changes in fire prescription conditions may result in fire that exceeds controls and enters fire vulnerable site, but this risk would be minimized through careful application of the design features during the implementation of the fire. This possibility must be weighed against the risk of a wild fire in the proposed treatment areas that would burn without controls or design features.

No National Register eligible, fire vulnerable sites are found in the lower altitude units where prescribed burning is proposed. In the lower elevation units, sites are primarily prehistoric surface artifact scatters that are not vulnerable to prescribed fire. In areas slated for prescribed fire within the lower elevation units, fire prescription conditions and control measures should result in minimal impacts to these sites. Cooler burning conditions are anticipated, avoiding adverse impacts to sites discussed above for the hotter wild fire conditions. One USFS administrative site (Mesa Guard Station) and prehistoric rock shelters, temporary camps, and a possible pit house site are vulnerable to fire, but these sites are located within mechanical treatment areas in the lower elevation units.

Mechanical treatment is proposed primarily within piñon-juniper and mountain brush settings where moderate numbers of prehistoric sites are present. National Register eligible surface lithic scatters, rock shelters, temporary camps, and the pit house site are found in mechanical treatment areas within Units 13-16. Although mechanical treatment may impact cultural sites through ground disturbance, sites would be flagged and avoided during these activities. “Islands” of vegetation left on archaeological sites would still pose a threat to sites by future wild fires due to increased fuel loads remaining on sites, concentrating grazing by wild and domesticated animals, and by identifying sites to visitors and potential vandalism. These effects will be minimized by manually reducing fuels on and around sites and piling fuels off site for burning.

If these measures are implemented during the proposed project, all of the National Register eligible sites within the treatment units (n=42) will be protected and the proposed treatments will have no effect on Historic Properties.

Cumulative Effects

Alternative A

In addition to increasing the risk of catastrophic wild fire, Alternative A, the no action alternative, fires may burn hotter and involve significantly larger acreage than the proposed treatment areas. Large numbers of archaeological sites may be impacted under these circumstances, either through the direct effects of wild fires, increased erosion, or suppression activities. Additionally, loss of vegetative cover over large tracts of land would expose numerous archaeological sites and may result in increased visitation and vulnerability to vandalism.

Alternative B

In the past, actions affecting cultural resources in the project area include road construction, private land development, mining, grazing, and recreation. Most of these activities have had a minimal effect on cultural resources in the project area, but there is evidence for casual collection and vandalism at several sites in the project area in the form of collection piles and looters holes. Once Alternative B opens up the vegetation in this area, visitor use and grazing on sites may increase; however there are no plans to increase livestock numbers and most recreational use is constrained and generally confined to designated road and trail networks. Design features, such as reducing vegetation within site areas, should limit potential for increased visibility and visitation, and avoid concentrating grazing on site areas. Monitoring of sites in the project area will be conducted and allow for trends in potential impacts to be monitored. The significant sites within the project area, particularly those that are vulnerable to fire, would be better managed and protected than in Alternative A.

4.10 Soils and Watershed Resources

Direct and Indirect Effects

Alternative A
The no action alternative would not have any direct effects to the soil resources. Soil development and erosional processes would continue to occur at current levels. The amount of the area in detrimentally disturbed soils is not expected to increase beyond threshold limits. The amount of ground cover and above ground organic matter would fluctuate with vegetative production and decay processes. The amounts are not expected to decrease below levels acceptable for long term site productivity. Increases in soil loss may occur with increases in recreational use or grazing management. Natural disturbances such as fire, floods, or landslides would continue to occur to shape the landscape and provide soil development.

The no action alternative may have indirect effects to the soil resource. These include the change of aspen soil types to conifer soil types. Aspen provide greater nutrient cycling of base cations in the soil system. Soils under conifers tend to be more acid and do not have as great of cycling of nutrients through the soil system. This may cause a different ecosystem or plant community than desired for the area and possibly lower the soil and plant diversity for a watershed. Aspen ecosystems also provide for greater below ground carbon storage than conifers which have high amount of carbon above ground. The no action alternative would also leave high amount of fuel on the soil surface. In the mechanically treated units as well as the prescribe fire units, the high amounts of fuel could lead to higher fire severity over larger areas of any future fires. A high fire severity burn can lead to excessive soil loss through leaching of nutrients, loss of soil carbon, and erosional losses of mineral soil.

No direct effects would result under the No Action alternative to water quality. The potential for indirect effects related to unmanaged wildfire, including impacts to water quality, nutrient loading, and aquatic habitat, is higher than under the Proposed Action.

