1996

South Manti Timber Salvage Sales Environmental Assessment

United States Forest Service

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South Manti Timber Salvage Sales

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SUMMARY

INTRODUCTION

This environmental assessment (EA) is intended to foster informed decision making and public participation on a site-specific proposal to implement activities designed to meet the purpose and need and goals and objectives of the Manti-La Sal National Forest Land and Resources Management Plan (Forest Plan). This EA discloses the direct, indirect, and cumulative environmental impacts of three action alternatives for timber harvest and road construction, and no action alternative on portions of the Ferron/Price and Sanpete Ranger Districts, Manti-La Sal National Forest in Sanpete and Sevier Counties, Utah. The area to be analyzed in support of this decision includes approximately 24,624 acres within Townships 19, 20, and 21 South, Range 4 East, Salt Lake Meridian (Figure S.1).

A process of public participation for the South Manti project began September 17, 1992 with a public meeting at Twelvemile Flat Campground. Meeting participants viewed forest lands affected by a spruce beetle epidemic, viewed the extent of beetle induced tree mortality, and discussed possible opportunities to salvage timber and improve forest health. On July 2, 1993 project proposal scoping packages were mailed to 62 people, organizations, and agencies on the project mailing list. At that time, (July 1993) an environmental assessment was to be prepared to disclose impacts of the proposed action. In late 1993, the Forest Supervisor determined there may be significant effects to the human environment and directed the IDT Leader to prepare an environmental impact statement.

On July 27, 1995 the President signed the Rescission Act (Public Law 104-19) which contained provisions related to emergency salvage of timber on lands administered by the U.S.D.A. Forest Service. The salvage provisions of the Act are intended to expedite salvage timber sales in order to achieve, to the maximum extent feasible, a salvage sale volume above the programed level to reduce the backlogged volume of salvage timber within a framework of maintaining forest health and ecosystem management. The authorities provided by P.L. 104-19 are in effect until December 31, 1996. On September 12, 1995 the Forest Supervisor determined the provisions of Public Law 104-19 applied to the South Manti Timber Salvage Sales project and directed the IDT Leader to produce a combined environmental assessment and biological evaluation (EA/BE) to disclose the environmental impacts of the proposed action.

Development of the EA is based on, and meets the direction contained in the National Forest Management Act (NFMA), the National Environmental Policy Act (NEPA) and Public Law 104-19. Following public review and comment on this predecisional review draft, responses to comments will be incorporated into the EA and a decision notice prepared. The scope of the analysis will be confined to the issues associated with the proposed action. This analysis will consider potential amendments to the Forest Plan and their effects and include all lands (Federal and non-federal) that may reasonably anticipate effects from implementation of the alternatives.

PURPOSE AND NEED

The Manti-La Sal National Forest Land and Resources Management Plan (approved 1986) states resource goals: and desired conditions the forest will move toward through incremental implementation of site-specific projects. Site-specific projects are designed to partly, or wholly, move the current resource condition toward the desired condition while meeting standards identified in the plan.

The proposed action is designed to "provide commercial timber sales of sufficient quantity and quality to maintain local timber industry and accomplish desired vegetation treatment goals" (Forest Plan, III-3).

SUMMARY

Salvage harvest of dead and dying timber and road development could provide opportunities for regional businesses to benefit from the offering and sale of forest wood fiber products and construction of roads. Demands for lumber and other building products are increasing as more people move into Utah and the number of homes being built increases. Competition and demand for sawtimber and homelogs is reasonably foreseeable in the next decade.

The proposed action is designed such that "...varying successional stages will be present to provide for a high level of vegetative diversity and productivity" (Forest Plan, III-2).

Reforestation by planting provides a more dependable approach to assure reestablishment of the spruce component in areas that have experienced extensive mortality. In addition, planted areas mature sooner than areas reforested through natural regeneration and move the forest toward a desired structural and compositional diversity condition more rapidly and with greater management control.

The proposed action is designed to "reduce the accumulated fuels to a tolerable risk level" (Forest Plan, III-5).

Salvage harvest of dead and dying timber could reduce the fuels currently available and susceptible to unmanaged wildfire thereby reducing the risk to other managed resources and property.

The proposed action is designed to "promote integrated pest management programs to prevent and control insects and disease infestations" (Forest Plan, III-5).

An analysis conducted in 1993 indicated prior to 1980, vegetative conditions within the analysis area were inherently vulnerable to bark beetle attack (Project File). During the 1980's beetle populations increased from endemic to epidemic populations because natural disturbance created ideal conditions conducive to an epidemic; including ample food sources and favorable climatic conditions.

Today, the majority of Englemann spruce over 10 inches in diameter in, and south of, Twelvemile Flat have been attacked and are either dying or dead. Spruce trees north of Twelvemile Flat with the exception of some in the Smoak Creek area have not yet experienced heavy insect activity. The beetle epidemic is anticipated to continue north into currently uninfested areas.

Salvage harvest of dead and dying timber could reduce beetle populations by removing infested trees. Chemical spraying of high value trees around recreation areas could retard or prevent beetle attacks and subsequent spruce mortality and thereby maintain desired recreation and aesthetic values.

DECISION TO BE MADE

The decision to be made by the Forest Supervisor based on this analysis is to approve or disapprove the:

• location, timing, and methods of timber harvest, silviculture diagnosis, reforestation, and post sale activities;

• location, timing, and methods of road construction, reconstruction, and access management;

• mitigation measures and monitoring necessary to implement timber harvest and road construction activities.
SUMMARY

ISSUE AND ALTERNATIVE DEVELOPMENT PROCESS

A summary of public participation, scoping, and issue development is presented in Chapter 5 of the EA. Of the 92 letters sent in the scoping process, twenty-two people and/or organizations responded as of October 31, 1994. Fourteen issues were approved for analysis in the EA, two of which are significant. The fourteen resource issues will be used to focus the environmental analysis and develop measures to mitigate and/or monitor anticipated environmental effects.

1. Land Stability
2. Soil Erodibility and Productivity
3. Air Quality
4. Water Quantity and Quality; Riparian/Wetlands; Aquatic Habitat; and Threatened, Endangered, and Sensitive Aquatic Species
5. Forest Health, Diversity, and Productivity; Rangeland Vegetation; Noxious Weeds; and Threatened, Endangered, and Sensitive Plant Species
6. Fuel Loading and Fire Risk
7. Elk, Deer, and Neotropical Migratory Birds; Management Indicator Species; and Threatened, Endangered, and Sensitive Animal Species
8. Transportation System, Visitor Safety, Access, and Travel Delays
9. Range Allocations and Improvements
10. Visual Landscape
11. Roadless Character
12. Cultural Resources
13. Economics
14. Energy

Issue number 5 (Forest Health, Diversity, and Productivity) and number 11 (Roadless Character) were found to be significant issues (40 CFR 1500.4(g), FSH 1909.15 12.3) because effects of the proposed action on the forest health and roadless character could not be avoided without substantive changes in the proposed action and wholly or partially meet the purpose and need statement. The interdisciplinary team used the significant issues (as described below) to define one or more of the significant issues.

Issue 5 The proposed action did not reduce the susceptibility of currently uninfested spruce stands to spruce beetle attack, so additional integrated pest management strategies should be considered. The proposed action did not reduce the susceptibility of dead and currently uninfested spruce stands to unmanageable fire across the landscape.

Issue 11 The proposed action enters into inventoried roadless areas and may affect the natural integrity, apparent naturalness, remoteness, solitude, special features, and boundary relationship characteristics. An alternative to avoid or lessen these effects should be considered.

DESCRIPTION OF ALTERNATIVES CONSIDERED IN DETAIL

Potential alternatives to the proposed action were identified, considered, and some eliminated from detailed study. Alternatives eliminated from detailed study are described in Chapter 2 of the EA. A no action alternative and three action alternatives were developed to provide a full range of reasonable alternatives that sharply define one or more of the significant issues.

Alternative 1 - No Action

Alternative 1 addresses the need to provide a "No Action" alternative (40 CFR 1502.14). Alternative 1 would not commercially harvest, remove, or destroy spruce beetle infested trees in the project area. Chemical spraying to suppress or reduce spruce beetle activity in, and surrounding, high value recreation areas would continue under separate analyses and decisions. No roads would be constructed, reconstructed, closed, or rehabilitated related to this proposal. Current management would continue along roads for fuelwood, post and poles, and trees through the small sales program. Reforestation would be through natural processes.

Alternative 2 - Proposed Action (Figure S.2)

Alternative 2 meets the purpose and need by providing a supply of timber to help satisfy local, regional, and national demands for timber products, recouping value from timber killed by spruce beetles, and by reducing fuel loading. Alternative 2 includes chemical spraying to protect high value trees from beetle attack in developed and dispersed recreation areas and administrative sites identified in the Forest Plan. Alternative 2 provides natural and artificial (planting) reforestation activities to restock deforested areas and provides future supplies of timber, wildlife habitat, and other resource values. Gopher populations would be reduced as required using lethal methods to assure reforestation success. Permitted livestock would be excluded from plantations to protect planted species. Fuelwood sales would occur in specified areas.

Alternative 2 would implement timber salvage sales on slopes less than 30 percent using ground-based logging systems covering 5,644 acres. Ground-based logging systems include but are not limited to tractor, rubber-tired skidders, etc. The sales could take a total of 19 operating seasons staggered across six calendar years to implement. The normal operating season for this activity would be July 1 to October 1. About 52.5 million board feet would be harvested. About 23 miles of road construction and 27 miles of construction would be required to support salvage and timber management activities. Roads would be added to the transportation system; intermittent local roads would be closed to the public. About 19 miles of project roads would be reclaimed after salvage activities are completed. An additional 19 miles of non-project roads adjacent to the project area would be reclaimed. Four aggregate sources may be opened and developed. Figure S.3 displays treatment unit locations compared to inventoried roadless area locations for Alternative 2.
SUMMARY

Alternative 3 (Figure S.4)

In addition to those issues and strategies addressed in Alternative 2, Alternative 3 specifically focuses on concerns identified in Issue 5 (Forest Health, diversity, and productivity). Alternative 3 would attempt to reduce stand susceptibility by using integrated pest management treatments across large contiguous areas of currently uninfested, green spruce stands. Alternative 3 will implement sanitation harvesting of high risk trees through thinning or individual tree selection in green, currently uninfested spruce-fir stands along the advancing epidemic front to reduce risk and subsequent losses of the spruce vegetative component within treated areas. Follow-up monitoring and future salvage harvest will occur, as required, in and around green stands to remove spruce trees infested following previous sanitation activities. Treatments to suppress or reduce spruce beetle activity, such as pheromone baiting and trap trees, would be implemented.

In addition to those activities proposed in Alternative 2, Alternative 3 provides for helicopter logging in stands which are not ground-based loggable due to ground conditions or because slopes are greater than 40%. About 31.3 MMBF of live, uninfested spruce and 63.2 MMBF of currently infested, dead spruce would be harvested and offered for sale. Alternative 3 would implement timber sales covering 10,212 acres. The sales could take a total of 21 operating seasons (July through October) staggered across nine calendar years to complete. Alternative 3 would require 23 miles of road construction, 29 miles of reconstruction, helicopter log deck areas, and operations pads to support salvage activities. Helicopter landing areas would be stabilized and reseded when management activities have finished. About 15 miles of project roads would be reclaimed after salvage activities are completed. An additional 19 miles of non-project roads adjacent to the project area would be reclaimed. Figure S.5 displays treatment unit locations compared to inventoried roadless area locations for Alternative 3.

Alternative 4 (Figure S.6)

Alternative 4 responds directly to Issue 11 (Roadless Character). Alternative 4 maintains current road characteristics in lands inventoried as roadless as compared to Alternative 3 and Alternative 2. Timber stands that lie within inventoried roadless areas are removed from consideration under this alternative. No new road construction or reconstruction will occur within inventoried roadless areas. Figure S.7 displays treatment unit locations compared to inventoried roadless area locations for Alternative 4.

In treated areas, we do anticipate Alternative 4 would reduce fuel loading, maintain long-term forest age and species diversity, and lead to areas that are less susceptible to beetle attack. About 14.6 MMBF of live, uninfested spruce and 46.9 MMBF of currently infested, dead spruce would be harvested and offered for sale. Alternative 4 would implement timber salvage sales covering 6,861 acres. The sales could take a total of 10 operating seasons (July through October) staggered across six calendar years to implement. Treatment units D4, D5, and E1 with harvest potential outside inventoried roadless areas require construction or reconstruction of alternate access routes. Alternative 4 would require 17 miles of road construction, 27 miles of reconstruction. About 13 miles of project roads would be reclaimed after salvage activities are completed. An additional 19 miles of non-project roads adjacent to the project area would be reclaimed.

DESIGN FEATURES COMMON TO ALL ACTION ALTERNATIVES

The action alternatives evaluated include direction provided by the Forest Plan. All applicable forest-wide and management area goals, direction, and standards and guidelines described in the Forest Plan are incorporated into the design of this project. Design features were grouped to address the fourteen resource issues with the intent to mitigate or lessen anticipated environmental effects. Monitoring to address the fourteen resource issues is also presented in Chapter 2 and Appendix A.3. The design features are presented in detail in Chapter 2 of the EA.

SUMMARY

COMPARISON OF ALTERNATIVES

Table 2.4 of Chapter 2 has been generated to summarize and compare alternatives relative to the issues and other analysis/decision factors. Comparisons are based on net effects to each resource issue if the entire alternative were selected and implemented. Effects account for all proposed activities and mitigations as displayed in the alternative maps and therefore represent a total, net effect of the alternative on the resource. Refer to Chapter 4 for a detailed discussion of environmental effects for each alternative.

IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The preferred alternative is Alternative 3 with some selections of Alternative 2 and Alternative 4 with regards to the roadless character issue. This choice is based on the following rationale:

1. Responsiveness to the Purpose and Need for Forest Plan

Alternative 3 provides a supply of timber to help satisfy local and regional demands for timber products, maintains long-term forest age and species diversity and productivity, reduces accumulated levels to tolerable risk levels, and leads to a forest that may be less susceptible to beetle attack. Natural and artificial reforestation provides for future supplies of timber, wildlife habitat, and other resource values.

2. Responsiveness to the Forest Health, Diversity, and Productivity Issue

Alternative 3 emphasizes application of additional, preventative integrated pest management strategies along the advancing epidemic front designed to reduce host susceptibility to beetle attack in currently uninfested spruce-fir stands. We understand this approach can not assure success given the magnitude of the beetle epidemic however we believe the proposed activities will have a reasonable chance of success to reduce beetle induced mortality in treated sites based on our experience and the cited literature. Our approach represents an attempt at adaptive management in collaboration with Forest Service research scientists within the framework of ecosystem management.

3. Responsiveness to the Roadless Issue

There are approximately 3,161 acres potentially impacted by the South Manti project inventoried as having undeveloped, roadless character (Table 4.15, The Manti-La Sal Land and Resources Management Plan Record of Decision (1986) (page 8) states the ...Utah Wilderness Act direct ed that other roadless areas not designated as wilderness be managed for non-wilderness uses." The Record of Decision also allocated lands to management areas with goals, desired conditions, and prescriptive standards to guide site-specific implementation activities. The Preferred Alternative is responsive to Forest Plan direction by managing for a variety of resource uses and conditions. It presents a balance of forest health treatments, salvage opportunities, and maintenance of roadless characteristics.
SUMMARY

The Preferred Alternative maintains the undeveloped, roadless character of the Heliotrope and Muddy Creek-Nelson Mountain inventoried roadless areas by selecting Alternative 4 (no entry in inventoried roadless areas) for proposed treatments covering 1,596 acres in these areas.

In portions of other inventoried roadless areas considered within the project analysis area, the Preferred Alternative emphasizes management for resource objectives that involve entry for salvage harvest. Within the Big Bear Canyon inventoried roadless area, the Preferred Alternative allows helicopter harvest in unit F-3 (36 acres) by selecting Alternative 3. Within the Black Mountain, Twelvemile, and White Mountain inventoried roadless areas the Preferred Alternative allows tractor harvest by selecting Alternative 2 covering 1,011 acres. This includes units G-1 and G-2 (Black Mountain 380 acres), B-3 and B-4 (Twelvemile 36 acres), and D-4 and D-5 (White Mountain 595 acres). The Preferred Alternative does not include helicopter harvest units for these three roadless areas (518 acres).

4 Responsiveness to the Economics Issue

Section 4.20 of Chapter 4 indicates Alternative 3, overall, has a negative present net value. Figure 2.2 geographically displays the treatment units and Table 2.2 displays the timber activities for Alternative 3. Completion of helicopter logging within treatment units E, F, and G is required to successfully implement the integrated pest management strategies of Alternative 3.

The high operating costs of helicopter logging and the ratio of acres logged using helicopter methods vs acres logged using ground-based methods were critical factors contributing to the outcome of whether a group of treatment units would have a positive or negative present net value. I have discussed this situation with the interdisciplinary team and have directed them to carefully organize future timber sale packages such that the government would realize the maximum return to the treasury.