In the event of a large wildfire in any of these subwatersheds, the potential for changes in watershed response and risk of flooding could increase. The current probability of an event of large enough magnitude to trigger such a change in response is unknown.

Alternative B

The action alternative would cause immediate changes to soil properties. These changes include nutrient release, increased nutrient availability, increased water availability, carbon content loss, ground cover loss, above ground organic matter loss, and potential erosion. Most of the changes to soil properties would occur with prescribe fire. The soil changes may increase short term site productivity and provide soil conditions favorable for regeneration of aspen and other early seral species.

Erosional losses could occur on units identified as severe for erosion risk following prescribed fire. Proper treatment design and mitigation measures may be required to reduce the risk of post treatment erosion. The mechanically treated units may have soil properties altered such as porosity, carbon content and nutrient cycling. A reduction of vegetative cover may increase erosion potential. However the amount of ground cover left remaining on site should be adequate to reduce the risk. Mitigation may be needed for sites that are susceptible to erosion.

The loss of ground cover and above ground organic matter may occur in all treatment units. Mitigation measures may be needed to ensure losses are within acceptable levels. The amount of ground cover and above ground organic matter loss is not expected to reduce long term site productivity of the individual activity areas (treatment units). The amount of detrimentally disturbed soils remaining following treatments is not expected to be above regional guidelines.

Water quality and aquatic habitat may be slightly affected in the short-term. During the burn, smoke may carry nutrients to water. Wind could transport ash to streams or wetlands. In the first few runoff events following burning, some ash and burned material may be transported to stream channels (Spencer et al. 2003).

These effects are expected to be minimal for the following reasons:

- A no-ignition buffer of 300 feet would be applied adjacent to all wetlands and perennial stream channels, and buffers of 50 feet would be applied to ephemeral stream channels. These buffers would provide filtration for any increased runoff, ash, or eroded sediment.
- Because the burned areas would create a patchy mosaic that comprises only 40 - 80% of the total treatment unit area, adequate buffers would exist throughout the burned areas to provide infiltration zones.
- Phasing the implementation would ensure that only a small proportion of any given subwatershed would be burned at one time.
- The amount, distribution and intensity of the proposed burns are not expected to increase water or sediment yield from the burned areas.

NCASI (2000, p. 41) compiles the findings of several studies of buffer strip effectiveness, and shows that in severely erodible soils on 60% slopes, a 90m wide buffer effectively filters 80% of sediment delivered from upslope. Since burning would be avoided on erodible soils and on steep slopes, and a 300 foot buffer strip would be applied, I expect more than 80% of any sediment delivered from upslope to be filtered prior to reaching any perennial channel.

Total phosphorus concentrations are associated with sediment concentrations, especially in easily weathered geologic formations (Dissmeyer 2000). There is limited information about phosphorus and fire management activities. The data summarized by Dissmeyer indicates that there is little change in phosphorus concentrations following prescribed fire. Spencer et al. (2003) measured phosphorous and nitrogen levels during an extensive wildfire that burned over the stream channels at levels 5 –60 times higher than background levels. Because of the design for the proposed burning, such increases are not likely.

Dwire and Kauffman (2003) note that riparian species have adaptations that allow for rapid recovery after disturbances such as fire, and that the resilience of riparian and stream ecosystems may allow them to recover faster than uplands. In a synthesis of published research on the response of macroinvertebrates to fire, Minshall (2003) concludes that a mosaic burn pattern of varying degrees of burn intensity in ‘natural, relatively unfragmented ecosystems’ is no cause for alarm over effects on aquatic ecosystems. Based on this information and taking the design of the proposed burning into account, I do not expect this alternative to result in impacts on aquatic habitat or wetlands.

Reduced vegetation can decrease the amount of evapotranspiration (ET) and result in increased groundwater and increased streamflow. Increases in peak streamflow can result in increased channel erosion and associated impacts on aquatic habitat (increased fine sediment, pool infilling, etc). In a simulation of the potential effects of prescribed fire on ET in an aspen stand, Flerchinger and Clark (2003) found that ET decreased by 14% the first year following the fire, but returned to pre-burn levels by year 3. In that simulation, streamflow increases reached their maximum in year 2 following the burn, when they ranged from 0 – 25%; by year 3, the maximum increase was 16%. In their simulation, an entire 61-acre watershed was burned. With a small proportion of a watershed burned, as in this alternative, short-term increases in streamflow resulting from decreased ET would not be large in magnitude and would be of short duration. Empirical studies have found it difficult to demonstrate increases in water yield due to fire. Clark (2001) suggests that even in response to wildfires, the duration of fire effects on water yield are not long enough to differentiate them from natural variability in streamflows.

A TMDL has been completed for Mill Creek for temperature. The implementation strategy includes providing greater bypass flows below the Ken's Lake diversion and stream restoration, including increasing shading with riparian planting, in the lower 14 miles of the stream. This area is downstream of the FS boundary. Implementing the treatments proposed in the Moab Face Project would have no effect on this TMDL implementation strategy, or on stream temperatures. The non-ignition buffers would protect vegetation around stream channels so that treatments would not affect stream shading. The mosaic burn pattern would prevent widespread overland flow and increases in soil water temperature that could influence stream temperatures.

Impacts to the recharge or water quality of the unconsolidated aquifer in Castle Valley are not expected. The Fire Management chapter of Dissmeyer's Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature (Landsberg and Tiedemann 2000) states that little research has been done on fire effects to groundwater, but that it is "reasonable to expect… little effect". Possible scenarios for effects to recharge include: 1) decreased transpiration on burned patches that could increase soil moisture and therefore increase recharge; or 2) decreased infiltration in patches of the burned area that would result in reduced soil moisture and recharge. Soil moisture is not a dominant component of the recharge, and only a portion of the contributing area would be treated. Landsberg and Tidemann present an "unlikely" scenario of intense post-fire flooding that could conceivably result in contamination of groundwater. In this scenario, the fire would influence the flooding but would not be the source of the contaminants.

A Utah Geological Survey report (Snyder 1996) notes that because the Castle Valley aquifer is relatively coarse-grained, water moves through it quickly and it has little ability to 'filter' contaminants. the primary concerns related to water quality are identified as increases in sediment/turbidity, temperature, nitrate, and nitrite. I have already discussed the design criteria that would minimize the risk of sediment and temperature increases. Landsberg and Tidemann (2000) also suggest that unburned stream buffers could minimize the chemical effects of burning on stream chemistry. Nitrate is discussed as a concern when pre-burn levels are near the standard: in this case, the highest measured nitrate concentration in Castle Valley wells was 4.3 mg/L (Lowe et. al. 2004), well below the standard of 10 mg/L. This study notes that the small proportion of sampled wells with nitrate concentrations higher than 1 mg/L were in close proximity to animal corrals. Nitrite does not appear to be a post-fire water quality problem, based on the few studies Landsberg and Tidemann (2000) found that reported it.

The anti-degradation policy applies to all streams upstream of the NFS boundary. This policy stipulates that "…no water quality degradation is allowable which would interfere with or become injurious to existing instream water uses". This project would follow Soil and Water Conservation Practices (SWCPs) in order to minimize potential effects to water quality and adhere to the anti-degradation policy.

The identified units would not be completely burned; the objective is to burn 40 - 80% of each unit, focusing on the denser areas of conifer encroachment. Overall fire intensity and severity should be low to moderate. Burning when soils are relatively moist would limit the formation of hydrophobic soil conditions. Maintenance of surface organic matter and some larger woody debris on the ground would maintain the soil's infiltration capacity and limit surface runoff. A mosaic of burned and unburned areas would allow any runoff from burned areas to be filtered though unburned areas. Runoff from the burned areas would be more obvious as it transports and deposits ash, but should not be much greater than before treatment.

A study of hydrologic response to fires in the intermountain region (McGreer 1996, as cited in NCASI 2000, p. 135) found that increases in peak flows are related to burn severity, soil characteristics, the percentage of the watershed burned, and the size of the watershed (smaller watersheds with a high percentage burned at a high severity were more likely to show a drastic response). In larger watersheds only partially burned at light to moderate severity, peak flows were affected little. As stated in the Soils Analysis (p.15), a summary of uncontrolled wildfires in Region 4 that were assessed under the Burned Area Emergency Rehabilitation (BAER) Program (all fires exceeding 3000 ac and any smaller fires where a potential for values at risk were identified by the responsible Line Officer) shows that approximately 10% of acres burned in wildfires were classified as severely burned (i.e., soils were detrimentally disturbed). Because this percentage is based on uncontrolled wildfires, it represents a worst-case scenario for the prescribed fire proposed in this project. If 10% of the area actually burned within a given subwatershed results in high severity burn effects to soils, runoff would be increased on less than 100 acres in that subwatershed (a maximum of 1000 ac would be treated in any given subwatershed in a given year; a maximum of 80% or 800 ac would actually be burned, so 10% of the burned area would be 80 ac). This total acreage would be made up of scattered areas. The patchy nature of the affected areas further reduces the potential for change in watershed response.

No detectable change in watershed response or runoff is expected due to the proposed treatments. I also do not expect the incremental effects of the proposed treatments to cause increased channel erosion.