I realize this strategy may result in a negative net present value or a below-cost timber sale. A below-cost timber sale may be acceptable to me because I believe there is a reasonable chance of achieving our long-term forest health, diversity, and productivity objectives. In addition, below cost sales are permitted under Public Law 104-19 if forest health objectives are addressed.
SUMMARY
FIGURE S.2

Alternative 2

LEGEND
+ Gravel Pits
• Helipads (none present)

Existing Roads
New Roads

Treatment Unit Number
Ground-based Logging

1 0 1 Miles

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SUMMARY
FIGURE S.3

Roadless Areas
Alternative 2

PROJECT BOUNDARY
TREATMENT UNITS
ROADLESS AREAS

Black Mtn
Big Bear Canyon

Heliotrope

Twelve Mile

Muddy Crk - Nelson Mtn
White Mtn

1 0 1 2 3 Miles

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SUMMARY

FIGURE S.4

Alternative 3

LEGEND

Gravel Pits
Helipads
Existing Roads
New Roads
Helicopter Logging
Treatment Unit Number
Ground-based Logging

SUMMARY

FIGURE S.5

Roadless Areas
Alternative 3

Black Mtn
Big Bear Canyon
Heliotrope
Twelve Mile
Muddy Crk - Nelson Mtn
White Mtn

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South Manti Timber Salvage Sales EA, Page S-12
**SUMMARY**

**FIGURE S.6**

**Alternative 4**

**LEGEND**

- Gravel Pits
- Helipads
- Existing Roads
- New Roads
- Helicopter Logging
- Treatment Unit Number
- Ground-based Logging

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**SUMMARY**

**FIGURE S.7**

**Roadless Areas**

**Alternative 4**

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CHAPTER 1

Purpose and Need for Action

1.0 Introduction

This environmental assessment (EA) discloses the direct, indirect, and cumulative environmental impacts of three action alternatives for timber harvest and road construction, and a no action alternative on portions of the Ferron-Price and Sanpete Ranger Districts, Manti-La Sal National Forest in Sanpete and Sevier Counties, Utah. The proposed action was designed to help achieve the goals and objectives of the Manti-La Sal National Forest Land and Resources Management Plan (Forest Plan).

A process of public participation for the South Manti project began September 17, 1992 with a public meeting at Twelvemile Flat Campground. Meeting participants viewed forest lands affected by a spruce beetle epidemic, viewed the extent of beetle induced tree mortality, and discussed possible opportunities to salvage timber and improve forest health. On July 2, 1993 project proposal scoping packages were mailed to 82 people, organizations, and agencies on the project mailing list. At that time, (July 1993) an environmental assessment was to be prepared to disclose impacts of the proposed action. In late 1993, the Forest Supervisor determined there may be significant effects to the human environment and directed the IDT Leader to prepare an environmental impact statement.

On July 27, 1995 the President signed the Rescission Act (Public Law 104-19) which contained provisions related to emergency salvage of timber on lands administered by the U.S.D.A., Forest Service. The salvage provisions of the Act are intended to expedite salvage timber sales in order to achieve, to the maximum extent feasible, a salvage sale volume above the programed level to reduce the backlogged volume of salvage timber within a framework of maintaining forest health and ecosystem management. The authorities provided by P.L. 104-19 are in effect until December 31, 1996. On September 12, 1995 the Forest Supervisor determined the provisions of Public Law 104-19 applied to the South Manti Timber Salvage Sales project and directed the IDT Leader to produce a combined environmental assessment and biological evaluation (EA/BE) to disclose the environmental impacts of the proposed action.

1.1 Proposed Action

The Forest Service proposes to harvest commercially salvageable dead and dying Engelmann spruce across 5,640 acres in portions of the Muddy, Ferron, Twelvemile, and Sixmile drainages (Figure 1.1). New roads would be constructed and existing forest development roads reconstructed to accommodate timber harvest activities. Three aggregate sources may be developed. Ground-based harvest methods would be used. Harvested areas will be regenerated through site preparation, hand planting, and natural seeding from trees remaining within and adjacent to harvested areas. Roads no longer needed for current or future management activities will be closed and reclaimed.

1.2 Purpose and Need

Insects and disease play an important role in properly functioning, healthy, sustainable ecosystems and the Forest Service recognizes endemic and epidemic populations of spruce beetle are within the historic range of variability on the Wasatch Plateau. Ecosystem management philosophy depends on a functioning, healthy, and sustainable ecosystem. Ecosystem management also acknowledges the desires and requirements of humans to live in, enjoy, and use products derived from the ecosystem.
The Mant-La Sal National Forest Land and Resources Management Plan (approved 1986) states resource goals and desired conditions the forest will move toward through incremental implementation of site-specific projects. Site-specific projects are designed to partly, or wholly, move the current resource condition toward the desired condition while meeting standards identified in the plan. The Forest Plan also identifies the anticipated types and quantities of goods and services that could be produced and sustained while maintaining a functioning, healthy ecosystem, within funding constraints, for the ten to fifteen year planning period (1986 to 2001).

The proposed action is designed to "provide commercial timber sales of sufficient quantity and quality to maintain local timber industry and accomplish desired vegetation treatment goals" (Forest Plan, III-3).

About 3,010 acres (29 percent) in the project area are allocated specifically to provide for wood fiber production and utilization (Management Area TBR) and another 7,182 acres (70 percent) are allocated to allow for wood utilization consistent with meeting other resource value requirements (Management Area RNG). Epidemic outbreaks of beetles and subsequent spruce mortality in lands allocated to providing long-term, continuous supplies of timber products are not desirable because spruce mortality is rapid, leading to large amounts of dead trees in a short period of time. While the short-term economic benefits of harvesting dead trees are obvious the long-term goal of providing a continuous supply may not be achieved because regeneration of spruce to a commercial age would take 80 to 140 years.

Salvage harvest of dead and dying timber and road development could provide opportunities for regional businesses to benefit from the offering and sale of forest wood fiber products and construction of roads. Demands for lumber and other building products are increasing as more people move into Utah and the number of homes being built increases. Competition and demand for sawmill and homelog values is reasonably foreseeable in the next decade.

The proposed action is designed such that "...varying successional stages will be present to provide for a high level of vegetative diversity and productivity" (Forest Plan, III-2).

The existing mortality of the spruce component and the impending potential additional losses discussed above will move ecosystem vegetation from an Engelmann spruce - Subalpine fir community toward a community dominated by Subalpine fir, which is the climax species. Epidemic outbreaks of beetles and subsequent spruce mortality are not desirable because spruce mortality is rapid, leading to large amounts of dead trees in a short period of time. While the short-term economic benefits of harvesting dead trees are obvious the long-term goal of providing a continuous supply may not be achieved because regeneration of spruce to a commercial age would take 80 to 140 years.

Restoration by planting provides a more dependable approach to assure reestablishment of the spruce component in areas that have experienced extensive mortality. In addition, planted areas mature sooner than areas reforested through natural regeneration and move the forest toward a structural and compositional diversity condition more rapidly and with greater management control.

CHAPTER 1

The proposed action is designed to "reduce the accumulated fuels to a tolerable risk level" (Forest Plan, III-9).

An analysis conducted June 1993 for the South Manti area indicated average fuel loading of 60 tons/acre in affected Engelmann spruce stands or about 7.5 times greater than the desired fuels condition. Under the current fuel loading conditions fire potential ratings increased from low to high and resistance to control increased from moderate to high. This means there is a high potential that a wildfire could spread rapidly and be very difficult to control.

Salvage harvest of dead and dying timber could reduce the fuels currently available and susceptible to unmanaged wildfire thereby reducing the risk to other managed resources and property.

The proposed action is designed to "promote integrated pest management programs to prevent and control insects and disease infestations" (Forest Plan, III-9).

An analysis conducted in 1993 indicated prior to 1980, vegetative conditions within the analysis area were inherently vulnerable to bark beetle attack (Project File). During the 1980's beetle populations increased from endemic to epidemic populations because natural disturbance created ideal conditions conducive to an epidemic; including ample food sources and favorable climatic conditions. Today, the majority of Engelmann spruce over 10 inches in diameter in, and south of, Twelvemile Flat have been attacked and are either dying or dead. Spruce trees north of Twelvemile Flat with the exception of some in the Sammie Creek area have not yet experienced heavy insect activity. The beetle epidemic is anticipated to continue north into currently untested areas.

Salvage harvest of dead and dying timber could reduce beetle populations by removing infested trees. Chemical spraying of high value trees around recreation areas could retard or prevent beetle attacks and subsequent spruce mortality and thereby maintain desired recreation and aesthetic values.

1.3 Incorporation by Reference

To decrease the bulk and redundancy of the environmental assessment for the South Manti Timber Sales analysis, this document will incorporate by reference (40 CFR 1502.21) recent previous analyses in Wasatch Plateau spruce/fir zones on the Ferron/Price and Sanpete Ranger Districts. These documents include the Timber Canyons Timber Sale Environmental Assessment (1992) and the Twelvemile Timber Sale Environmental Assessment (1993). This analysis also ties to the forest-wide direction and management area goals and standards of the Manti-La Sal National Forest Land and Resources Management Plan and incorporates by reference the analysis disclosed in the EIS, Appendix, and Record of Decision (1996), as amended. The analyses and specific information being incorporated by reference and all appropriate literature citations used in the previous analyses would become part of this analysis. Copies of the incorporated documents are available for review at the Forest Supervisor's office, Manti-La Sal National Forest, 599 West Price River Drive, Price, UT, 84501.

1.4 Scope of the Proposed Action and Decision

The scope of the analysis will be confined to the issues associated with the proposed action and approved alternatives. This analysis will consider potential amendments to the Forest Plan and their effects and include all lands (Federal and non-Federal) that may reasonably anticipate effects from implementation of the alternatives. The reasonably anticipated effects are predicted and analyzed within a spatial and temporal scope.

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CHAPTER 1

Anticipated effects of the alternatives may reasonably span across the following geographic area. The proposed project is located within the southern portion of the Wasatch Plateau on the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest. The area to be analyzed in support of this decision includes approximately 24,624 acres within Townships 19, 20, and 21 South, Range 4 East, Salt Lake Meridian, Sanpete, and Sevier Counties, Utah (Figure 1.1).

1.5 Decision to Be Made

The decision to be made by the Forest Supervisor based on this analysis is to approve or disapprove the:

- location, timing, and methods of timber harvest, silviculture diagnosis, reforestation, and post sale activities;
- location, timing, and methods of road construction, reconstruction, and access management;
- mitigation measures and monitoring necessary to implement timber harvest and road construction activities.
CHAPTER 2
ALTERNATIVES

2.0 INTRODUCTION
This chapter describes the alternatives developed in response to the issues and concerns identified in the scoping process that, wholly or partially, meet the purpose and need identified in Chapter 1. Included are the issue and alternative development process, significant issues, alternatives not analyzed in detail, alternatives analyzed in detail, design features common to all action alternatives, a comparison summary of the effects by alternative, and identification of the preferred alternative.

2.1 ISSUE AND ALTERNATIVE DEVELOPMENT PROCESS
A summary of public participation, scoping, and issue development is presented in Chapter 5 of this EA. Of the 82 letters sent in the scoping process, twenty-two people and/or organizations responded as of October 31, 1994. Fourteen issues were approved for analysis in the EA, two of which are significant. Issues not analyzed in detail are disclosed in the project file.

The following fourteen resource issues will be used to focus the environmental analysis and develop measures to mitigate and/or monitor anticipated environmental effects. Each issue statement includes an evaluation criteria or method to measure responsiveness (effects) to the issue. The resource issues, issue statements, and evaluation criteria are as follows:

Land Stability
The North Horn Formation, unconsolidated rock material overlying the formation, and soils derived from the North Horn Formation are inherently unstable. Timber harvest and road construction activities could induce landslides or these activities could be damaged as a result of landslides.

Evaluation Criteria
- Area classified as unstable, moderately unstable, moderately stable, and stable.
- Compare acres of new road construction and reconstruction in unstable and moderately unstable lands for each alternative.

Soil Erosion and Productivity
Timber harvest and road construction activities could increase soil erosion. Soil productivity could change due to losses of soil material caused by erosion, compaction, and displacement from harvesting equipment.

Evaluation Criteria
- Erosion rates (tons per acre, percent change).
- Bare soils (percent change of analysis area with bare soils).
- Meets Forest Plan productivity standard.
Air Quality

Timber harvesting and associated activities may reduce the air quality for a period of time.

Evaluation Criteria

- Meets State of Utah Air Quality Standards

Water Quantity and Quality; Riparian/Wetlands; Aquatic Habitat; and Threatened, Endangered, and Sensitive Aquatic Species

Timber harvest and road construction activities could impact the quantity and quality of water resources in the Muddy, Twelvemile, Sixmile, and Ferron Creek watersheds. These watersheds also include the following lakes and reservoirs: Ferron, Duck Fork, Emery, Spinnens, Emerlad, Blue, Henningson, Slide, Island, WPA Ponds, Shingle Mill, Deeps, Three Lakes, Oleys, Rush Pond, and Six Mile Ponds.

Surface water resources could be depleted or diverted by timber harvest and road construction activities. Timber harvesting activities could impact water quality in terms of increased sedimentation, stream temperature, and impacts to water chemistry. Aquatic habitat and species such as cutthroat trout, amphibians, and macroinvertebrates are dependent on water quantity, water quality, and functioning, healthy wetland and riparian systems. Large woody debris is one component of a healthy riparian/perennial water system.

Evaluation Criteria

Quantity

- Changes in water yield by subwatershed.

Quality

- Surface water sources affected.
- Chance of contaminate introduced.
- Acres of vegetation disturbed by skid trails, number of landings, and roads.
- Sediment yield modeled; amounts, when, where, duration?
- Meets State of Utah Water Quality law

Riparian, Wetlands, Floodplains

- Acres of riparian management area (RPN) disturbed.
- Acres of floodplain disturbed.
- Occurrences of new road and major reconstruction across RPN areas and floodplains.
- Acres of wetland area disturbed.
- Meets Forest Plan riparian, wetland, and floodplain standards

CHAPTER 2

CHAPTER 2

Aquatic Habitat

- Meets Forest Plan riparian, wetlands, and floodplains standards
- Manage stream habitat to a least 50 percent of potential where self-sustaining fisheries occur.

Threatened and Endangered Species, Sensitive Aquatic Species

No threatened, endangered species, or sensitive aquatic species occur within the project area. Fish of the Colorado river may be impacted.

- Habitat disturbed.

Forest Health, Diversity, and Productivity; Rangeland Vegetation; Noxious Weeds; and Threatened, Endangered, and Sensitive Terrestrial Plant Species

The proposed action applies some integrated pest management strategies but some thought the Forest Service should be more aggressive and proactive regarding the beetle epidemic and apply additional strategies. The primary objective would be to try and disrupt beetle population dynamics and reduce spread rates on selected sites, thereby reducing spruce mortality and maintaining sustainable wood products over time. Harvesting the high risk, green spruce component in currently unaffected, green spruce stands would reduce basal area, decrease average stand diameter, and improve stand diversity. This strategy may increase stand resistance to beetle attack by increasing tree vigor and decreasing stand susceptibility.

Construction equipment may carry in noxious weed seed from other areas, or enhance the spread of existing populations. Noxious weeds may become easily established on disturbed sites.

Evaluation Criteria

Forest health, diversity, and productivity;

- Stand resistance to Spruce beetle attack. Compare acres of spruce treated by alternative. Compare changes in the risk classification developed by Schmid and Frye.
- Compare trend of Periodic Annual Increment of growth with Mean Annual Increment.
- Compare trends in vegetative diversity.

Rangeland vegetation; noxious weeds;

- Change in spread or establishment of noxious weeds.

Threatened, endangered, and sensitive plant species [Astragalus montii (Endangered), Eriogonum carringtonia (Sensitive), Silene petersonii (Sensitive), Senecio musiniensis (Sensitive)].

- Acres disturbed of existing population sites and disturbance of habitat.

Fuel Loading and Fire Risk

Mortality of Engelmann spruce and activities associated with harvesting will increase dead and down fuels within the area. The potential risk of an unmanageable fire occurring may increase proportionately to increased fuel loading.
CHAPTER 2

Evaluation Criteria

- Increase of fuels over time by location, tons/acre.
- Risk rating based on fuels photo guide, rate of spread, intensity.

Elk, Deer, and Neotropical Migratory Birds; Management Indicator Species; and Threatened, Endangered, and Sensitive Terrestrial Animal Species

Timber harvesting and road construction activities may alter the habitat, behavior, and local populations of deer, elk, blue grouse, golden eagles, tree cavity dependent species, and neotropical migratory birds.

Evaluation Criteria

Wildlife

- Acres of habitat impacted.
- Changes in road densities affecting deer and elk vulnerability and use of available habitat.
- Amount of wintering habitat (fir trees) disturbed and amount of edge habitat between sage and open forest vegetation maintained for blue grouse.
- Number of golden eagle nest sites disturbed.

Threatened, Endangered, and Sensitive Wildlife Species

No threatened or endangered species occur within the project area. Sensitive species include Goshawk, Flammulated Owl, Three Toed Woodpecker, Spotted Bat, and Townsend's Big-Eared Bat.

- Goshawk - Acres of suitable habitat impacted by harvest activities.
- Flammulated Owl - Acres of disturbance in conifer stands on steep slopes and ridge tops.
- Three Toed Woodpecker - Amount of forest vegetation (foraging) removed or lost due to the insect epidemic. Number of snags (nesting) remaining per unit area.
- Spotted Bat and Townsend’s Big-Eared Bat - Potential of impact to roosting sites.

Transportation System, Visitor Safety, Access, and Travel Delays

Timber harvest activities will require road construction, reconstruction, and reconditioning, which may impact forest users’ safety, access, and travel times. For roads needing surfacing, aggregate will be obtained from off-Forest sources, existing Forest sources, or from sites in the area not yet developed. If existing Forest sources are used, NEPA analysis will be reviewed and updated as needed. If new aggregate sources are developed, a NEPA analysis will be conducted on those sites. Traffic related to the harvest and road work activities could conflict with recreational traffic, especially during hunting seasons and holidays on the following system roads: 50013, 50022, 50043, 50024, 50047, 50049, 50150, 50151, 50161, 50169, 50270, 51170, 52062, 52069.

Evaluation Criteria

Transportation System

- Miles of new and reconstructed road by alternative.
- Miles of reclamed road by alternative.

CHANGES IN ROAD DENSITY (MILES PER SQUARE MILE)

User Safety

- Vehicies per day: current and projected.
- Dates of road use proposed compared to opening season dates for elk and deer hunting and holidays.

User Access

- Compare miles of existing road to miles of road following alternative completion.

User Travel Times

- Increase in travel time due to more vehicles using the road, construction delay locations, length of average delay.

Range Allotments and Improvements

Conflicts of use and impacts to existing range improvements, such as spring improvements and fences.

Evaluation Criteria

- Potentially affected use areas, access corridors, and season of use.
- Acres of suitable rangeland restricted for timber regeneration purposes and duration of restriction.
- Improvements affected.