Cumulative Effects

Alternative A

The no action alternative cumulative effects include the past, current and future land uses in the project area. These are predominantly grazing and recreational use. Past grazing effects could affect the long term health of the ecosystem. It is assumed any unacceptable practices have been corrected as they occur and the area is managed toward desired conditions. Recreational use and forest user access is a continuing growing demand in the project area. Soil resources would continue to be impacted by the recreational use and the impacts are anticipated to increase with increased use of the forest resources. Proper recreational use management and consideration for soil resources would limit the future impacts to acceptable levels.

Alternative B

The action alternative cumulative effects are similar to the no action. Both grazing management and recreational use are additive uses within the project area. Vegetative management as proposed for the treatment units would potentially add to the soil disturbance amounts within the project area. However, these disturbances are expected to be within acceptable limits and meet desired conditions for the soil resources. The cumulative effects of the action alternative are expected to be within the desired soil conditions for the project area.

Effects on watershed resources from the action alternative are predicted to be minor and short term in duration. They are not expected to recur at frequent or even periodic intervals. With the soil and water quality mitigation measures which are part of all action alternatives of this analysis, vegetation and ground covers are expected to recover quickly after project implementation, meaning that erosion and sediment transport rates would return to pre-fire levels within 1 to 3 years. With the establishment of Riparian Habitat Conservation Area buffer zones sediment delivery rates to live water sources adjacent to burn areas should have little, if any, increases. Therefore, noticeable effects from the proposed actions to watershed resources, that are cumulative to those already occurring in the project area from past, present, and foreseeable actions, are not expected to occur.

The analysis of cumulative effects on watershed resources is documented in a worksheet in the project file. The activities that were determined to have the potential for cumulative effects are livestock grazing and dispersed recreation (OHV use).
<u>Livestock grazing</u> could damage freshly burned sites, both through trampling impacts and browsing of newly established vegetation that provides necessary ground cover. No cumulative effects from livestock grazing are expected because cattle would be excluded from the burned areas until vegetation establishment has occurred. This is estimated to require three years, but the exclusion would remain in effect until vegetation parameters are met. This would be determined through monitoring as described in the Range report.

<u>OHV use</u> could have cumulative effects on soils, if burning renders previously un-impacted areas suitable for OHV access and these areas are accessed prior to vegetation establishment. The Moab Face area is not a popular OHV area, and this use is not prevalent. The risk is greatest in areas adjacent to existing roads, recreation sites, and OHV trails, and would peak during the window between burning and the first snowfall, which would coincide with hunting season. Buffers would be left along road corridors, where possible, to minimize the visibility and attraction of treated areas to OHV users. Forest personnel patrol during this time of year and attempt to curtail unauthorized OHV use. Any impacts from OHV use would likely be restricted in area by the patchiness of the burn, and, even within the burned patches, by debris that remains after the fire. Any new trails that are identified during post-burn monitoring would be obliterated.

4.11 Livestock Operations

Direct and Indirect Effects

Alternative A
Under this alternative, the risk of a catastrophic fire is highest, potentially impacting permittees in the future (e.g. loss of available forage and direct livestock mortality) . In the absence of prescribed or wildfire, there would be no increase over current forage production. As conifers continue to encroach on aspen, forage production would remain low and continue to decrease in these stands resulting in reduced allowable use levels. In mountain brush and pinyon/juniper woodlands, older single-layer stands would continue to increase in the area, with a gradual decrease in available forage where it currently exists.

Alternative B
Under Alternative B, there are 11,434 treatment acres on 6 allotments. Livestock grazing would not be allowed in higher elevation treatment units until aspen leaders are 5 to 6 feet tall and a density of greater than 2,500 sprouts per acre when 3 feet tall (goal is to achieve approximately 400 well-formed aspen stems per acre when they reach 13 feet tall according to *Aspen:Ecology and Management in the Western United States*- USDA Forest Service 1985). This may take as little as one growing season or as long as 5-6 years depending on site conditions, but usually occurs within 2-3 years. The areas would be monitored to determine if these time frames are appropriate. Area with enough fine fuels to support ignition and fire, would not need to be rested from livestock grazing prior to burning. Keeping livestock out of treatment areas is likely to involve increased herding efforts, nonuse of a pasture or unit, trailing in new areas, modified salt distribution, and intensive monitoring of livestock. Necessary actions would be identified in the individual allotment annual operating plans that are coordinated each grazing season with permit holders. Treatments would be distributed between allotments over the 10 year treatment schedule in a manner to avoid undue hardship on livestock operators.

Many of the treatments affect suitable range where there would be a net beneficial effect on the vegetative condition following treatment and rest for livestock. Close coordination of mechanical or prescribed burn treatments would be made to ensure relatively small portions of a single allotment are treated in any given year. Effects of livestock grazing on untreated areas should continue to be similar to current conditions. Exceeding grazing use standards outlined in the Forest Plan would not be allowed.

Cumulative Effects

Alternative A
A loss of livestock capacity would continue from conifer encroachment into aspen, pinyon/juniper woodland encroachment into sagebrush/grasslands, and continued prolonged drought. In addition, increased dispersed recreation sites across the

mountain reduces livestock forage by trampling vegetation. Available forage would be limited to both domestic livestock and elk. Reductions in numbers of grazing animals may be required over time should areas of declining forage show signs of over utilization.

Alternative B

Past, present and future actions that may impact forage for livestock on the La Sal Mountains include:

- Elk grazing (ongoing)
- Old treatments in PJ
- Timber harvest on state and private
- Pack Creek thinning and prescribed burn in PJ and mountain brush
- BLM treatments in Pole Canyon (prescribed burn in old chaining, 2002)

While elk are present on the La Sal Mountains, they are within the herd objective of 2,650 animals, post-hunting season. None the less, there is some competition between livestock and elk for forage. Continued, prolonged drought intensifies this competition in some areas although reductions in livestock numbers and natural reductions in elk calf production and increased hunting permits offsets impacts from both animals. Timber harvest of aspen on state and private lands on the east side of the La Sal Mountains has increased forage for elk and deer and reduced pressure and competition for forage resources on the Moab Face of the mountain.

Numerous old pinyon/juniper treatment projects have occurred across the Moab Face area since the 1960's. Many of these treatments have been retreated. In each case, the results were an increase in herbaceous vegetation that increases forage for livestock as well as big game. Cumulatively, these projects add to the proposed project to provide more forage for livestock. While livestock numbers are not planned to increase as a result of the Moab Face project, better distribution of livestock should result, improving forage utilization.

4.12 Comparison of Alternatives

Issue Element ***Evaluation Criteria***	***Alternative A:*** ***No Action***	***Alternative B:*** ***Combination Treatment***
Air Quality Smoke emission or particulate matter	769.33 tons total emissions	457.8 tons total emissions
Visual Quality # acres visual quality objectives will not be met	0 acres not meeting visual quality objectives	0 acres not meeting visual quality objectives
Forest Users Length of time, amount of area, & type of forest user impacted	No Impact	Temporary impact during fire implementation. Only areas immediate to treatment units would be impacted. Impact would include smokeand travel restrictions. One year impact on forest users using burned site.
Vegetation # acres treated by fire # WUI acres where fuel loads are reduced.	 0 acres 0 acres	 6530 acres 4884 acres
Fire Environment Fire behavior	Mid Flame wind speed 3.2 Rate of spread 8.3-40.9 ch/hr Heat per unit area 259-1630 btu/sq ft Fire Line Intensity 12-502 btu/sq ft Flame Length 1.4-7.9 ft	Mid Flame wind speed 0.8 Rate of spread 1.8-11.3 ch/hr Heat per unit area 216-1317 btu/sq ft Fire Line Intensity 3-112 btu/sq ft Flame Length 0.8-3.9 ft
Fish, Wildlife & Plants *Goshawk-* % foraging area treated # acres of habitat meeting guidelines *3-Toed Woodpecker-* # acres suitable habitat impacted *Deer/Elk-* # acres of aspen regeneration Cover:forage ratio (Desired- 50:50)	 0 acres 0 acres 0 acres deer fawn- 79:21 elk calve- 86:14 cumulative- 60:40	 25% short term- long term- 893 negative 1570 negative 677 positive 5600 acres deer fawn- 72:28 elk calve- 74:26 cumulative- 55:45
Inventoried Roadless Area Values # acres IRA impacted	 0 acres	 0 acres
Vegetation, Fire and Fuels # acres treated by fire # WUI acres where fuel loads are reduced.	0 acres 0 acres	6530 acres 4884 acres
Cultural/Heritage Resources # cultural resources eligible	0 National Register eligible sites protected	42 National Register eligible sites protected

to National Register of Historic Places registration protected		
Soils and Watershed Detrimental disturbance estimates (15% threshold) Qualitative comparison of erosion potential (based on soil type) Affects to Water Quality Flood Potential and Channel Stability	No detrimental disturbance No soil loss expected No direct effects. Indirect effects would be greater than Alt. B due to unmanaged wildfire No direct effects. No direct effects. Indirect effects would be greater than Alt. B due to unmanaged wildfire	Potentially 5% of total area = within Regional Guidelines Units 3,4 & 6 may exceed tolerance rating for potential soil loss Slight affect/short-term No detectable change in watershed response or runoff is expected
Livestock Operations: # head months impacted	0 head months	3527 over 10 years

4.13 OTHER ISSUES AND CONSIDERATIONS

4.13.1 **Alien Grass Expansion and Seeding**

Lightly burned or unburned areas within the mosaic of a burned landscape provide a reservoir of seeds that revitalize more heavily burned acreage. When ample desired vegetation remains following a burn, then reseeding may not be required. This is easier to manage under prescribed conditions than with wildfires.