Visual Landscape

The spruce component, averaging about 70 percent of the mixed conifer forest visual landscape is currently changing from green to red and grey as the beetles attack and cause tree mortality within the green spruce component. Timber harvesting and road construction activities will alter present landscapes and the visitors experience as seen from scenic road corridors, developed recreation areas, campgrounds, lakes, and reservoirs.

Evaluation Criteria

- Compare the predicted visual condition by alternative to Forest Plan standards.

Roadless Character

Road construction associated with the timber harvest activities may impact inventoried roadless areas and the roadless characteristics (Natural Integrity, apparent naturalness, remoteness, solitude, special features, and manageability/boundary element).

Evaluation Criteria

- Compare the acres of inventoried roadless area impacted by timber harvest and road building activities in relationship to natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability.
CHAPTER 2

Cultural Resources

The harvesting of timber and associated activities could potentially affect cultural resources. Sufficient information is available to reliably identify areas most likely to contain significant archaeological and historical properties and evaluate impacts using a predictive model.

Evaluation Criteria:

- Acres of high potential for containing prehistoric sites disturbed by alternative.
- Number of expected prehistoric sites within treatment units.
- Number of expected historic sites within treatment units.
- Number of significant sites affected.
- Compliance with appropriate federal historic sites protection, mitigation, and consultation guidelines as mandated.

Economics

Timber harvesting and associated activities may effect the economies of local communities and contribute to the national treasury.

Evaluation Criteria:

- Projected annual employment based on volume by alternative.
- Dollars generated.
- Payment in lieu of taxes to Counties (Sanpete and Sevier)
- A present net value, benefit/cost ratio analysis by alternative.

Energy

Disclosure of energy consumption by alternative is required under the National Environmental Policy Act (40 CFR 1502.16).

Evaluation Criteria:

- Millions of british thermal units consumed per thousand board feet harvested (MMBTU/MBF) by alternative.
- Input vs output (MMBTU per year)

2.2 SIGNIFICANT ISSUES

The following significant issues (40 CFR 1500.4 (d), FSH 1909.15 12.3) were used by the interdisciplinary team to develop alternatives to the proposed action and develop measures to mitigate and/or monitor anticipated environmental effects.

- What will be the effects of timber harvest and road construction on forest health, diversity, and productivity? (See Issue at 2.1.5)

The proposed action did not reduce the susceptibility of currently uninfested spruce stands to spruce beetle attack, so additional integrated pest management strategies should be considered. The proposed action did not reduce the susceptibility of dead and currently uninfested spruce stands to unmanageable fire across the landscape; especially on steeper slopes, so additional fuel reduction strategies should be considered. Strategies could include basal area reductions and adjusting conifer composition ratios in currently uninfested forest stands, on steep and gentle terrain, through thinning harvest of green spruce (sanitation salvage) and salvage of dead spruce on steep terrain.

- What will be the effects of timber harvest and road construction on the roadless character? (See Issue at 2.1.11)

The proposed action enters into inventoried roadless areas and may affect the natural integrity, apparent naturalness, remoteness, solitude, special features, and boundary relationship characteristics. Actions to address the issue could preclude entry into the inventoried roadless areas.

2.3 ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY

Potential alternatives to the proposed action were identified, considered, and some eliminated from detailed study. These alternatives are described below along with a discussion explaining why the alternatives were not considered further.

- Seven alternative concepts were considered in 1993 and early 1994 but not given detailed study in this analysis. These alternatives focused on potential salvage harvest sites and how to schedule salvage harvest activities. None of the alternatives were linked to significant issues. As a result they would not provide a reasonable range of alternatives nor a reasonable range of effects addressing the approved significant issues.

- An alternative excluded road construction in inventoried roadless areas and permitted the use of helicopter logging in roadless areas. Based on recent case law it was felt this alternative may not sharply define the roadless issue and effects on roadless characteristics.

- An alternative, similar to Alternative 3, addressing the forest health issue was considered using cable yarding systems instead of helicopter yarding systems on slopes greater than 40 percent. Although there are areas suitable for cable yarding within the project boundary and cable yarding methods are more cost efficient than helicopter yarding methods, cable yarding was not considered in detail because preliminary estimates of potential adverse effects, including economic effects, created by road building on steep, unstable slopes were initially predicted to be greater than desired.

2.4 DESCRIPTION OF ALTERNATIVES CONSIDERED IN DETAIL

A no action alternative and three action alternatives were developed to provide a full range of reasonable alternatives that sharply define one or more of the significant issues. Some of the alternatives attempt to examine methods which lessen impacts on the environment and still achieve at least part of the purpose and need. Alternatives include mitigation and monitoring to address issues and anticipated environmental effects.

Alternative 1 - No Action

Alternative 1 addresses the need to provide a "No Action" alternative (40 CFR 1502.14). Alternative 1 would not commercially harvest, remove, or destroy spruce beetle infested trees in the project area.
CHAPTER 2

No other treatments to suppress or reduce spruce beetle activity, such as chemosterilant baiting and trap trees would be implemented. No treatments to reduce fuel loading would be implemented. No roads would be constructed, reconstructed, closed, or rehabilitated related to this proposal. Reforestation would be through natural processes.

Chemical spraying to suppress or reduce spruce beetle activity in, and surrounding, high value recreation areas would continue under separate analyses and decisions. Current management would continue along roads for fuelwood, post and poles, and trees through the small sales program. No mitigation measures or monitoring would be required as part of this alternative other than meeting Forest Plan direction, standards, and guidelines.

Alternative 2 - Proposed Action

Alternative 2 meets the purpose and need by providing a supply of timber to help satisfy local, regional, and national demands for timber products, recouping value from timber killed by spruce beetles, and by reducing fuel loading. Table 2.1 displays activities or component features of Alternative 2. For analysis purposes, treatment units displayed in Table 2.1 were aggregated together into reasonable groups to provide a reasonable spacial and temporal framework upon which to base the effects analysis. These groups do not necessarily represent the number or size of future timber sales. Timber sales will be developed based on many factors including volume locations, economics, harvest methods, road construction requirements, etc. Figure 2.1 displays spatial relationships of the activities proposed in Alternative 2. Figure 2.2 displays treatment unit locations compared to inventoried roadless area locations for Alternative 2.

Integrated Pest Management Activities

Alternative 2 would implement salvage harvest of dead and dying Engelmann spruce trees within spruce-fir stands. Although some beetles will be removed when infested trees are salvage harvested, these reductions will have little effect on the overall beetle populations due to the outbreak populations found throughout the affected area. Reducing stand susceptibility to beetle attack is not addressed under this alternative.

Alternative 2 includes chemical spraying to protect high value trees from beetle attack in developed and dispersed recreation areas and administrative sites identified in the Forest Plan.

Commercial Treatment Activities

Harvest of dead and dying trees on slopes less than 40 percent using ground-based logging systems including, but are not limited to, tractor, rubber tired skidders, etc. would begin in treatment units A and proceed south toward unit D. Concurrently, we anticipate susceptible spruce in units E, F, and G will eventually be attacked and killed by spruce beetles. Harvest of dead and dying trees in Units E, F, and G would proceed once beetle induced mortality has occurred. Salvage harvesting will remove, as practicable, the recently infested, dying trees first to remove beetles and maintain higher economic values, then remove the dead trees.

Alternative 2 would implement timber salvage across approximately 5,640 acres. Alternative 2 could take a total of 16 operating seasons staggered across six calendar years to implement. The normal operating season for this activity would be July 1 to October 1. About 52.5 million board feet would be harvested.
### ACTIVITY

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<th>B1-4, D1, D3-4</th>
<th>D2, D4-5</th>
<th>E1-3, F1-2, G1, G3-4</th>
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<th>NA</th>
<th>NA</th>
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<td>2,091</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>5,640</td>
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<td>NA</td>
<td>NA</td>
<td>16 operating seasons staggered across 6 years</td>
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<td>972</td>
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<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
</tr>
<tr>
<td>ROADS (mi)</td>
<td>New Construction</td>
<td>8.6</td>
<td>5.3</td>
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<td>5.9</td>
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<td>NA</td>
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<td>737</td>
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<td>153</td>
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<td></td>
<td>Gopher Control</td>
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<td>285</td>
<td>173</td>
<td>168</td>
<td>NA</td>
<td>NA</td>
<td>1,188</td>
</tr>
</tbody>
</table>

South Manti Timber Salvage Sales EA, Page 2 - 10
Alternative 2

LEGEND

- Gravel Pits
- Helipads (none present)
- Existing Roads
- New Roads

Treatment Unit Number
Ground-based Logging

1 0 1 Miles

South Manti Timber Salvage Sales EA, Page 2 - 11

Roadless Areas
Alternative 2

Black Mtn
Big Bear Canyon
Heliotrope
Twelve Mile
Muddy Crk - Nelson Mtn
White Mtn

1 0 1 2 3 Miles

South Manti Timber Salvage Sales EA, Page 2 - 12
CHAPTER 2

Alternative 3

In addition to those issues and strategies addressed in Alternative 2, Alternative 3 specifically focuses on concerns identified in Issue 5 (Forest Health, diversity, and productivity). Alternative 3 emphasizes application of additional, preventative integrated pest management strategies along the advancing epidemic front designed to reduce host susceptibility to beetle attack in currently uninfested spruce-fir stands and to further reduce fuel loading on steep terrain.

The strategies proposed in Alternative 3 have effectively reduced mortality associated with mountain pine beetle in lodgepole and ponderosa pine stands (Schmitz et al, 1989, Gibson, 1988, and Schmid and Mita, 1992). Similar approaches have been used on much smaller outbreak beetle populations with excellent results. We understand this approach can not assure success given the magnitude of the beetle epidemic however we believe the proposed activities will have a reasonable chance of success to reduce beetle induced mortality in treated sites based on previous experience with other bark beetles and cited literature.

This approach represents an attempt at adaptive management in collaboration with Forest Service research scientists. We anticipate Alternative 3 will maintain long-term forest age and species diversity, reduce fire hazard, and lead to a forest that is less susceptible to beetle attack. Table 2.2 displays activities or component features of Alternative 3. For analysis purposes, treatment units displayed in Table 2.2 were aggregated together into reasonable groups to provide a reasonable spatial and temporal framework upon which to base the effects analysis. These groups do not necessarily represent the number or size of future timber sales. Timber sales will be developed based on many factors including volume locations, economics, harvest methods, road construction requirements etc. Figure 2.3 displays spacial relationships of the activities proposed in Alternative 3. Figure 2.4 displays treatment unit locations compared to inventoried roadless area locations for Alternative 3.

Integrated Pest Management Activities

In addition to those IPM strategies addressed in Alternative 2, Alternative 3 will attempt to reduce stand susceptibility by using integrated pest management treatments across a large contiguous landscape of currently uninfested, green spruce stands. Alternative 3 will implement sanitation harvesting of high risk trees through thinning or individual tree selection in green, currently uninfested spruce-fir stands along the advancing epidemic front to reduce risk and subsequent losses of the spruce vegetative component within treated areas. Guidelines for minimizing spruce beetle populations in logging residuals (Schmid, 1977) will be implemented. Follow-up monitoring and future salvage harvest will occur, as required, in and around green stands to remove spruce trees infested following previous sanitation activities. Follow-up salvage activities will attempt to remove brood populations by removing infested trees, thus attempting to reduce additional future tree mortality within treated areas.

Treatments to suppress or reduce spruce beetle activity, such as pheromone baiting and trap trees, would be implemented. Wherever possible trap sites would be located in accessible areas where infested trees can be removed with scheduled harvest activities, where scenic quality objectives can be maintained, and where replacement seedling, suppling, or pole size trees are available to replace large diameter trees sacrificed to contain and localize beetle infestations.

Commercial Treatment Activities

In addition to those activities proposed in Alternative 2, Alternative 3 provides for helicopter logging in stands which are not loggable due to ground conditions or because slopes are greater than 40%, About 31.3 MMBF of live, uninfested spruce and 63.2 MMBF of currently infested, dead spruce would be harvested across 10,212 acres and offered for sale. Alternative 3 could take a total of 21 operating seasons (July through October) staggered across nine calendar years to complete.

Transportation

Same as Alternative 2 except approximately 19 miles of system road and 10 miles of non-system road would be reconstructed. Alternative 3 would require additional log deck ing areas and operations pads to support salvage activities. Helicopter landing areas would be stabilized and reseeded when management activities have finished. For roads needing surfacing, aggregate will be obtained from off-Forest sources, existing Forest sources, or from sites in the area not yet developed. If existing Forest sources are used, NEPA analysis will be reviewed and updated as needed. If new aggregate sources are developed, a NEPA analysis will be conducted on those sites. (Figure 2.3).

Fifteen miles of road used in support of timber management activities would be reclaimed. This would include any reconstructed non-system road or newly constructed road not needed for future management of forest resources. This also includes system road #50136 and a segment of #51170. Separate from the project roads, an additional 19 miles of non-project roads, not needed for future resource management activities, would be reclaimed adjacent to the, treatment area as funding becomes available, for this reclamation work.

Post-Harvest Reforestation

No change from Alternative 2 except more acres would be treated to achieve reforestation objectives.
### TABLE 2.2
Summary of Alternative 3

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>TREATMENT UNITS</th>
<th>ALTERNATIVE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E1-4</td>
<td>F1-3</td>
</tr>
<tr>
<td>TIMING (Seasons)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>VOLUME (mmbf)</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Dead/Dying</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Live</td>
<td>1.7</td>
<td>10.2</td>
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<tr>
<td>Total</td>
<td>1.6</td>
<td>12.1</td>
</tr>
<tr>
<td>LOGGING SYSTEM (ac)</td>
<td>595</td>
<td>635</td>
</tr>
<tr>
<td>Ground-Based</td>
<td>1,137</td>
<td>1,286</td>
</tr>
<tr>
<td>Helicopter</td>
<td>595</td>
<td>635</td>
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<tr>
<td>ROADS (mi)</td>
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<tr>
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<td>Reclamation (Project)</td>
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<td>Gopher Control</td>
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</table>

Note: The data includes specific activities and their respective units for each alternative, with totals across the seasons. The table highlights the distribution and comparison of activities such as treatments, volumes, logging systems, roads, and reforestation efforts.
CHAPTER 2

Alternative 4

Alternative 4 responds directly to Issue 11 (Roadless Character). Alternative 4 maintains current characteristics in lands inventoried as roadless as compared to Alternative 3 and Alternative 2. Timber harvest and supporting road activities that lie within inventoried roadless areas are removed from consideration under this alternative. Table 2.3 displays activities or component features of Alternative 4. For analysis purposes, treatment units displayed in Table 2.3 were aggregated together into reasonable groups to provide a reasonable spacial and temporal framework upon which to base the effects analysis. These groups do not necessarily represent the number or size of future timber sales. Timber sales will be developed based on many factors including volume locations, economics, harvest methods, road construction requirements etc. Figure 2.5 displays spacial relationships of the activities proposed in Alternative 4. Figure 2.6 displays treatment unit locations compared to inventoried roadless area locations for Alternative 4.

Integrated Pest Management Activities

Same as Alternative 3 except Alternative 4 would treat fewer acres.

Commercial Treatment Activities

Alternative 4 removes timber stands that lie within inventoried roadless areas from consideration under this alternative. About 14.8 MMBF of live, uninfested spruce and 46.9 MMBF of currently infested, dead spruce would be harvested covering 6,861 acres and offered for sale. Alternative 4 could take a total of 10 operating seasons (July through October) staggered across six calendar years to implement.

Transportation

Same as Alternative 2 except treatment units D4, D5, and E1 with harvest potential outside inventoried roadless areas require construction or reconstruction of alternate access routes. 18 miles of system roads and 9 miles of non-system roads would be reconstructed. 17 miles of new road would be constructed. For roads needing surfacing, aggregate will be obtained from off-Forest sources, existing Forest sources, or from sites in the area not yet developed. If existing Forest sources are used, NEPA analysis will be reviewed and updated as needed. If new aggregate sources are developed, a NEPA analysis will be conducted on those sites. (Figure 2.5).

Thirteen miles of roads used in support of timber management activities would be reclaimed. This would include any reconstructed non-system road or newly constructed road not needed for future management of forest resources. This also includes system road #50136 and a segment of #51170. Separate from the project roads, an additional 19 miles of non-project roads, not needed for future resource management activities, would be reclaimed adjacent to, the treatment area, as funding becomes available, for this reclamation work.

Post-Harvest Reforestation

No change from Alternative 3 except fewer acres will be reforested because fewer acres will be harvested.
# CHAPTER 2

## TABLE 2.3
Summary of Alternative 4

<table>
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<tr>
<th>ACTIVITY</th>
<th>TREATMENT UNITS</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>ALTERNATIVE TOTAL</th>
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<td>G1,3,4</td>
<td>A1,11, C1,3</td>
<td>C4,8, F1,2,4,5</td>
<td>B1-4, D1,3,4</td>
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<td>NA</td>
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<tr>
<td>VOLUME (mmbf)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dead/Dying</td>
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<td>13.7</td>
<td>9.5</td>
<td>15.3</td>
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<td>13.7</td>
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<td>15.3</td>
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<td></td>
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<tr>
<td>New Construction</td>
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<td>0.9</td>
<td>5.2</td>
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<td>7.4</td>
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<td>0.0</td>
<td>5.0</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
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<td>REFORESTATION (ac)</td>
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<td></td>
<td></td>
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<td>252</td>
<td>277</td>
<td>315</td>
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<td>NA</td>
</tr>
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<td>176</td>
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<td>418</td>
<td>242</td>
<td>384</td>
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<td>480</td>
<td>267</td>
<td>401</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
CHAPTER 2
FIGURE 2.5

Alternative 4

LEGEND

Gravel Pits

Helipads

Existing Roads

New Roads

Helicopter Logging

Treatment Unit Number

Ground-based Logging

CHAPTER 2
FIGURE 2.6

Roadless Areas
Alternative 4

PROJECT BOUNDARY
TREATMENT UNITS
ROADLESS AREAS
CHAPTER 2

2.5 DESIGN FEATURES COMMON TO ALL ACTION ALTERNATIVES

The action alternatives evaluated include direction provided by the Forest Plan. All applicable forest-wide and management area goals, direction, and standards and guidelines described in the Forest Plan are incorporated into the design of this project. Design features were grouped to address the fourteen resource issues with the intent to mitigate or lessen anticipated environmental effects. Monitoring to address the fourteen resource issues is presented in this section and in Appendix A.3.