A potential indirect impact of the treatment project is the establishment of undesirable/non-native and noxious plants following a burn. This is not considered an impact of mechanical treatment. For example, cheatgrass (*Bromus tectorum*) is a low-quality non-native annual grass which can invade following fire, cultivation, or grazing because of its ability to grow rapidly after a disturbance, absorbing all available soil moisture (Klemmedson and Smith, 1964). It tends to dominate sites once it appears and does not allow high quality native seeds to become established. The establishment of cheatgrass is highly dependent on the presence of desirable seed sources, moisture levels, the amount of cheatgrass already present and other factors that are not well understood. Cheatgrass is present in scattered pockets at the lower elevations of the project area.

Manually seeding the area with either native or non-native plant seed can prevent cheatgrass from becoming established. On some sites, non-native seed such as crested wheatgrass (*Agropyron cristatum*) or intermediate wheatgrass (*Agropyron intermedium*) can establish early and prevent cheatgrass from taking hold (Evans and Young, 1978). Depending on the non-native species used, it may slowly be taken over by native plants or it may remain dominant. The presence or potential for non-native undesirable plants as well as noxious weeds must be monitored both prior to and following fire and the establishment prevented in order to maintain Properly Functioning Condition. Where cheatgrass is present in the burn treatment areas, seeding of the immediate area is warranted.

4.13.2 **Livestock Grazing and Fire**

Invariably, the issue of livestock grazing and its impact on fire cycles arises during debates regarding the latest policy to reintroduce fire back into the ecosystem. While the desire is to have fire return to the forest in near-natural intervals, lands administered by the US Forest Service remain mandated to operate under the principles of the Multiple-Use Sustained Yield Act of 1960. Providing a mix of goods and services means our ecosystems will not necessarily be managed in the pre-European settler sense.

None the less, livestock grazing has had and will continue to have an effect on fire regimes. The following list probably best covers historic effects from livestock grazing on fire (Keane et. Al. 2002): It should be noted, however, that excessive over-grazing had the greatest impact on fire regimes. Current Forest Plan standards for grazing utilization help to minimize these impacts.

Historically, livestock grazing removed fine fuels (grasses) from the forest floor. The reduction in grass cover not only removed fuel for fire spread but for fire ignition as well.

Livestock also removal grass that competed with tree seedlings for water and nutrients. This favored tree establishment and promoted encroachment that further reduced grass cover by shading and other factors.

Most tree species require bare soil for successful germination. Heavy grazing that removed the grassy understory of many forest floors created bare disturbed soil sites that favored tree establishment and lead to greater tree stocking density.

Livestock grazing also contributed to the spread and persistence of fire-prone weedy species such as cheatgrass.

In most of the instances listed above, *heavy* grazing was the culprit. Under managed situations where stubble height is managed to standards, many of the impacts are reduced or eliminated.

Bartos and Campbell (2002) have shown that following aspen treatment, aspen shoots must be at least 6 feet in height to survive livestock grazing. Aspen shoots are most susceptible to grazing in the spring and fall. The best time to graze regenerating aspen stands would be the middle of the summer and only after the terminal bud is out of reach of grazing. Depending on soil moisture and nutrients, this may take one year or it may take several years. The standard of postponing livestock entry for two grazing seasons may or may not be enough to allow aspen to reestablish.

It should be noted that while the removal of domestic livestock following disturbance of aspen for regeneration is helpful, the greater impact may come from wild ungulates such as elk. Fencing may be required or treatment of large landscapes (as proposed in Moab Face) spreading browsing pressure may be the only methods for allowing aspen stands to regenerate successfully. This point is emphasized in the following statement:

“Heavy browsing of the suckers can deplete aspen root reserves, jeopardize successful regeneration, and threaten the very survival of the aspen stand. Coordination and difficult decisions are needed before suckering will be successful. Actions to induce suckering must not be initiated before relief from excessive browsing is obtained (USDA 1994).”

4.14.1 **Insect and Disease Factors with Fire**

Insects and pathogens have also played a role in the pattern of vegetation across the landscape. Nature has a way of balancing itself. When the artificial removal of fire from the natural disturbance regime occurs, other factors take over to thin and manage forests. In this case, the dense thickets of stunted trees that exist are being thinned and in some cases cleared by epidemics of insects and pathogens. While these agents exist at endemic levels in healthy forests, their numbers and their affects escalate during unhealthy forest conditions.

Tree mortality rises under the influence of such insects as the western spruce budworm or diseases such as aspen heart rot (*Phellinus tremulae*), mistletoe and root rot. As the cycle of nature continues, these factors play a large role in the increase in dead and down fuels present in our forests. Consequently, high fuel loads both vertically and horizontally, increases fire hazard and intensity. Results are large, intense, stand-replacing fires that kill not only the small dense thickets of trees but the remnant large trees that survived many years with a regime of periodic low-intensity fires.

One of the effects of fire, whether prescribed or wild, is the subsequent loss of trees from stress caused by the fire. Survival of conifers following fire depends on the type and degree of injuries, initial tree vigor, and the postfire environment that includes insects, diseases and weather. As fire injury increases, the probability of death due to one or more of these causes also increases (Rasmussen et al. 1996).

Douglas fir bark beetles, red turpentine beetles, Englemann spruce beetle, decay and fungi all thrive on post-fire forest conditions. Virus and parasitic wasps follow and feed on the beetles (Herbertson 2002). Large trees are some times better equipped to survive stress from fires since their bark is thicker and more resistant. However, these trees require more water and under drought conditions can be under greater stress and more susceptible to insect infestation. Smoke from large fires can also put stress on trees by clogging stomata (photosynthetic pores) predisposing them to diseases and insects (Herbertson 2002).

Canopy fires that cause complete defoliation usually result in complete burning or severe scorching of the inner bark, especially in thin-barked species. Trees with this type of injury are no longer suitable for bark beetle infestation (Rasmussen et al. 1996).

A study by Rasmussen et al. (1996) was conducted in Yellowstone Park post-fire during 1991,1992, and 1993. The fire occurred in 1988. Plot areas monitored had to contain green trees and therefore did not include areas where canopy fires had occurred. Results show that mortality of Engelmann spruce following the fire included 31.9 percent by fire injury, 6.6 percent by insects and 2.5 percent from unidentified factors. Half of the 6.6 percent killed by insects were from spruce beetle (*Dendroctonus refipennis*). Other insects that caused spruce death were *Ips pilifrons*, and wood borers of families Buprestidae and Cerambycidae. The high rate of spruce loss from fire injury was related to thin bark and susceptibility of these trees to fire.

Subalpine fir mortality was attributed to fire injury (50 percent) with insects accounting for 7.5 percent and 5.2 percent unidentified causes. Subalpine fir was the most sensitive to fire in this study. Most insect caused mortality was caused by wood borers in the families Buprestidae and Cerambycidae (Rasmussen et al. 1996).

Chapter 5: Monitoring and Evaluation

Proper monitoring and record-keeping is essential in order for results to be evaluated and used in designing and improving future treatments. There are basically two types of monitoring- implementation and effectiveness monitoring. *Implementation* monitoring is used to determine if the project was carried out as planned. Burn plans are used, for example, to set specific parameters for each burn treatment and establishes monitoring to see that the treatment is conducted as planned. Example questions for implementation monitoring may be, "Did the smoke plan accurately describe the predicted conditions and results?" or "Was media urilized to let the public know of road closures?"

It is also important to measure a variety of characteristics prior to treatment and compare these with results measured after treatment. These measures are used to monitor the *effectiveness* of the project. Questions that are used for this type of monitoring include:

1. Was the vegetation treatment successful in regenerating aspen? If so, how soon after treatment did the aspen respond? If not, why not?

2. What was the effect of grazing on aspen seedlings/saplings? To what degree did browsing impact aspen regeneration? How does this compare to similar treatments of smaller and/or larger size?

3. What affect did the treatment have on conifer encroachment of aspen clones?

4. How did herbaceous species respond to the prescribed burn? Which species returned? Which ones were new? Which ones are native and non-native? How do species in treated areas compare to untreated areas.

5. How quickly did ground cover return following the burn and were there signs of soil movement within the treatment area?

The following are examples of measurements which can be taken to monitor the results of project treatment:

Quantity and quality of regeneration. The project area would be monitored the first and fifth year following treatment to record early response, measured in terms of the number of aspen suckers per acre. According to Brian Ferguson, Regional Silviculturist, Intermountain Region the objective depending on habitat type would be to have 2000-5000 stems per acre at 6 feet height over 70% of the area treated. This means that those stems must maintain a strong terminal leader with no grazing hits. Another critical monitoring point is to see at least 1000-1500 stems per acre when they are 10-15 feet tall and 1.5 inches diameter breast height.