Land Stability

- Complete appropriate order of geologic inventory and, as appropriate, geotechnical investigations in areas where proposed activities or uses could be endangered by geologically related hazards such as land instability, earthquakes, subsidence and/or increase risks of subsidence, land instability, ground water pollution, or diversion. (FP, III-34)

- Assure that appropriate geotechnical and/or geologic data are included in design and construction of facilities, or other developments, so as to minimize the potential of inducing failure. (FP, III-34)

- Avoid, where practicable, construction of new roads and staging areas on lands with slopes greater than 40%, lands classified unstable or moderately unstable, and on known landslides. Where avoidance is not practicable, locate and design facilities to minimize landslide risk.

- Minimize the harvest of green trees within 100 feet of roads within unstable areas.

Monitoring

- Monitor identified geologic hazards for effects from management activities. (FP, III-34)

Soil Erosion and Productivity

- Maintain soil erosion losses at or below soil loss tolerance values as defined by the Soil Conservation Service as modified by the Forest Service. (FP, III-32)

- Add mulch, fertilizer, and other soil amendments as necessary to reduce soil erosion and increase vegetative growth. (FP, III-32)

- Design continuing mitigation or rest rotation practices and followup maintenance activities to insure that vegetative ground cover exceeds 80 percent of adjacent similar undisturbed sites. (FP, III-32)

- Use appropriate design guides for sediment controlling structures (FP, III-32).

- An erosion and sediment control plan will be prepared for all sales as prescribed in the Soil and Water conservation practices Handbook and the standard timber sale stipulations (CT 6.6). During harvest operations the timber operator shall maintain seasonal erosion control structures.

- Restrict skidding and hauling operations on soils and roads during intermittent storm events. (The usual operating season is July 1 through October 1). Generally, soils are too wet when equipment creates 6" ruts. Aggregate surfaced roads are too wet when ruts are 2"; 3" for native surfaced roads. Revegetate disturbed sites within one season after termination of the activity.

- Coverage of 10-15 tons per acre of woody debris is recommended to maintain soil productivity. Use C(T)6.73# - Recruitment Of Large Woody Debris to assure retention of large woody material. Large
woody material would be defined as being greater than three inches in diameter. Engelmann Spruce would not be used unless the material is from a tree that has been dead for more than two years and no Engelmann Spruce bark beetle larvae are in the bark’s cambium layer. The materials should be evenly distributed over the area and at least twenty-five percent of the material should be greater than ten inches in diameter. It is desirable to have the materials in varying degrees of decomposition.

- Apply best management practices (BMP’s) or soil and water conservation practices (SWCP’s) (Appendix A.2) to all road construction and timber sale activities. Forest Service Handbook 2C09.22, Soil and Water Conservation Practices, lists these practices.
- Maintain annual soil erosion at less than 3 tons per acre per year. Measuring soil erosion in tons per acre is not practical. The Forest assumes successful implementation of appropriate BMP’s will maintain soil erosion within standards.

Air Quality
- The Memorandum of Understanding (signed by the Forest Service June 6, 1988) with the State of Utah Air Conservation Committee will be implemented. The Forest assumes successful implementation of the MOU provisions will maintain air quality within applicable State and Federal regulations.
- A burn plan will be prepared prior to prescribed fires. The Forest Service will obtain open burning permits, as required by the Utah Air Conservation Commission, within the provisions of the State-wide Clearing Index for atmospheric dispersion.

Water Quantity and Quality; Riparian/Wetlands; Floodplains; Aquatic Habitat; and Threatened, Endangered, and Sensitive Aquatic Species

Quantity
- Protect water developments (diversion ditches, data stations, stock tanks, etc.).
- Water use must comply with applicable water laws.

Quality
- Apply BMP’s as specified in FSH 2509.22 and in the Memorandum of Understanding between the Division of Water Quality, Utah Department of Environmental Quality, the Utah Department of Agriculture and the U.S. Department of Agriculture Dated 12/11/92 to protect water quality. The implementation of the provisions of these documents will assure that this activity will comply with the applicable water quality protection regulations.
- Prior to preparation of the timber sale contract, an Interdisciplinary Team (IDT) and presale forester will visit the sale and prescribe site specific Soil and Water Conservation Practices that will be included in each sale contract.

Monitoring
- A hydrologist, soil scientist, engineer and presale forester will monitor sale implementation to determine if the prescribed BMP’s were implemented and effective in protecting water quality (Appendix A.2 and A.3).
CHAPTER 2

Aquatic Habitat

- Macroinvertebrates: The diversity index DAT (DAT combines measurements of the number of taxa and biomass as an indication of diversity) will be maintained at or above 11, the standing crop at or above 1.6, and the biotic condition index at or above 75 (FP, III-22).

- Prior to contract, all perennial streams crossed by proposed roads will be reviewed by an IDT to determine appropriate fish passage structures.

- Manage stream habitat to at least 50% of potential where existing self-sustaining fisheries occur (FP, III-22).

Monitoring

- Prior to project implementation, baseline aquatic habitat surveys will be conducted to assess habitat condition using Region 1/Region 4 basin-wide inventory procedures (USFS Intermountain Research Station, 1995). Highest priority drainages for these assessments will be the Duck Fork, Lake Fork, and Indian Creek. Portions of the Upper Muddy Creek, Sixmile Creek, and Twelvemile Creek drainages will be inventoried as resources allow (Appendix A.3).

- Macroinvertebrate monitoring stations and sampling schedules will be established by the fisheries biologist and hydrologist to monitor the effects of implementing the selected alternative. Baseline invertebrate samples will be taken prior to any project implementation.

- Threatened, Endangered, and Sensitive Aquatic Species.

- Where activities or uses may impact threatened or endangered species or their habitats, initiate consultation procedures. Include the results of consultation in determining the viability of the activity or use.

Forest Health, Diversity, and Productivity; Rangeland Vegetation; Noxious Weeds; and Threatened, Endangered, and Sensitive Terrestrial Plant Species

- Timber sale contracts will be developed using the Intermountain Region’s approved C(T) provisions for 2400-6(T) contracts and Special Provisions for 2400-3(T) contracts. Other permits that may be used are the Forest Product Permit (2400-14), fuelwood permit, free-use permit, and administrative use permit.

- Locations for temporary roads, log landings, and skid trails would be approved as specified in the timber sale contract provisions. Generally, log landings for ground-based operations would be located along harvest access roads every 1/8th to 1/4th mile. Log landing and decking areas would likely be less than 1/2 acre in size for ground-based harvest areas and less than 2 acres in size for helicopter harvest units.

- Special Provisions CT6.401#: Timing and Removal Of Trees and CT6.429#: Skidding And Yarding To Reduce Insect Hazard would be used to control timing of the removal of live Engelmann spruce trees and setting minimum piece sizes that will require removal.

- Special Provisions CT6.410#: Felling And Bucking, CT6.411#: Directional Felling, CT6.425#: Tractor Or Rubber Tired Skidding Restrictions, CT6.426#: Tractor Restrictions, and CT6.428#: -

CHAPTER 2

Maximum Product Length For Skidding And Yarding would be included in the timber sale contract to provide protection measures for live residual tree stands.

- Special Provision CT6.242#: Forwarding would be used where resource considerations such as soil compaction and road density require the use of log forwarders.

- Special operation instructions to close and stabilize temporary work roads, skid trails, and landings will be listed in the following C(T) provisions.

- C(T)6.6#: Erosion Prevention And Control. Under this provision list:
  1. Cross ditches as specified in CT6.601#: Diagrams And Specifications For Cross-Ditch Construction. Use Form R4-2400-36 for diagram.
  2. Outslopeing and berm removal as specified in C(T)6.603#: Specifications For Outslopeing and Berm Removal (Machine Construction). Location of work will be designated on the ground by flagging.
  3. Erosion control seeding as specified in C(T)6.607#: Erosion Control Seeding. The seed mixture must be certified to have a minimum of 90% pure live seed (PLS) and a maximum of 1% weeds, none of which are noxious. Apply seed at the rate of 9 pounds per acre or heavier to the disturbed sites that are most likely to produce runoff and soil loss. Sites likely to produce runoff or lose soil may be lightly seeded with 2.4 pounds per acre.
  4. Scarification as specified in C(T)6.609#: Scarification Of Temporary Roads And Landings. Minimum scarification depth shall be 6 inches.
  5. Other erosion control requirements will be implemented as required to meet individual stand or road conditions or needs (i.e. water retention dams, hand constructed water bars, hand constructed cross-ditches, hand constructed brush dams, seeding of specified roads).

- Special operation instructions for slash disposal will be listed in Provision C(T)6.7#: Slash Disposal.
  1. Purchaser shall machine pile landings, top limbs and tops to a 3 inch DBH (Diameter Inside Bark), and top and scatter logging slash through all cutting units so slash depths are no more than 18 inches high.
  2. Other C(T)6.7#: slash disposal requirements will be implemented as required to meet individual stand or road construction conditions or needs, and will be prescribed by the Silviculturist or Engineer (i.e. construction of firelines, slash piling other than landings, chipping, bury slash, fell damaged trees, fell or push over residual stands, firebreaks, Purchaser burn slash, construct slash free strips by dozer along contour lines, disposal of peeling residues, scatter slash away from leave trees that are 8 inches DBH (Diameter Breast Height) and larger.

- No firewood gathering in harvest areas during contract operations.

- Include CT6.25#: Protection of Habitat of Endangered Species, CT6.24#: Protect Cultural Resources.

- Prescribed precommercial thinning activities will be implemented to improve stand health, promote diameter and crown growth and development, improve species diversity and distribution, reduce encroachment of less desirable species on desirable species (Aspen, Engelmann spruce, Douglas-fir, and Limber pine), and meet short and long-term resource objectives.

- Reforestation activities will be prescribed and monitored by a Silviculturist.

- Reforestation of harvest areas will be accomplished by natural regeneration, or by hand planting 3-year old bareroot seedlings or 1-year old containerized seedlings grown from seed collected from

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appropriate seed sources. Site preparation tools for reforestation activities will include machine scarification, hand scarification, and fire.

- Ten to fifteen tons per acre of large (> 3") woody debris will be maintained on site to protect soil productivity, and to provide microsite protection for seedling establishment and protection.

- Where site conditions allow, reforestation stocking objectives will meet or exceed Forest Plan stocking standards. (FP, III-27)

- Reforestation (plantation) investments will be protected. FSH 2409.26b (6.04-Responsibility) states that "A decision to regenerate any vegetation manipulation project is also a decision to protect the investment." In accordance with this, potential plantations will be reviewed by a Silviculturist. After coordination with appropriate range or wildlife management personnel, prescriptions will be implemented which provide appropriate protection of investments. Plantation protection and/or monitoring activities will continue until stated silvicultural objectives are met (FSH 2409.26b, 6.31 - Protection).

- Appropriate protection activities may include exclusion of livestock from plantations through fencing or allotment administration (rest rotation, closure, herding practices, or salt placement), or strychnine baiting of burrows to reduce pocket gopher populations.

- Plan these work projects in the Sale Area Improvement Plan (KV (Knutson-Vandenbarg)) and collect revegetation to complete the work where possible. IF KV funds are not available, projects will be programmed and funded using appropriated funds. Annual maintenance and removal of protection structures (i.e. fences) will be included in the funding process.

- Native plant species and species which discourage pocket gopher activity are preferred for revegetating plantings, skid roads, temporary roads, or other disturbed areas. Species composition, including tree species in the Range management units, will be reviewed by silviculturists, vegetation management specialists, and wildlife biologists to determine appropriate species mixes.

Rangeland Vegetation; Noxious Weeds;
- Control noxious weeds. (FP, III-25)
- Special Provision CT6.26# - Noxious Weed Control will be used to prevent the potential spread of noxious weeds into harvest units. Timber purchasers would be required to furnish proof of weed-free equipment. If available, KV funds would be collected to treat any noxious weeds that may invade disturbed areas following operations.

Monitoring
- A monitoring program to document any increase in noxious weed populations will be implemented along the system roads leading to the timber sale area and within the timber sale area. Monitoring and treatment work would be included in the sale area improvement plan (Appendix A.3).

Threatened, Endangered, and Sensitive Plant Species [Astragalus montii (Endangered), Erigeron carringtonae (Sensitive), Silene petersonii (Sensitive), Senecio musiniensis (Sensitive)].

- Where activities or uses may impact threatened or endangered species or their habitats, initiate consultation procedures. Include the results of consultation in determining the viability of the activity or use.

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Fuel Loading and Fire Risk
- Slash, substandard, and cur material left at landings would be piled or scattered by the timber purchaser. Areas of heavy slash concentrations throughout the units would be machine and/or hand piled. These piles would be burned by Forest Service personnel. Deposits needed to complete this work would be collected through the brush disposal plan.

Elk, Deer, and Neotropical Migratory Birds; Management Indicator Species; and Threatened, Endangered, and Sensitive Wildlife Species

Wildlife
- Maintain adequate elk hiding cover. In elk calving areas (primarily aspen), and to re-establish security cover where needed (primarily in conifer sites) to reduce vulnerability to hunting (FP, III-19).
- Promote Aspen to provide forage and cover for wildlife (FP, III-23, 29).
- Across the project area, maintain a forage cover ratio of 50-to-55. Foraging areas are composed primarily of openings and aspen while areas of cover are primarily forested (both conifers and aspen) (FP, III-19).
- Maintain and/or improve habitat suitable for blue grouse to provide a mix of 10% breeding, 20% brood rearing, 40% feeding and 30% wintering (FP, III-20).
- Manage vegetative composition (habitat diversity) across the project area to maintain at least 50% of current (current when the Forest Plan was approved) habitat for existing and approved introduced wildlife species (FP, III-22).
- Provide two logs per acre within the project area (FP, III-22). Minimum log size of 10 inches in diameter on the large end and 8 feet in length
- Retain slash on at least 10 percent of the area (FP, III-22).
- Maintain 90 snags pe. 100 acres in the project area (FP, III-22).
- Wildlife snag trees will be identified and off limits to firewood harvest.
- Firewood harvest will be limited to dead and down trees and will be permitted only in designated areas.

Threatened and Endangered Wildlife Species
- Where activities or uses may impact threatened or endangered species or their habitats, initiate consultation procedures. This will be accomplished by writing a biological analysis to analyze potential impacts to threatened and endangered species. All activities will be conducted using recommendations provided by the biological analysis.

Sensitive Species (Goshawk, Flammulated Owl, Three Toed Woodpecker, Spotted Bat, and Townsend’s Big-Eared Bat)
- Goshawk - Manage for at least six 30-acre nest sites within each identified nesting territory. Surveys for new nesting territories will be conducted in areas of suitable habitat the year prior to each sale.

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- Flammulated Owl - Along ridge tops and at mid-slope on south or east aspects in areas containing Douglas-fir mixed with spruce and/ or aspen manage for the retention of all large snags containing cavities. In these same areas retain small pockets of dense vegetation.

- Three Toed Woodpecker - Retain 90 snags per 100 acres, in a variety of size classes; and retain all trees with cavities.

- Spotted Bat - Manage for vegetative diversity across the landscape. Inventory limestone cliffs, mines, or caves where impacts may occur.

- Townsends Big-Eared Bat - Manage for vegetative diversity across the landscape. Inventory limestone cliffs, mines, caves or old buildings where impacts may occur.

Transportation System, Visitor Safety, Access, and Travel Delays

Transportation

- Reduce total road miles while emphasizing improvement on remaining miles (FP, III-5).

- Encourage the development of system roads when constructed or reconstructed for special purposes to meet existing and potential all purpose needs (FP, III-40).

- Temporary work roads shall be returned to resource production and use compatible with the management unit emphasis, and within one season after termination of the activity for which the road was constructed (I., III-41). Special Provisions CT6.5# - Erosion Prevention And Control, CT6.601# - Diagrams And Specifications For Cross Ditch Construction, CT6.603# - Specifications For Outslip- ing And Berm Removal (Machine Constructed), and CT6.608# - Scarification Of Temporary Roads And Landings would be included in the timber sale contract to rehabilitate temporary roads.

User Safety

- Allow commercial or permitted use on system roads. If the road meets design standards but the combined use does not fulfill public safety requirements due to volume of traffic, the road may be administratively managed to control conflicting traffic, unsafe conditions or traffic flows (FP, III-40).

- Warning signs will be installed at the entrance to road construction or reconstruction projects, on system roads used for timber haul, at the junction of system roads and work roads, and near dispersed camp areas 1/4 mile from logging operations (CT 6.33).

User Access

- Vehicle Access Restrictions and Operating Season Restrictions: Vehicle access restrictions will remain in effect as shown on the 1990 Forest Visitor/Travel Map, as amended.

- Hauling logs on weekends, holidays, and the day before the opening date and during the first 5 days of the general elk and deer hunts will be prohibited. The dates of hunts will be established by the State Division of Wildlife Resources. These restrictions would be identified in timber sale contract provision CT5.12: Use of Roads by Purchaser.

- Where possible locate/construct work roads to facilitate closure which will minimize unauthorized use.

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- Preclude public use of newly constructed project roads to keep the public from becoming accus- tomed to driving to certain areas that were not accessible with vehicles prior to the road construction. Consider signing, berms, felling trees, etc.

- Roads will be located, designed, and constructed for short and long term timber needs, including fuelwood sales (FP, III-68).

- Close newly constructed project roads to the public after initial intended use is complete when the establishment of public use is undesirable or management direction has previously been established to close the road (FP, III-39).