Livestock and wildlife utilization to monitor impacts from browsing animals as measured by the number of suckers browsed per acre. Actions may need to be taken to minimize impacts should they occur.

Plant species composition in treated areas versus adjacent untreated areas. This could also be used over the long term to monitor time of first conifer seedlings and their advancement.

Surface erosion or runoff would be monitored using the same watershed monitoring techniques used in wildfire situations. Mitigation measures would be monitored for effectiveness.

Post-project monitoring for effects on National Register eligible archaeological sites and features within the project area will be implemented. A subset of sites (10 %) will be added to the District Heritage Monitoring Plan to monitor the long-term effects of the project and potential impacts from issues such as natural erosion, visitor use and vandalism, grazing, and other factors.

Monitoring of soil resources in the Moab Face project area would ensure compliance with forest and regional direction, to ensure project objectives are being met, and to provide critical information that can be used for future projects. The objectives of the monitoring are:

1. To provide information on the effects of prescribed fire to soil resources. More specifically to add to the knowledge base of prescribe fire to soil resources supporting aspen ecosystems.
2. To ensure compliance with project implementation direction and treatments are within forest standard and guidelines for soil resources.
3. To provide information on any mitigation needs that may have to be installed or implemented.
4. To determine if desired soil conditions are being met through project implementation.

The above objectives would be met through several forms of qualitative and quantitative monitoring of the soil resources. The types of monitoring, purpose, schedule and methods to use are given below.

Type: Soil Temperature
Purpose: To monitor the effects of soil heating during burning. This information would be used to assist in identifying areas that may have high fire severity. It would also be used to provide knowledge on the effects of prescribe fire to soil resources in aspen ecosystems.
Schedule: Monitoring would take place during treatment burns.
Methods: Templaq heat sensitive paints or other similar materials would be used to determine depth and temperature of soil heating. A minimum of 3 treatment units would be sampled. Each treatment unit samples would have 3 burn and 3 control plots. Each plot shall be a set of Templaq paint or other material with a range of temperatures for determining amount of heat into soil. It is recommended to use ceramic tile pushed 2 inches into the soil surface with Templaq paint on tile.

Type: Ground Cover
Purpose: To determine the amount of ground cover post treatment. This information would be used to determine if any mitigation would be required following treatment. It would also be used to add to the information base on effects of prescribed fire and mechanical treatments to surface ground cover.
Schedule: Pre treatment, immediately post treatment and 1 year post treatment.
Methods: Visual observations would be used in treatment units. Three treatment units would be selected for 100 foot transects with sampling ground cover at each 1 foot interval. A minimum of 3 100 foot transects would be taken in the units quantitatively sampled. Units would be sampled pre and post treatment. Rebar is recommended for end points so the same transect location can be sampled. For safety purposes, rebar locations are marked on maps using gps coordinates.

Type: Erosion Bridge
Purpose: To monitor the effects of prescribed fire to soil erosional processes. This type of monitoring is to be used to add to the knowledge base of the effects of prescribed fire. The erosion bridge monitoring is not required for this project. It is optional.
Schedule: Pre fire, 1 year post fire and 2 year post fire.
Methods: Methods are found in the Region 4 Soil Monitoring Guide. A 4 foot erosion bridge is used. A minimum of 3 treatment units should be sampled. Each unit sampled requires 3 transects in a burn area and 3 in control (unburned) areas.

Type: Shovel Test
Purpose: This test is a qualitative test to determine compaction that may have been caused by mechanical treatment equipment. It is used to determine mitigation needs.
Schedule: During and immediately after treatment implementation.
Methods: A standard shovel test of resistance is used. The user must calibrate themselves with compacted and non-compacted areas. This can be done by visiting known areas of compaction and control areas that area not compacted.

Type: Fire Severity
Purpose: To determine the extent if any that prescribe fire treatment units burned with high fire severity. This information is used to determine if mitigation measures need to be implemented. It is also used to add to the knowledge base of the effects of fire to soil resources.
Schedule: Immediately after prescribe fire treatments.
Methods: Visual observations of fire severity using indicators of organic matter consumed, hydrophobic soil conditions, and color of mineral soil. The definition of high fire severity in R4 Soil Quality Guidelines (FSH 2509.18.2) shall be used for the monitoring.

Chapter 6: Reference List

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Chapter 7: Appendices

7.1 Treatment Unit Maps