- Reclaim non-system roads in and adjacent to the project that will not be used for logging activities and are not needed for future resource management. These roads would be reclaimed over a period of 10 to 15 years as funding becomes available. They number approximately 19 miles and are dispersed throughout the described area.

Range Allotments and Improvements

- Coordinate grazing and timber activities.

- Maintain and protect all range improvements.

- Livestock grazing would be discouraged within roadways for two to three seasons to allow grass seedlings (for erosion control) to become established. Grazing could be discouraged by herding techniques, animal husbandry, and seed mixes not attractive to livestock.

- In the harvest units grazing would be prohibited until spruce and fir regeneration reaches a minimum average height of 4 feet. This height should be attained within 15 to 20 years.

Visual Landscape

- Achieve landscape enhancement through addition, deletion or alteration of landscape elements. Examples of these include: addition of vegetative species to introduce unique form, color or texture to existing vegetation and vegetation manipulation to open up vistas or screen out undesirable views. (FP, III-17)

- Employ techniques such as feathering, leave trees, shaping cuts to duplicate naturally occurring open pockets, or aspen clones in the area, which alleviate unnaturally appearing geometric lines and forms.

- Avoid skylining salvage related disturbance. Objects or unnaturally appearing forms become greatly exaggerated when in silhouette on the horizon; particularly when contrasted against a blue-sky or moonlit background.

- Where practical, angle skidding and logging road corridors away from system roads and major trails and align them as close to the natural contour as possible to prevent direct views down these corridors.

- Where necessary to meet Forest Plan visual quality standard, remove or visually screen from view, salvage-created slash which may be readily recognized within the immediate foreground view. Where practical, directionally fell trees away from roads and trails and cut trees at a slant (low to the ground) positioning the exposed cut to face away from the trail or road. An IDT and presale forester will visit

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the project area and identify visually sensitive areas to include in the contract. The presale forester will display these areas on the sale area map. (see BT6.412, C(T)6.7).

Monitoring

- Establish photo points prior to salvage operation. Within one year after the sale closes in visually sensitive areas and within 2 years in other areas; visit and specifically document the effects of salvage activities and the subsequent effectiveness of mitigation measures (Appendix A.3).

Roadless Character

- The Forest Plan does not have a section entitled "roadless" and does not provide direction/ mitigation for roadless characteristics. However, it is primarily through their visual sense that most visitors would perceive a roadless area; consequently a majority of the associated mitigation would overlap with that pertaining to visual quality.

Cultural Resources

Implement the Memorandum of Understanding with Utah State Historic Preservation Office (SHPO) and Advisory Counsel. Implementation of the operating plan (Project File) in-part includes:

- Conduct inventories of all harvest units, landings, skid roads and trails, road construction and reconstruction, and other associated activities prior to timber sale and road contracts.
- Evaluate and protect in-place all National Register eligible sites.
- When in-place protection is not possible, modify proposed activities to avoid, mitigate, or minimize impacts in consultation with the SHPO and Advisory Council.
- Where project activities can not be modified to protect sites in-place, develop plans to recover scientific data in accordance with the National Resources Protection Act, Archaeological Resources Protection Act, and the Native American Graves Repatriation Act.
- Include cultural resource clause in all timber sale and road contracts requiring protection of known resources and resources inadvertently discovered during project activities.
- Consult with appropriate Native American groups on projects having the potential to affect traditional properties, use areas, and practices.

Economics

- None

Energy

- None

2.6 COMPARISON OF ALTERNATIVES

Table 2.4 has been generated to summarize and compare alternatives relative to the issues and other analysis/decision factors. Summary of the effects account for all proposed activities and mitigations as displayed in the alternative tables and maps. Comparisons are based on net, overall effects to each resource issue if the entire alternative were selected and implemented. Refer to Chapter 4 for a detailed discussion of environmental effects for each alternative. Potential effects of a large intense wildfire are not generally included in the effects projected in Table 2.4 although the risk of such an event does vary from one alternative to another (as summarized in the table section on fire risk/fuels).

2.7 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The preferred alternative is Alternative 3 with some selections of Alternative 2 and Alternative 4 with regards to the roadless character issue. This choice is based on the following rationale:

1 Responsiveness to the Purpose and Need for Forest Plan

Alternative 3 provides a supply of timber to help satisfy local and regional demands for timber products, maintains long-term forest age and species diversity and productivity, reduces accumulated fuels to tolerable risk levels, and leads to a forest that may be less susceptible to beetle attack. Natural and artificial reforestation provides for future supplies of timber, wildlife habitat, and other resource values.

2 Responsiveness to the Forest Health, Diversity, and Productivity issue

Alternative 3 emphasizes application of additional, preventative integrated pest management strategies along the advancing epidemic front designed to reduce host susceptibility to beetle attack in currently untreated spruce-fir stands. We understand this approach can not assure success given the magnitude of the beetle epidemic however we believe the proposed activities will have a reasonable chance of success to reduce beetle induced mortality in treated sites based on our experience and the cited literature. Our approach represents an attempt at adaptive management in collaboration with Forest Service research scientists within the framework of ecosystem management.

3 Responsiveness to the Roadless issue

There are approximately 3,161 acres potentially impacted by the South Manti project inventoried as having undeveloped, roadless character (Table 4.13). The Manti-La Sal Land and Resources Management Plan Record of Decision (1986) (page 8) states the "...Utah Wilderness Act directed that other roadless areas not designated as wilderness be managed for non-wilderness uses." The Record of Decision also allocated lands to management areas with goals, desired conditions, and prescriptive standards to guide site-specific implementation activities. The Preferred Alternative is responsive to Forest Plan direction by managing for a variety of resource uses and conditions. It presents a balance of forest health treatments, salvage opportunities, and maintenance of roadless characteristics.

The Preferred Alternative maintains the undeveloped, roadless character of the Heliotrope and Muddy Creek-Nelson Mountain inventoried roadless areas by selecting Alternative 4 (no entry in inventoried roadless areas) for proposed treatments covering 1,596 acres in these areas

Entering in the Heliotrope roadless area would cause the size of the area to drop below the 5,000 acre minimum criteria as an inventoried roadless area. Although areas within Heliotrope are allocated to timber and range management, the Preferred Alternative maintains the minimum size of the area by not selecting for entry at this time.
CHAPTER 2

Entering in the Muddy Creek-Nelson Mountain inventoried area could increase roaded recreation in this area. The Preferred Alternative weighs the value of the timber verses maintaining the roadless character in this portion of the Muddy Creek-Nelson Mountain roadless area and favors maintenance of the roadless character.

In portions of other inventoried roadless areas considered within the project analysis area, the Preferred Alternative emphasizes management for resource objectives that involve entry for salvage harvest. Harvest entry in these areas is generally to treat the fuel mosaic to reduce risk of large, intense wildfires across the landscape and to attempt to retard spruce beetle mortality. Treatments are largely on the edge of the roadless areas, involve minimal road development, and do not significantly affect their overall roadless character.

Within the Big Beal Canyon inventoried roadless area, the Preferred Alternative allows helicopter harvest in unit F-3 (36 acres) by selecting Alternative 3. Within the Black Mountain, Twelvemile, and White Mountain inventoried roadless areas the Preferred Alternative allows tractor harvest by selecting Alternative 2 covering 1,011 acres. This includes units G-1 and G-2 (Black Mountain 380 acres), B-3 and B-4 (Twelvemile 36 acres), and D-4 and D-5 (White Mountain 595 acres). The Preferred Alternative does not include helicopter harvest units for these three roadless areas (518 acres). The direct, indirect, and cumulative impacts to the undeveloped character of these inventoried roadless areas has been analyzed and is consistent with the Forest Plan Record of Decision.

Section 4.20 of Chapter 4 indicates Alternative 3, overall, has a negative present net value. Figure 2.2 geographically displays the treatment units for Alternative 3. Completion of helicopter logging within treatment units E,F, and G is required to successfully implement the integrated pest management strategies of Alternative 3.

Table 2.2 displays the timber activities for Alternative 3. Treatment units E,F,D,B have a negative present net value and treatment units G,A,C have a positive present net value. The high operating costs of helicopter logging and the ratio of acres logged using helicopter methods vs acres logged using ground-based methods were critical factors contributing to the outcome of whether a group of treatment units would have a positive or negative present net value. I have discussed this situation with the interdisciplinary team and have directed them to carefully organize future timber sales packages such that the government would realize the maximum return to the treasury.

I realize this strategy may result in a negative net present value or a below-cost timber sale. A below-cost timber sale may be acceptable to me if there is a reasonable chance of achieving our long-term forest health, diversity, and productivity objectives. In addition, below cost sales are permitted under Public Law 104-19 if Forest Health objectives are addressed.

I also realize this strategy could eliminate some helicopter logging salvage harvest of dead and dying trees in other treatment units. The loss of salvage harvest is necessary and acceptable because the primary objective of Alternative 3 is to address forest health, diversity, and productivity; not maximize dead salage volume.

A positive net present value is not always required to provide a reasonable opportunity for the timber sale to be bid on and awarded. For example, the Dixie National Forest recently awarded an Engelmann spruce salvage sale with the helicopter harvest units bid at the 10 dollar per thousand minimum rate. Therefore, I believe an attempt to offer a sale is reasonable in light of the recent success of our neighboring Forest.

Should the helicopter harvest portions of treatment units E, F, and G not sell then the primary objective of Alternative 3; application of silviculture treatments to reduce spruce susceptibility to beetle attack addressing forest health, diversity, productivity, and fuel loading would not be realized in those untreated acres. In this situation we would continue to implement the ground-based sanitation and salvage portion of Alternative 3, attempting to reduce spruce susceptibility to beetle attack and maintain some spruce component in areas treated by ground-based harvest methods. This situation would essentially be identical to implementing Alternative 2 while maintaining the roadless characteristics of the areas excluded as mentioned above.
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**TABLE 2.4**
Comparison Summary of Effects by Issue and Alternative

<table>
<thead>
<tr>
<th>RESOURCE ISSUE</th>
<th>EVALUATION CRITERIA</th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LAND STABILITY</strong></td>
<td>Area in stability category.</td>
<td>Tree mortality is increasing landslide potential, especially in unstable and moderately unstable areas. Intense wildfires could further increase potential. Unstable 4,152 acres (41 percent), Moderately Unstable 1,695 acres (18.5 percent), Moderately Stable 3,748 acres (36.5 percent), and Stable 377 acres (4 percent).</td>
<td>Same as Alternative 1, except potential for intense wildfires reduced.</td>
<td>Same as Alternative 1, except potential for intense wildfires reduced.</td>
<td>Same as Alternative 1, except potential for intense wildfires reduced.</td>
</tr>
<tr>
<td></td>
<td>Compares acres of new road construction and reconstruction in unstable and moderately unstable areas to acres in moderately stable and stable land stability categories.</td>
<td>No new road construction or reconstruction, therefore no increased potential for landslides.</td>
<td>Potential for roads to induce landslides or be damaged by landslides is increased above Alternative 1 by 83.5 acres, of which, 51.0 acres (61 percent) are in unstable and moderately unstable areas.</td>
<td>Potential for roads to induce landslides or be damaged by landslides is increased above Alternative 1 by 87.3 acres, of which, 53.4 acres (61 percent) are in unstable and moderately unstable areas.</td>
<td>Potential for roads to induce landslides or be damaged by landslides is increased above Alternative 1 by 65.5 acres. of which, 38.6 acres (59 percent) are in unstable and moderately unstable areas.</td>
</tr>
<tr>
<td><strong>SOIL ERODIBILITY AND PRODUCTIVITY</strong></td>
<td>Erosion Rates</td>
<td>Less than 0.01 tons/acre</td>
<td>0.1 To 1.8 tons/acre</td>
<td>0.05-2.0 tons/acre</td>
<td>0.05-2.0 tons/acre</td>
</tr>
<tr>
<td></td>
<td>Bare Soils</td>
<td>Timbered areas have nearly 100 percent ground cover.</td>
<td>15 percent bare ground after ground-based logging on 5,640 acres.</td>
<td>Three percent bare ground after helicopter logging on 4,572 acres and 20 percent bare ground after ground-based logging on 5,640 acres.</td>
<td>Three percent bare ground after helicopter logging on 3,987 acres, and 20 percent bare ground after ground-based logging on 3,928 acres.</td>
</tr>
<tr>
<td></td>
<td>Meets Forest Plan Standards</td>
<td>Meets Standards.</td>
<td>Soil erosion will be held within soil loss tolerance values. Meets Forest Plan and Regional Soil Quality Standards.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2.</td>
</tr>
<tr>
<td><strong>AIR QUALITY</strong></td>
<td>Meets Utah State Air Quality Standards</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>RESOURCE ISSUE</td>
<td>EVALUATION CRITERIA</td>
<td>ALTERNATIVE 1</td>
<td>ALTERNATIVE 2</td>
<td>ALTERNATIVE 3</td>
<td>ALTERNATIVE 4</td>
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</tr>
<tr>
<td>WATER QUANTITY</td>
<td>Changes in Water yield</td>
<td>Green trees killed by beetles would reduce transpiration and increase water yield for as long as the trees would have lived. Water yields will increase over 10 percent in seven streams leading to severe bed and bank erosion and channel adjustments. There would be slightly more water available for downstream uses. The return to pre-epidemic stream conditions would take about 30 years.</td>
<td>Same as Alternative 1 except salvage harvest and road construction would remove an additional 186 acres of green trees leading to an insignificant increase in water yield. All trees are killed by beetles before logging. Therefore, there would be no direct effect on water yield beyond impacts described in Alternative 1</td>
<td>Same as Alternative 1 except salvage harvest and road construction would remove an additional 106 acres of green trees leading to an insignificant increase in water yield. Sanitation harvest and road construction will remove green trees five to ten years prior to when projected mortality would have occurred under no action</td>
<td>Same as Alternative 1 except salvage harvest and road construction would remove an additional 184 acres of green trees leading to an insignificant increase in water yield.</td>
</tr>
<tr>
<td>WATER QUALITY</td>
<td>Chemical Spills</td>
<td>None</td>
<td>Throughout the life of the project there remains, after application of mitigation measures, some degree of hazard for accidental spills into water resources. Should a spill occur mitigation will be applied to meet State standards.</td>
<td>Same as Alternative 2</td>
<td>Same as Alternative 2.</td>
</tr>
<tr>
<td></td>
<td>Sediment</td>
<td>Changes in surface and stream sediment yield</td>
<td>Predicted increases in water yield and subsequent bed and bank erosion may introduce additional sediment into seven streams. Surface erosion sediment yields will not be measurable, and therefore, not significant.</td>
<td></td>
<td>Same as Alternative 2 except Little Horse Creek would have an eleven percent increase in surface sediment yield.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>RESOURCE ISSUE</th>
<th>EVALUATION CRITERIA</th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian/Floodplains</td>
<td>Area of Riparian management unit within treatment units</td>
<td>0</td>
<td>245 acres</td>
<td>375 acres</td>
<td>310 acres</td>
</tr>
<tr>
<td></td>
<td>Occurrences of new road and major reconstruction across riparian management units and floodplains</td>
<td>0</td>
<td>10 crossings. Vegetation will be covered and will not contribute to riparian function. Each stream crossing is a functionally dependent use of the floodplain and there are no practical alternatives other than no action.</td>
<td>Same as Alternative 2 except 14 crossings</td>
<td>Same as Alternative 2 except 13 crossings</td>
</tr>
<tr>
<td></td>
<td>Feet of new road and major reconstruction parallel to, and within, riparian management areas</td>
<td>0</td>
<td>1,300 feet. Vegetation will be covered and will not contribute to riparian function.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2 except 500 feet</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Wetland area within treatment units</td>
<td>0</td>
<td>88 acres of wetlands. Wetlands disturbed will be rehabilitated resulting in no long term change from current condition.</td>
<td>Same as Alternative 2 except 118 acres of wetlands</td>
<td>Same as Alternative 2 except 112 acres of wetlands</td>
</tr>
<tr>
<td>AQUATIC HABITAT</td>
<td>Stream Habitat</td>
<td>Manage stream habitat to at least 50 percent of potential where self-sustaining fisheries occur</td>
<td>Slight increases in densities and production of fish and macroinvertebrates due to additions of bug-killed wood to streams. Decreased streambank stability, loss of bank undercut and some poor-filling due to increased water yields. Temporary loss of some fish habitat. Meets Forest Plan standard.</td>
<td>Same as Alternative 1 except minimal increase in water yields and erosion as compared to Alternative 1, therefore slightly greater loss of fish habitat.</td>
<td>Potential harvest of some green timber from RPN’s therefore less added wood than Alternative 1 and 2 and lower fish and macroinvertebrate densities. Minimal increase in water yields and erosion as compared to Alternative 2, therefore slightly greater loss of fish habitat than Alternative 2. Alternative 3 meets Forest Plan standard.</td>
</tr>
<tr>
<td></td>
<td>Threatened, Endangered, &amp; Sensitive Aquatic Species</td>
<td>Effects to habitat</td>
<td>No known populations of threatened, endangered, or sensitive aquatic species in the project area. No Effect.</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1.</td>
</tr>
<tr>
<td>RESOURCE ISSUE</td>
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</tr>
<tr>
<td>FOREST HEALTH, DIVERSITY, AND PRODUCTIVITY</td>
<td>Stand Resistance to Spruce Beetle Attack</td>
<td>0 acres of 4465 acres of live, currently uninfested Engelmann spruce stands are treated to reduce stand average basal area per acre to promote a healthier condition with reduced hazard of spruce beetle infection</td>
<td>0 acres of 4465 acres of live, currently uninfested Engelmann spruce stands are treated to reduce stand average basal area per acre to promote a healthier condition with reduced hazard of spruce beetle infection</td>
<td>4465 acres (100 percent) of live, currently uninfested Engelmann spruce stands are treated to reduce stand average basal area per acre to promote a healthier condition with reduced hazard of spruce beetle infection</td>
<td>2651 acres of 4465 acres of live, currently uninfested Engelmann spruce stands are treated to reduce stand average basal area per acre to promote a healthier condition with reduced hazard of spruce beetle infection</td>
</tr>
<tr>
<td></td>
<td>Mortality induced changes in stand hazard ratings would result in an average change from a Moderate rating to a Low rating on the 5740 acres of infested stands, from a Moderate to a Low to Moderate rating on the 4465 acres of currently uninfested stands, and from an average Moderate to an average Low rating for the total 10,211 acres of area proposed for treatment.</td>
<td>Mortality induced changes in stand hazard ratings would result in an average change from a Moderate rating to a Low rating on the 5740 acres of infested stands, from a Moderate to a Low to Moderate rating on the 4465 acres of currently uninfested stands, and from an average Moderate to an average Low rating for the total 10,211 acres of area proposed for treatment.</td>
<td>Mortality induced changes in stand hazard ratings would result in an average change from Moderate rating to a Low rating on 5746 acres of infested stands.</td>
<td>Mortality induced changes in stand hazard ratings would result in an average change from Moderate rating to a Low rating on 5746 acres of infested stands.</td>
<td>Mortality induced changes in stand hazard ratings would result in an average change from Moderate rating to a Low rating on 5746 acres of infested stands.</td>
</tr>
<tr>
<td></td>
<td>Silviculture treatments in currently uninfested stands will result in a change of 1891 acres of stands with a Moderate to High hazard rating to 451 acres of Low and 1440 acres of moderate rating (2574 acres of Moderate rating would remain unchanged).</td>
<td>Silviculture treatments in currently uninfested stands will result in a change of 1891 acres of stands with a Moderate to High hazard rating to 451 acres of Low and 1440 acres of moderate rating (2574 acres of Moderate rating would remain unchanged).</td>
<td>Total treatment unit average hazard rating would change from Moderate to a Low/Moderate rating.</td>
<td>Total treatment unit average hazard rating would change from Moderate to a Low/Moderate rating.</td>
<td>Total treatment unit average hazard rating would change from Moderate to a Low/Moderate rating.</td>
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<tr>
<td>FOREST HEALTH, DIVERSITY, AND PRODUCTIVITY (continual)</td>
<td>Compare trend of Periodic Annual Increment (PAI) and Mean Annual Increment (MAI)</td>
<td>Engelmann spruce mortality results in a decline in average stand periodic annual increment over 10 years to -96 ft³ per acre in spruce beetle infested stands, 208 ft³ in currently uninfested stands, and -145 ft³ per acre in all treatment units</td>
<td>Engelmann spruce mortality results in a decline in average stand periodic annual increment over 10 years to -21 ft³ per acre in spruce beetle infested stands, -120 ft³ in currently uninfested stands, and -64 ft³ per acre in all treatment units</td>
<td>Engelmann spruce mortality results in a decline in average stand periodic annual increment over 10 years to -16 ft³ per acre in spruce beetle infested stands, 35 ft³ in currently uninfested stands, and 24 ft³ per acre in all treatment units.</td>
<td>Engelmann spruce mortality results in a decline in average stand periodic annual increment over 10 years to -8 ft³ per acre in spruce beetle infested stands, -82 ft³ in currently uninfested stands, and -45 ft³ per acre in all treatment units.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 150 years would be required for mean annual increment of infested and uninfested to return to a production level similar to that which existed prior to the spruce beetle epidemic.</td>
<td>Mean annual increment declines over 10 years to 5 ft³ per acre in spruce beetle infested stands, 7 ft³ per acre in currently uninfested stands, and 6 ft³ per acre in all treatment units.</td>
<td>Mean annual increment declines over 10 years to 10 ft³ per acre in spruce beetle infested stands, 13 ft³ per acre in currently uninfested stands, and 11 ft³ per acre in all treatment units.</td>
<td>Mean annual increment declines over 10 years to 10 ft³ per acre in spruce beetle infested stands, 15 ft³ per acre in currently uninfested stands, and 12 ft³ per acre in all treatment units.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Approximately 150 years would be required for mean annual increment of infested stands to return to a production level similar to that which existed prior to the spruce beetle epidemic.</td>
<td>Approximately 120 years would be required for mean annual increment of infested stands to return to a production level similar to that which existed prior to the spruce beetle epidemic.</td>
<td>Approximately 150 years would be required for mean annual increment of infested stands to return to a production level similar to that which existed prior to the spruce beetle epidemic.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Uninfested stands would require approximately 120 years, and the average time required for all treatment units to return to a production level similar to that which existed prior to the spruce beetle epidemic would be 140 years.</td>
<td>Uninfested stands would require approximately 30 years, and the average time required for all treatment units to return to a production level similar to that which existed prior to the spruce beetle epidemic would be 90 years.</td>
<td>Uninfested stands would require approximately 140 years, and the average time required for all treatment units to return to a production level similar to that which existed prior to the spruce beetle epidemic would be 140 years.</td>
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<tr>
<td>Forest Health, Diversity, and Productivity (cont)</td>
<td>Compare trends in vegetative diversity</td>
<td>Forest type: 9435 acres of Spruce-Fir and Spruce Forest Type are converted to Subalpine Fir Forest Type.</td>
<td>Same as Alternative 1, except that post salvage reforestation activities on 2459 acres provides the opportunity to reduce effects described in Alternative 1 over a long-term period.</td>
<td>Forest type: 6425 acres of Spruce-Fir and Spruce Forest Type are converted to Subalpine Fir Forest Type.</td>
<td>Forest type: 6700 acres of Spruce-Fir and Spruce Forest Type are converted to Subalpine Fir Forest Type.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stand structure: 5297 acres of stands with a Multi-storied, uneven-aged stand structure are converted to an open, meadow-like condition. 220 acres of stands with a Multi-storied structure are converted to a Single-story even-aged stand structure.</td>
<td>Stand structure: 2723 acres of stands with a Multi-storied, uneven-aged stand structure are converted to an open, meadow-like condition. 220 acres of stands with a Multi-storied structure are converted to a Single-story even-aged stand structure.</td>
<td>Stand structure: 3241 acres of stands with a Multi-storied, uneven-aged stand structure are converted to an open, meadow-like condition. 220 acres of stands with a Multi-storied structure are converted to a Single-story even-aged stand structure.</td>
<td>Stand structure: 3241 acres of stands with a Multi-storied, uneven-aged stand structure are converted to an open, meadow-like condition. 220 acres of stands with a Multi-storied structure are converted to a Single-story even-aged stand structure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Genetic diversity: This alternative provides the largest impact to genetic diversity. Remaining spruce are reduced in numbers are fragmented, and isolated within the ecosystem. Interaction of gene pools may be limited, inbreeding may increase, and undesirable tree characteristics may be propagated.</td>
<td>Genetic diversity: In infested stand areas, effects are similar to Alternative 1 &amp; 2, except that this alternative provides the highest level of reforestation activities to reduce effects described in Alternatives 1 &amp; 2 over a long-term period. In uninfested stand areas, intensive management activities will maintain or enhance vegetative diversity within treated stands. Forest Type, Stand Structure, and Genetic Diversity will be maintained within these stands.</td>
<td>Genetic diversity: Same as Alternative 3 except that treatment areas and reforestation activities are reduced. Level of effects is between Alternatives 2 &amp; 3.</td>
<td>Genetic diversity: Same as Alternative 3 except that treatment areas and reforestation activities are reduced. Level of effects is between Alternatives 2 &amp; 3.</td>
</tr>
<tr>
<td>Rangeland vegetation &amp; noxious weeds</td>
<td>Changes in spread or establishment of new and existing populations</td>
<td>Existing populations would continue to be treated in accordance with existing decisions and agreements. Noxious weed populations would remain static or decrease.</td>
<td>Throughout the life of the project there remains, after application of mitigation measures, some degree of risk for the introduction and establishment of noxious weeds. Should new populations be introduced mitigation will be applied in accordance with existing decisions and agreements.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2.</td>
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<tr>
<td>THREATENED, ENDANGERED, &amp; SENSITIVE PLANT SPECIES</td>
<td>Habitat affected</td>
<td>No impacts</td>
<td>No impacts because suitable habitat is not adversely affected.</td>
<td>Same as Alternative 2</td>
<td>Same as Alternative 2</td>
</tr>
<tr>
<td>Astragalus monti, and Erechtogen carringtoniae</td>
<td>Habitat affected</td>
<td>No impacts</td>
<td>Disturbance and loss of habitat at the gravel pits will impact approximately 50 plants over 0.25 acres. The loss of habitat and plants will not adversely affect the areas populations</td>
<td>Same as Alternative 2</td>
<td>Same as Alternative 2</td>
</tr>
<tr>
<td>Silene petersonii and Senecio muscinensis</td>
<td>Habitat affected</td>
<td>No impacts</td>
<td></td>
<td>Same as Alternative 2</td>
<td>Same as Alternative 2</td>
</tr>
<tr>
<td>FIRE RISK/FUELS</td>
<td>Change in fuel loading</td>
<td>As beetle killed Engelmann Spruce falls, fuel loading becomes critical (exceed Forest Plan standard), and fire starts may be unmanageable.</td>
<td>Risk of stand replacement fire reduced, compared to Alternative 1, because 55 percent of the acres will receive fuels reduction work to decrease chance of stand replacement fires</td>
<td>Same as Alternative 2 except risk of stand replacement fire reduced on entire (100 percent) project area.</td>
<td>Same as Alternative 3 except roadless areas remain as in Alternative 1. Fire risk in 69 percent of the area will be reduced.</td>
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### RESOURCE EVALUATION ALTERNATIVE

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<tbody>
<tr>
<td>WILDLIFE HABITAT</td>
<td>Deer and Elk</td>
<td>Acres of habitat temporarily displaced from.</td>
<td>About 50 percent of the available habitat across 24,624 acres is not used by elk for forage or cover because of road density/habitat-use relationships. Decreased road densities decreases deer and elk vulnerability by decreasing potential for hunter success during hunting season. Vulnerability to natural predators is not significantly affected. Improved foraging does not have a significant impact to deer and elk. Natural reforestation would again provide adequate security cover in approximately 40 to 50 years.</td>
<td>Same as Alternative 2 except about 53 percent of the available habitat across 24,624 acres is not used by elk for forage or cover because of road density/habitat-use relationships.</td>
<td>Same as Alternative 2 except about 51 percent of the available habitat across 24,624 acres is not used by elk for forage or cover because of road density/habitat-use relationships.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Changes in road densities across analysis area (24,624 acres) (miles/square mile).</td>
<td>Road density across 24,624 acres decreased to 2.0 miles per square mile.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2.</td>
</tr>
<tr>
<td></td>
<td>Blue Grouse</td>
<td>Amount of winter habitat potentially disturbed.</td>
<td>Impacts to habitat are minimal.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2.</td>
</tr>
<tr>
<td></td>
<td>Golden Eagles</td>
<td>Number of Golden Eagles nests disturbed.</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Blue Grouse</th>
<th>Amount of winter habitat potentially disturbed.</th>
<th>Zero, No Effect</th>
<th>Impacts to habitat are minimal.</th>
<th>Same as Alternative 2.</th>
<th>Same as Alternative 2.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden Eagles</td>
<td>Number of Golden Eagles nests disturbed.</td>
<td>Zero, No Effect</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1</td>
<td>Same as Alternative 1</td>
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<tr>
<td>Threatened, Endangered, &amp; Sensitive Wildlife Species</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Goshawk</td>
<td>Acres of suitable habitat impacted by harvest activities</td>
<td>Zero, No Effect</td>
<td>1,124 acres disturbed. Nest areas will be protected as per Regional Guidance resulting in little impact to known populations</td>
<td>Same as Alternative 1 except 1,504 acres disturbed</td>
<td>Same as Alternative 2 except 816 acres disturbed</td>
</tr>
<tr>
<td>Flammulated Owl</td>
<td>Acres of disturbance on ridge tops &amp; steep slopes</td>
<td>Zero acres disturbed so no impacts anticipated</td>
<td>Same as Alternative 1.</td>
<td>4,587 acres disturbed. Maintaining snags in suitable habitat results in little impact</td>
<td>Same as Alternative 3 except 1,386 acres disturbed</td>
</tr>
<tr>
<td>Three-Toed Woodpecker</td>
<td>Volume of timber removed MMBF (forage reward)</td>
<td>Woodpecker populations are maintained proportionate to beetle populations. Woodpecker populations are expected to reduce as beetle populations eventually reduce following spruce mortality.</td>
<td>Same as Alternative 1 except woodpecker populations are expected to be reduced sooner because some of their food source (beetles) is removed when 52.5 MMBF of timber is removed.</td>
<td>Same as Alternative 2 except harvest in E, F, and G units (94.5 MMBF) will remove beetle forage, potentially reducing beetle populations, resulting in a proportionate reduction in woodpecker populations. This reduction could occur 5 to 10 years prior to the same woodpecker reduction anticipated in Alternative 1.</td>
<td>Same as Alternative 3 except harvest in E and D units precluded resulting in a total harvest of 61.7 MMBF, thus providing additional beetles to woodpeckers for a few years.</td>
</tr>
<tr>
<td>Townsends Big-Eared &amp; Spotted Bats</td>
<td>Potential impact to potential roosting habitat</td>
<td>Zero, No Effect</td>
<td>1 (site)</td>
<td>1 (site)</td>
<td>1 (site)</td>
</tr>
<tr>
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</tr>
<tr>
<td>TRANSPORTATION</td>
<td>Miles of reconstructed system road</td>
<td>0</td>
<td>13.6 miles</td>
<td>18.3 miles</td>
<td>18.1 miles</td>
</tr>
<tr>
<td></td>
<td>Miles of reconstructed Non-system Road</td>
<td>0</td>
<td>10.4 miles</td>
<td>10.4 miles</td>
<td>8.8 miles</td>
</tr>
<tr>
<td></td>
<td>Miles of new road constructed</td>
<td>0</td>
<td>23.0 miles</td>
<td>23.0 miles</td>
<td>17.3 miles</td>
</tr>
<tr>
<td></td>
<td>Miles of project road reclaimed</td>
<td>0</td>
<td>15.3 miles</td>
<td>15.3 miles</td>
<td>13.3 miles</td>
</tr>
<tr>
<td></td>
<td>Miles of non-project road reclaimed</td>
<td>0</td>
<td>18.6 miles</td>
<td>18.6 miles</td>
<td>18.6 miles</td>
</tr>
<tr>
<td></td>
<td>Road density (miles per square mile)</td>
<td>2.3 miles per square mile across 24,624 acres</td>
<td>2.0 miles per square mile across 24,624 acres</td>
<td>Same as Alternative 2</td>
<td>1.9 miles per square mile across 24,624 acres</td>
</tr>
<tr>
<td>VISITOR SAFETY</td>
<td>Projected traffic levels, vehicles per day (vpd)</td>
<td>Current traffic levels maintained at 50 vpd (near Twelvemile Campground) to 170 vpd, maximum, near Mayfield.</td>
<td>66-191 vpd added to the system: projection varies by year, this is the low and high values out of 6 years.</td>
<td>61-192 vpd added to the system: projection varies by year, this is the low and high values out of 9 years.</td>
<td>90-162 vpd added to the system: projection varies by year, this is the low and high values out of 6 years.</td>
</tr>
<tr>
<td>USER ACCESS</td>
<td>Road use vs. hunting dates</td>
<td>N/A</td>
<td>No conflicts due to mitigation</td>
<td>Same as Alternative 2</td>
<td>Same as Alternative 2</td>
</tr>
<tr>
<td></td>
<td>Compare miles of existing road open to public to miles of road open to public following alternative completion</td>
<td>87 miles</td>
<td>76 miles remain, a net reduction of about 11 miles.</td>
<td>Same as Alternative 2</td>
<td>72 miles remain, a net reduction of about 15 miles.</td>
</tr>
<tr>
<td>TRAVEL DELAY</td>
<td>Delay: minutes per hour of travel on the Ferron-Mayfield road from Mayfield to the Twelvemile Campground</td>
<td>N/A</td>
<td>4-12 minutes</td>
<td>5-12 minutes</td>
<td>6-11 minutes</td>
</tr>
<tr>
<td></td>
<td>Location of construction delays</td>
<td>N/A</td>
<td>#50150 &amp; #50022 East of Twelvemile Campground</td>
<td>#50044 from Black Fork Drainage to JCN #50150</td>
<td>#50150 above Emerald Lake</td>
</tr>
<tr>
<td></td>
<td>Average length of delay during construction</td>
<td>N/A</td>
<td>2 hours average</td>
<td>2 hours average</td>
<td>2 hours average</td>
</tr>
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</tr>
<tr>
<td>RANGE ALLOTMENTS</td>
<td>Decreases in suitable rangeland available to grazing</td>
<td>No change from existing condition.</td>
<td>Impacts to allotments will vary from no impact to 11 percent loss of suitable rangeland. The loss of suitable rangeland may, or may not directly relate to loss of animal unit months because of the variations in plantation protection methods; fencing vs herding, or adjusting grazing schedules or management. Allotments with the greatest potential impacts are the Emery C&amp;H, Indian Creek S&amp;G, Peavine S&amp;G, and Blue Lake S&amp;G.</td>
<td>Same as Alternative 2 except impacts to allotments will vary from no impact to a 14 percent loss of suitable rangeland.</td>
<td>Same as Alternative 3.</td>
</tr>
<tr>
<td></td>
<td>Impacts to existing allotment improvements</td>
<td>None</td>
<td>Some short term impacts to fence and cattle guards is anticipated through out the life of the project. All damage will be repaired or replaced at the timber operators expense.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 2.</td>
</tr>
<tr>
<td>VISUAL LANDSCAPE</td>
<td>Retention</td>
<td>Areas managed under retention would meet VQO standard on all 14 acres.</td>
<td>Retention will not be met in views associated with (visually evident) new roading (NE-2) in the treatment unit E-2 open areas south of Ferron Reservoir recreation complex.</td>
<td>Same as Alternative 2.</td>
<td>Same as Alternative 1.</td>
</tr>
<tr>
<td></td>
<td>Modification</td>
<td>Areas managed under modification would meet VQO standard or not be affected. Modification standard would be met on all 739 acres.</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1.</td>
<td>Same as Alternative 1.</td>
</tr>
<tr>
<td></td>
<td>Partial Retention</td>
<td>Present viewsheds would not be altered by human activities therefore partial retention will be met on all 9,459 acres. Views would change in color and texture from green, full trees to brown and grey, narrow snags. Scenery would be subject to cyclical natural processes such as fire, drought, and natural succession. Achieving the preinfestation views would take at least 100 years.</td>
<td>Partial Retention may not be met in views associated with visually dominant new and reconstructed roading in C treatment units near Hennington Reservoir and Blue Lake. Positive effects of removing visually objectionable dead snags across 5,218 logged acres will be apparent immediately. Partial retention would eventually be met in all other viewsheds after salvage operations and subsequent mitigation (including revegetation) is complete.</td>
<td>Effects to views associated with roading will remain the same as Alternative 2. Partial retention would eventually be met in all other viewsheds after salvage/ sanitation operations and subsequent mitigation is complete.</td>
<td>Effects to views associated with roading will remain the same as Alternative 2. Partial Retention will be met as in Alternative 3 with no direct impacts to inventoried roadless areas. Views within roadless areas would change in color and texture from green, full trees to brown and grey, narrow snags. Roadless area scenery would be subject to cyclical natural processes such as fire, drought, and natural succession. achieving the preinfestation views would take at least 100 years.</td>
</tr>
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<tr>
<td>Roadless Character</td>
<td>Compare inventoried roadless areas impacted by timber harvested and associated roadbuilding in relationship to natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability.</td>
<td>130,093 acres for six roadless areas. Inventoried roadless areas would continue to be affected mainly by natural processes. Roadless characteristics would continue to be indirectly affected some distance within roadless areas by the sights and sounds of existing, adjacent, developments.</td>
<td>Natural integrity, apparent naturalness, opportunities for solitude, and related sense of remoteness would be negatively impacted by 0.5 miles of new roads and 1,689 acres (1.3 percent of total) disturbed by harvest activities. Roadless characteristics would be indirectly affected some distance within roadless areas by the sights and sounds of adjacent salvage operations.</td>
<td>Same as Alternative 2, except an additional 1,472 acres (3,161 acres or 2 percent of the total) would be harvested with a helicopter and have a proportionate negative effect to roadless characteristics.</td>
<td>Same as Alternative 1 except roadless characteristics would be indirectly affected some distance within roadless areas by the sights and sounds of adjacent salvage operations.</td>
</tr>
</tbody>
</table>

| Cultural Resources | Area of High Potential for Prehistoric Sites. | Of the 24,608 acres included in the No Action alternative, 4,106 acres are classified as high potential for prehistoric sites. | Of the 5,640 acres potentially affected by this alternative, 1,032 acres are classified as high potential for prehistoric sites. | Of the 10,212 acres potentially affected by this alternative, 2,416 acres are classified as high potential for prehistoric sites. | Of the 7,015 acres potentially affected by this alternative, 2,327 acres are classified as high potential for prehistoric sites. |
|                    | Number of Expected Prehistoric Sites Potentially Affected. | 0 | 5-11 prehistoric sites are expected to be located within areas of high, moderate, and low probability for prehistoric cultural resources (5,640 total acres). | 9-15 prehistoric sites are expected to be located within areas of high, moderate, and low probability for prehistoric cultural resources (10,212 total acres). | 5-11 prehistoric sites are expected to be located within areas of high, moderate, and low probability for prehistoric cultural resources (7,015 total acres). |
|                    | Number of Expected Historic Sites Potentially Affected. | 0 | 9-11 historic sites are expected to be located within all areas potentially affected by this alternative (5,640 total acres) | 3-5 historic sites are expected to be located within all areas potentially affected by this alternative (10,212 total acres). | 9-11 historic sites are expected to be located within areas potentially affected by this alternative (7,015 total acres). |
|                    | Summary of Effects to Potentially Significant Cultural Resources | All undertakings would be inventoried, cultural resources evaluated, and significant sites protected. No effect to cultural resources. | Through enactment of the Forest - SHPO MOU, there should be no effect to cultural resources. | Same as Alternative 2. | Same as Alternative 2 |

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<td><strong>ECONOMICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Projected Annual Employment</td>
<td>0</td>
<td>567</td>
<td>1,020</td>
<td>666</td>
</tr>
<tr>
<td></td>
<td>Employment</td>
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<td>Income</td>
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<td>Payment in Lieu Of</td>
<td>Dollars Paid To Counties</td>
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<td>$1,154,000</td>
<td>$390,000</td>
<td>$214,000</td>
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<td>Taxes To Counties</td>
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<tr>
<td>Present Net Value</td>
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<td>$1,377,000</td>
<td>Negative $2,825,000</td>
<td>Same as Alternative 3 except 'Net Present value may be a negative $1,734,000.</td>
</tr>
</tbody>
</table>

Even though a timber sale maybe below cost to the government it is possible timber purchasers would bid on and be awarded sales for minimum rates. For example, the Dixie National Forest recently awarded an Engelmann spruce salvage sale with the helicopter harvest units bid at the 10-dollar minimum rate. The Rescission Act (P.L. 104-19) allows below cost sales to be offered at minimum rates to meet the Forest Health objectives of the Act. The Forest Service may consider a below cost outcome acceptable if, on balance, long-term forest health would improve.

| **ENERGY**           |                            |               |               |               |               |
|                      | Input (consumption)        | 5,356         | 1,050         | 1,889         | 1,391         |
|                      | MMBTU per year             |               |               |               |               |
|                      | Output MMBTU per year      | N/A           | 1,382         | 2,482         | 1,623         |

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CHAPTER 3

THE AFFECTED ENVIRONMENT

3.0 INTRODUCTION

This chapter describes the existing environmental conditions which may or may not be changed or affected by the alternatives described in Chapter 2. Forest-wide and management area goals, direction, and standards from the Manti-La Sal National Forest Land and Resources Management Plan relevant to this analysis and decision are discussed. For each resource issue, the geographic scope of anticipated effects is described followed by a brief description of the existing conditions.

Resource reports developed for this analysis contain more information than what is presented in this chapter. These reports are part of the project file, and are available for review at the Manti-La Sal National Forest Supervisor’s office in Price, Utah.

Forest Plan Management Direction

This analysis tiers to the forest-wide direction and management area goals and standards of the Manti-La Sal National Forest Land and Resources Management Plan and incorporates by reference the analysis disclosed in the EIS and Record of Decision (1986), as amended. Forest and Management Area goals, direction, and standards and guidelines are found in the Forest Plan, Chapter III, pages 1-97.

Forest Goals (Forest Plan, III 2-6) germane to this analysis are:

- Soil and Water - Maintain satisfactory watershed conditions. Provide favorable conditions of water flow (quality, quantity, and timing). Protect soil and water productivity so that neither will be significantly or permanently impaired. Protect and enhance riparian areas including dependent resources.

- Vegetation - Certain vegetation types are to be managed such that varying successional stages will be present to provide for a high level of vegetative diversity and productivity.

- Range - Maintain upward or stable trends in vegetation and soil conditions. Control noxious weeds and poisonous plants in cooperation with forest users and State and Local agencies.

- Timber - Maintain a healthy forest by applying appropriate silvicultural treatments. Provide commercial timber sales of sufficient quantity and quality to maintain local timber industry and accomplish desired vegetation treatment goals. Meet as much of the demand for wood fiber and forest products as possible, consistent with multiple use objectives. Ensure programmed reforestation is kept current.

- Protection - Promote an integrated pest management program to prevent and control insect and disease infestations. Minimize hazards from wildfire and reduce the accumulated fuels to a tolerable risk level.

- Wildlife and Fish - Maintain or improve wildlife habitat diversity. Maintain or improve fisheries habitat. Protect, maintain, and/or improve habitat for Threatened, Endangered, and sensitive plants and animals.

- Cultural - Locate and determine the significance of Paleontological, historical, and archaeological sites and, as appropriate, nominate sites to the National Register.
CHAPTER 3

Facilities - Manage the transportation system to safely and economically transport people, products, and services to accomplish planned management area programs and goals.

Forest-wide Direction and Standards and Guidelines from the Forest Plan are found on pages III 16-43. Management Area Goals, Direction, and Standards and Guidelines (Forest Plan, pages III 44-97) germane to this analysis are displayed in Figure 3.1 and describe below.

Management Area DRS - Developed Recreation Sites (18 acres, < 1 percent where 100 percent equals 10,212 acres) (Forest Plan, page III-47): Manage trees and shrubs to enhance visual quality and recreation opportunities on existing and proposed recreation sites. Remove unsafe and/or dead trees in developed sites. Plant new trees to provide desired tree cover when natural regeneration is insufficient.

Management Area UDM - Undeveloped Motorized Recreation Sites (6 Sites) (Forest Plan, page III-52): Timber activities and use may occur subject to maintaining appropriate Recreation Opportunity Spectrum (ROS) user experience or setting characteristics visual quality objectives, not permanently exceeding threshold levels for noise and air quality, or seriously impairing recreation use. Manage tree stands using commercial or noncommercial methods to maintain or enhance recreation values, visual quality, visitor safety, or control insects and disease.

Management Area RNG - Range Forage Production (7,182 acres, 70 Percent) (Forest Plan, page III-64): Maintain and manage non-commercial forested inclusions to provide a high level of forage production, wildlife habitat, and diversity.

Management Area TBR - Wood Fiber Production and Utilization (3,010 acres, 29 percent) (Forest Plan, page III-67): Harvest methods for the Engelmann Spruce/Subalpine fir cover type are single tree and group selection and shelterwood. Harvesting will be accomplished with methods including cable, conventional crawler tractor, or rubber tired skidders. This prescription could alter water yield through vegetation management, as well as decrease evapotranspiration and maximize snow retention in small openings on low energy slopes.

Management Area RPN - Riparian (375 acres, 4 percent. This management area is within other management areas. The acres are, therefor double counted.) (Forest Plan, page III-69): Manage forest cover types to perpetuate tree cover and provide healthy stands, high water quality and wildlife and fish habitat. Avoid locating log landing and decking areas within the riparian area. Prior to implementation of project activities, delineate and evaluate riparian areas and/or wetlands that may be impacted. Minimize significant soil compaction and disturbance in riparian ecosystems. Locate new roads and trails outside riparian areas unless alternative routes have been reviewed and rejected.

Management Area WPE - Watershed Protection and Improvement (2 acres, < 1 percent) (Forest Plan, page III-77): Management emphasis is for watershed protection and improvement in areas where watershed treatments have been, or should be applied, and where other use restrictions are implemented to protect on-site and downstream values from flooding and sedimentation. Other uses and activities that do not damage the watershed will be permitted. Emphasis is placed on management practices and restoration projects which increase vegetative cover and control surface runoff.
CHAPTER 3

Figure 3.1

Forest Plan Management Units

Legend

Management Units

- DRS
- RNG
- TBR
- WPE

1 0 1 Mile

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CHAPTER 3

Geography

The proposed project area is located in Central Utah in the southern portion of the Wasatch Plateau. The Wasatch Plateau is a north-south trending high plateau bounded by Castle Valley to the east and the Sanpete Valley to the west. The project area is located within Sanpete and Sevier Counties, Utah, approximately 12 miles east of the town of Mayfield, and 45 miles southwest of Price, Utah. The area can be accessed by system road 022, Utah State Highway 132, and Utah State Highway 89 a few miles west of Mayfield.

Elevations range between 8,000 to 11,000 feet above sea level. The topography of the proposed project area varies from rolling plateaus to the steeper, east-west trending drainages and associated canyons, leaving a distinct ridge along the crest. Land features include heavy and open-scattered spruce/fir stands; meadows; limestone, siltstone and sandstone rock types; glacial cirques, mudflows, and till; streams; reservoirs; lakes; brush fields, and open rangeland. The basic character of the area has been historically influenced by wildfires, prehistoric humans, domestic grazing, timber harvesting, water impoundment projects, and recreational uses such as hunting, camping, and snowmobiling.

Climate

The mean annual precipitation is 28 to 35 inches and dominantly more than 30. The May thru September precipitation (mainly rainfall) is 8 to 12 inches and dominantly more than 10 inches. Temperatures in the area range from -13 to 80 degrees F. From the Utah Hydrologic Atlas the freeze free season ranges from 0 to 40 days and is dominantly 0 to 20 days. High intensity thunderstorms are common from mid July through September. Local light winds usually blow up the canyons during the day and down the canyons as air cools and moves to lower elevations during the night. During the day, a neutral to unstable atmosphere predominates with winds usually coming out of the southwest. Storm systems generally come from the northwest to west, preceded by winds from the southwest to southeast. Winds above 65 miles per hour have been recorded across Skyline Ridge.

Geology

Rock units exposed in the general area range from mid Cretaceous (90 million years) to Paleocene (70 million years) in age. The units, from oldest to youngest, are the North Horn Formation, Flagstaff Limestone, and surficial deposits consisting of glacial till, colluvium, alluvium, and landslide debris.

The North Horn Formation consists of interbedded shale, sandstone, conglomerate, and limestone. Shale members contain a high percentage of clay with low resistance to erosion and low shear strength when wet. It is known to form unstable slopes, especially when wet. The Flagstaff Limestone is relatively competent, cliff-forming, and caps the major high ridges and peaks. It consists of limestone with minor amounts of shale and sandstone. Rock falls and rock slumps are common on steep cliff faces undercut by erosion and landslides in the underlying less resistant North Horn Formation. Failure planes are commonly formed along shale partings. Surficial materials (glacial till, colluvium, alluvium, and landslide debris) derived from the Flagstaff Limestone and North Horn Formation drape the slopes at depths up to 170 feet. Landslide deposits as thick as 350 feet have been measured at the Manti Canyon North Slide. Soil creep is evident along steep slopes, especially north-facing slopes that tend to have thicker soil deposits.

The geologic structure is fairly simple. East of the divide, the rock units dip generally about 4 to 6 degrees to the west. West of the divide, the rock units dip sharply westward, as much as 20 degrees,
forming a steep single-limbed fold known as the Wasatch Monocline. North-south trending faults are common within the monocline.

3.1 LAND STABILITY

The project area contains numerous landslides; including rock slides, rock falls, rock slumps, debris flows, earth flows, and complex landslides that contain more than one mode of movement (Project File). These features have been common since the last glacial period. Landslides mapped within the project area appear to be the result of geologic conditions and naturally occurring triggering mechanisms such as extreme precipitation cycles, earthquakes, and erosion.

Late snowstorms, rapid snowmelt, and high runoff volumes in 1983 and 1984 caused flooding, severe erosion, and saturation of surficial materials. Approximately 427 new landslides were mapped on the Wasatch Plateau. A greater number of landslides occurred on the west side of Skyline Drive within the North Horn Formation. These high magnitude landslide events would have a low frequency of occurrence. The recurrence interval for the two-year precipitation total received through June of 1983 is about 125 years along the west side of the Wasatch Plateau (Project File).

Recent isolated landslides have also occurred within the project area, and other areas with similar geologic conditions, during average or below average precipitation years or cycles. Such landslides would be considered to be high frequency, low magnitude events relative to the 1983/1984 landslide event. Examples include the Slide Lake landslide (1969) in the project area, Boulger Canyon landslide (1971), and the Cottonwood (1975) and Manti North landslides in Manti Canyon (1975). A portion of these landslides are known to have been triggered by human activities such as road building and water pipeline development where there has been a disruption of natural drainage and/or inefficient drainage. It is probable that historic human activities have caused changes in vegetation, topography, and water flow which contributed to these landslides that ultimately resulted in isolated landslides. Earthquakes are also thought to be triggering mechanisms for landslide activity on the Manti Division. In the South Manti project area however, there are no obvious spatial correlations between recent land disurbances such as roads, campgrounds, or reservoirs, and the occurrence of high frequency, low magnitude landslides.

A land stability map was produced for the South Manti project area. Godfrey’s 1978 and 1985 work was used as a base for refinement considering more recent and detailed information. Recent and paleolandslides were mapped from aerial photography and land stability zones were delineated based on landslide occurrences and geologic and topographic information. Four stability zones were delineated as described below and displayed on (Figure 3.2). For the project area (24,587 acres) there are 8,625 acres (37 percent) classified as unstable, 6,799 acres (27 percent) moderately unstable, 7,350 acres (30 percent) moderately stable, and 1,613 acres (6 percent) stable. For all treatment units (10,212 acres) there are 4,192 acres (41 percent) classified as unstable, 1,895 acres (18.5 percent) moderately unstable, 3,748 acres (36.5 percent) moderately stable, and 377 acres (4 percent) stable.

UNSTABLE - Areas that are actively sliding or moving, exhibit a high occurrence of landslides (recent and ancient), plus other areas that have similar geologic and topographic characteristics. These areas have a high potential for new landslides to occur and existing landslides to become active with or without human activity. The characteristics of the area used to define these areas include (1) North Horn Formation outcrops and overlying surficial deposits with slopes greater than 35 percent, (2) Flagstaff Limestone outcrops and overlying surficial deposits with slopes ranging from 35-60 percent that are adjacent to and could be undercut by erosion of the North Horn Formation, and (3) Flagstaff Limestone cliffs with slopes that exceed 60 percent.

MODERATELY UNSTABLE - Areas that contain fewer landslides (recent and ancient) than the unstable area, plus other areas with similar geologic and topographic characteristics. These areas have potential for new or reactivated landslides with human activity and during average and above precipitation years or cycles. These areas often contain the toes or runout zones of landslides that occurred on steeper slopes above. The defining geologic characteristic is North Horn Formation outcrops and overlying surficial deposits with slopes ranging from 20-35 percent.

MODERATELY STABLE - Areas that contain few landslides and have slopes generally below the threshold associated with landslides in the exposed formations. This area can contain the runout zones of landslides that originated in the more unstable zones on steeper slopes. Small slumps and local sloughing may occur due to saturated conditions, erosion, and intensive human activity. Defining characteristics include (1) North Horn Formation outcrops with slopes less than 20 percent, (2) Flagstaff Limestone outcrops on slopes that range from 35-60 percent where not undercut by erosion and landslides in the North Horn Formation, and (3) Flagstaff Limestone outcrops on slopes ranging from 10-35 percent.

STABLE - Flat-lying areas in stable formations (Flagstaff Limestone). No stability problems are anticipated in these areas. Defining characteristics include (1) Flagstaff Limestone outcrops on slopes less than 10 percent and (2) alluvial deposits on slopes less than 10 percent.
CHAPTER 3

3.2 SOILS

The soils in the project area were mapped on aerial photographs at a scale of 1:40,000 (about 1.7 inches per mile) and then transferred to base maps at a scale of 1:24,000 (about 2.6 inches per mile). The area included in the cumulative effects analysis for soils (erosion and productivity) is the project area itself. Off-site impacts of sediment are discussed in the land stability and water quality sections.

Nearly all of the soils of the project area are derived from limestone of the Flagstaff formation and shale and limestone of the North Horn formation. These are usually residual materials over bedrock on the plateau tops, colluvial materials on the mountain slopes, and glacial till and landslide materials in the basins. In general, the soils have dark colored topsoil layers of about 6 to 18 inches in thickness. Soil textures are typically clay loam or clay, with varying amounts of rock fragments. The soils derived from limestone materials are generally cobbly or stony, while those from shaly material have lower rock fragment contents. Soil reaction is typically pH 6.0 to 7.8. Subsoils typically have light color from the influence of limestone. A dense subsoil material is often encountered in the soils developed on glacial till.

Most soils have a moderate to moderately high susceptibility to compaction rating on sites where ground based equipment operations are anticipated. This would generally apply to slopes of less than 40 percent and primarily to slopes less than a 20 percent. Most soils have a moderate erodibility rating, however the amount of erosion that will occur is greatly dependent upon the steepness of the slope and the amount of surface cover. Much of the area has slope gradients over 40 percent, where unmitigated surface disturbance could cause a significant increase in soil erosion. Table 3.1 compares soil erosion potential ratings by soil map unit using soil erodibility and erosion hazard.

<table>
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<tr>
<th>Map Unit Number</th>
<th>Soil Erodibility</th>
<th>Erosion Hazard</th>
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<tbody>
<tr>
<td>1</td>
<td>Moderate</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>2</td>
<td>Moderate to High</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>3</td>
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<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Moderate to High</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>7</td>
<td>Low</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>8</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>9</td>
<td>Moderate to High</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>11</td>
<td>Moderate</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>12</td>
<td>Moderate</td>
<td>Moderate to High</td>
</tr>
</tbody>
</table>

The soil erodibility factor (K) is a relative measure of the susceptibility of soil particle to detachment and transport by rainfall and runoff. K-values that have been obtained experimentally range from .02 to .69 where low equals less than 0.20, moderate equals 0.20 to 0.40, and high equals greater than 0.40. Erosion hazard is a relative measure of erosion potential under a bare ground condition. The rating does not include cover from vegetation or organic matter and does include rock fragments in the soil. Actual soil erosion rates would be substantially lower when vegetative cover is present. A rating of low equals less than 5 tons/acre (.03 inch), moderate equals 5 to 50 tons/acre (.03 to .3 inch), and high equals greater than 50 tons/acre (.3 inch).
CHAPTER 3

Soil Map Unit Descriptions

Detailed descriptions of the map units and soils are available in the draft report of the Soil Resource Inventory of the Manti Division, Manti-La Sal National Forest; which is available at the Forest Supervisor's Office. The following is a brief description of each of the soil map units:

1. Moderately deep, well drained, medium textured soils on limestone on tablelands at high elevations. Slopes are 0 to 20 percent. Vegetation is mostly a grass-forb type. 47 acres (<1 Percent).

2. Moderately deep and deep, medium to fine textured soils on rolling mountain slopes on shale and limestone at high elevations. Slopes are 10 to 40 percent, and the vegetation is mostly a grass-forb type. 23 acres (<1 Percent).

3. Rock outcrops. 14 acres (<1 Percent).

4. High mountain benches with medium and fine textured soils on limestone and shale. Slopes are 5 to 30 percent and the vegetation is a mosaic of spruce-fir patches and grass-forb openings. 419 acres (4 Percent).

5. Steep, generally south facing mountain slopes on limestone and shale. Slopes are 30 to 80 percent, and the vegetation includes mountain brush, grass-forb, and scattered aspen and conifers. Soils range from deep fine textured soils to shallow cobbly soils. 110 acres (1 Percent).

6. Steep, south facing mountain slopes with moderately deep and deep medium to fine textured soils. Slopes are 30 to 60 percent, and the vegetation is mostly grass-forb, elderberry, and aspen. 34 acres (<1 Percent).

7. Steep, rocky ridges and glacial headlands at high elevations. Slopes are 30 to 80 percent, and the vegetation is mostly a spruce-fir type. Soils are shallow to deep and are very stony. 1,522 acres (15 Percent).

8. Glacial basins and benches at high elevations. Geologic materials include glacial till and some landslide material, with inclusions of residual limestone. Slopes are generally 5 to 25 percent and the vegetation includes spruce-fir and aspen types with grass-forb and mountain brush openings. The soils are medium to fine textured, and are often cobbly. 2,502 acres (25 Percent).

9. Rough, rocky basins and benches at high elevations. Soils are very stony, bouldery, and cobbly. Slopes are 5 to 40 percent, and the vegetation is a spruce-fir type. 2,201 acres (22 Percent).

10. Benches and depositional mountain slope lands from glacial and landslide material of limestone and shale origin. Slopes are 5 to 40 percent, and the vegetation includes spruce-fir and aspen types. The soils are deep and have fine to moderately fine textures. They are very cobbly to nearly stone free. Small ponds and wet spots are common in this unit. 1,681 acres (16 Percent).

11. Moderately deep basin slope lands and benches mostly on old landslide materials. Soils are deep and have medium to fine textures. Slopes are 10 to 40 percent, and the vegetation includes sagebrush, grass-forb, and aspen types. 5 acres (<1 Percent).

12. Steeply sloping, north facing mountain slopes on limestone at high elevations. Slopes are 30 to 75 percent, and the vegetation is a spruce-fir type. The soils are generally deep and have moderately fine textures with a high cobble or stone content. 1,652 acres (16 Percent).

Soil Productivity

The long term productivity and sustainability of forests and rangelands depends on maintaining the quality of soil properties and conditions that affect the productivity and hydrologic function for soils. Guidelines (FSH 2509.18 Soil Management Handbook) have been set, beyond which we are reasonably certain that there will be long-term losses in inherent productivity or hydrologic function. Under current conditions none of the areas proposed for treatment exceed the soil quality standards. Current erosion rates are well within soil loss tolerance thresholds. Ground cover and above ground organic matter is at or above optimum levels for the various soil types.

3.3 AIR QUALITY

The Manti-La Sal National Forest lies within the Upper Colorado River Air Basin. High winds are common and dispersion is often very good. However, calm periods do occur which allow smoke or engine emissions to settle nearby and even to drift downslope towards the valleys. Usually winds will blow from the west and towards the east which means that the communities of Ferron and Emery would be downwind. When the winds are from the east the communities of Mayfield and Sterling would be downwind. All of these communities are more than 10 miles from the project area. Capital Reef National Park is to the south and is not downwind except during unusual events.

Regulatory Framework:

Memorandum of Understanding between State of Utah Air Conservation Committee and the U. S. Department of Agriculture, Forest Service was signed by the Forest Service in 1988. This document describes the conditions and procedures for prescribed fires within the National Forest. Since all operations will comply with this memorandum, all burning in conjunction with this project will conform to the Air Quality Standards.

The entire Manti-La Sal National Forest is designated as a Class II air quality area and must conform to the related air quality standards. The northern portion of Capital Reef National Park is within 30 miles of the southern portion of the project. Capital Reef National Park must conform to the more stringent Class I air quality standards. Capital Reef National Park is normally not downwind.

The entire proposed project is within Sanpete and Sevier Counties, Utah which are attainment areas (an area that meets national air quality standards). Utah County about 40 miles to the north is the closest non-attainment area. Impacts to Utah county are not reasonably foreseeable because winds do not prevail from the south (usually from the southwest) and distance to Utah County would usually disperse pollutants.

The Forest Plan (pg 111-43) requires that all projects meet State and Federal air quality objectives. Some sources of air pollution capable of degrading air quality exist on the Forest. Unpaved roads, mining activities, wildfire, prescribed burns and construction activities can decrease air quality.
CHAPTER 3

These activities, according to the Forest Plan, are managed so that air quality standards are not exceeded and air quality is not significantly impacted. Power plants and other industries adjacent to the Forest are generally located downwind of Forest lands and do not usually affect air quality on the Forest. Air pollution sources upwind of the Forest are legally constrained from significantly degrading air quality over the Forest (Project File).

Visibility:

Visibility ranges from 40 to 120 miles throughout much of the year. Exceptions are usually caused by precipitation of fugitive dust during windstorms. Average visibility in rural areas of the Southwestern United States has been estimated to be between 65 and 80 miles, which also shows that the air is some of the cleanest in the country (Project File).

Industrial activity in the area is light or dispersed and the resulting air quality in the region is generally good to excellent. Air quality monitoring has not been extensive in the region, but most reports (Project File) show levels below National Ambient Air Quality Standards (NAAQS).

Total suspended solids is a measure of the amount of material suspended in the air. The amount of materials suspended in the air reduces the range of vision and diminishes the quality of the view by extinguishing the light passing through the air. The amount of light extinguished depends on the composition of the particles. The project area has some of the best air quality, regarding total suspended solids and least light extinction, in the United States.

Measurements of total suspended particles have not been made in the project area, however, measurements taken in 1974 of surrounding cities have occurred. The maximum 24-hour average, total suspended solids measured for Price and Castle Dale were 88 and 86 respectively. The National Ambient Air Quality Standards for a maximum 24-hour period are: secondary PM 10 levels (micrograms per cubic meter); primary - 260 ug/m³ (Project File). Total suspended particles levels have exceeded National standards in several locations usually as a result of dust displaced by high winds.

Health:

This project is likely to produce engine emissions from the equipment used, smoke from slash disposal and fugitive dust. The components of exhaust from internal combustion engines that may be aggravated by the emissions from this project are PM 10 (airborne particles with a diameter of less than 10 microns), SOx (airborne compounds that are oxides of Sulfur), NOx (airborne compounds that are oxides of Nitrogen), HIC (airborne Hydrogen Chlorides), and CO (Carbon Monoxide gas). The project file contains 1990 emissions data for surrounding counties. Carbon and Emery counties have high levels of emissions in some categories while Sanpete and Sevier Counties have relatively low emissions. The PM 10 levels are predominately (greater than 90 percent average for all four counties) caused by fugitive dust from roads. Monitoring of Sulfur Dioxide, Oxidant, and Nitrogen Oxides in the area have shown levels well below NAAQS. No monitoring has been done in the project area for carbon monoxide or hydrocarbons, but the rural nature of the region and the generally good dispersion characteristics suggest acceptable levels of these compounds (Project File).

3.4 WATER QUANTITY

The proposed project falls within the Colorado River and Sevier River Basins. The Colorado River basin includes Muddy and Ferron watersheds. Muddy Creek is tributary to the Dirty Devil River which flows to the Colorado River at Lake Powell. Ferron Creek is tributary to the San Rafael River which joins the Colorado River above Lake Powell. The Sevier River Basin includes Sixmile and Twentymile watersheds both of which flow to the San Pitch River which flows to the Sevier River. Portions of the project area drain into Salina Creek and then into the Sevier River. The Sevier River is a closed basin totally within the State of Utah.

For analysis purposes the drainage basins have been divided into four watersheds and further divided into 35 subwatersheds. The proposed treatment units that have perennial streams within them are A5, 7, 9, C5, D1-5, E2, F1-3, G1, G4. The proposed treatment units that have no perennial streams within them are A1-3, 6, 8, 10, 11, B1-4, C1-4, 6, 9, E1-3, 4, 13, 23.

Seventeen lakes, reservoirs, and ponds could be affected by the proposed action or about 22 percent of the lakes within the Manti-La Sal Forest boundary. The following lakes are important to irrigation, recreation and fisheries; Sixmile Ponds, Deep Lake, WPA Ponds, Island Lake, Duck Fork Reservoir, Rush Ponds, Ferron Reservoir, Willow Lake, Julius Flat, Blue Lake, Henningston Reservoir, Slide Lake, Emerald Lake, Spinners Reservoir, Oleys Lakes, Emery Reservoir, and Three Lakes.

Water Yield

The area of this timber sale has some of the highest water yield rates on the Wasatch Plateau and is important as a water supply for both Sanpete and Emery Counties. The higher yields are related to the higher precipitation on the high elevations. The mean annual water yield from the area is reported as 8 to 18 inches per year (Project File).

Near the ridges there are few streams, even though there is high precipitation, because the underlying rock is limestone. Most of the precipitation water and snowmelt infiltrates and percolates through this layer and then reappears as springs near the contact between the limestone and the underlying sandstone and shales.

The epidemic will cause an increase in water yield that may cause some channel adjustments as discussed in Chapter 4. The increases in water yield are within the measurement error at the Forest Boundary.

Timing of Flow

The snowpack remains until late May or June due to the average low temperatures and 10,000 ft elevation. Peak flow in streams is likely to occur in early to mid-June when the snowmelt runoff contributes the majority of annual stream flow. Low flows of the streams occur during the winter usually during February. Summer thunderstorms can cause flash flooding in any of the small canyons although they generally do not produce enough volume to be a large percentage of the annual flow in the larger drainages.

Spruce trees that have been killed by beetles over the past several years no longer transpire water. More of the water remains in the ground since the transpiration which uses water from the rooting zone is reduced. Therefore, it follows that less water will be needed to recharge the soil moisture, and higher flow floods and water yields are more likely now than in the past. Subwatersheds were analyzed and it was shown that any impacts would be very small below the mouths of these selected streams.
CHAPTER 3

3.5 WATER QUALITY

Regulatory Framework

The Water Quality Standards for the streams of Utah are legislated by the state. These are given in the Standards of Quality for Waters of the State (Utah) R217-2, Utah Administrative Code February 16, 1994. These standards are tied to the beneficial uses that are made of the water. For each stream reach in the State of Utah the beneficial uses have been identified.

All waters within the project area are designated as high quality waters. The water quality standards for the waters within and downstream from the project are Ferron Creek and tributaries from Millsite Reservoir to headwaters include standards 1C, 2B, 3C and 4; Muddy Creek and tributaries from Highway U-10 crossing to headwaters include standards 2B, 3A, 4; Twelvemile Creek and tributaries, from U.S. Forest Service boundary to headwaters include standards 2B, 3A, and 4; Sixmile Creek and tributaries include standards 2B, 3A, and 4; and Salina Creek include standards 2B, 3B, 4.

1C Protected for domestic purposes with prior treatment by standard complete treatment processes as required by the Utah Department of Health.

2B Protected for recreation uses including boating and water skiing but not including swimming.

3A Protected for cold water fisheries.

3B Protected for warm water fisheries.

3C Protected for non-game fish and other aquatic life.

4D Protected for waterfowl, shore birds, and other wildlife.

3.6 RIPARIAN/WETLANDS/FLOODPLAINS

Riparian areas, wetlands, and floodplains are inherently interconnected and overlapping. Riparian areas are associated with perennial surface water; water that is present all year except for severe drought. Wetlands are associated with surface or ground water that is present often, and long enough, so that conditions characteristic of wetlands are reflected in the species of vegetation and the character of the soils. Floodplains are areas that are inundated by floods. The floodplains of concern are those areas that would be flooded by the 100 and 500 year recurrence events.

Riparian

Riparian management units (RPMs) are defined in the Forest Plan as extending 100 feet on either side of the high water line of all perennial water and therefore encompass all of the riparian vegetation types. The RPM units associated with the proposed action are mapped at a scale of 1:24,000. RPM units are associated with both perennial streams and lakes/reservoirs. The proposed treatment units that have no riparian management units within them are A1-3,4,6,8,10,11; B1-4; C1-4,6-9; E1,3,4;
CHAPTER 3

G2.3. The proposed treatment units that have riparian management units within them are A5, 7, 9; C5; D1-1; E2; F1-3; G14. There are approximately 375 acres (3.5 percent) of riparian management unit within all treatment units.

The dominant vegetation community has been inventoried in some riparian management units. Those units that contain conifer species have the potential of being impacted by the proposed action. Those that contain no conifers will not be impacted by logging operations except for possible impact at road crossings. The average width of all inventoried riparian areas within treatment units are 26 feet including the width of the stream. Approximately thirty three percent of all riparian length is in conifer types.

Riparian management units surrounding seventeen lakes, reservoirs, and ponds could be affected by the proposed action or about 22 percent of the lakes within the Manti-La Sal Forest boundary (see water quantity section). Approximately 40 acres (<1 percent) of riparian management unit are associated with lakes.

Wetlands

Wetlands are managed under the guidance of Executive Order (E.O.) 11990 and FSM 2527. Wetlands regulations are enforced by the Army Corps of Engineers and Environmental Protection Agency and generally a 404 permit is needed from the Corps. A nationwide permit is in place concerning wetlands affecting less than 10 acres. Those units that contain conifer species have the potential of being impacted by the proposed action. Those that contain no conifers will not be impacted by logging operations except for possible impact at road crossings. The average width of all inventoried riparian areas within treatment units are 26 feet including the width of the stream. Approximately thirty three percent of all riparian length is in conifer types.

Wetlands are regulated by Executive Order 11988 and FSM 2527. FSM 2527 states; the 100 year floodplain and the 500 year floodplain, for critical actions, will be avoided so far as practicable. No facility will be developed within the 100 year flood plain unless it is a functionally dependant use such as a culvert or a bridge. Where no practicable alternative is available, the facility is labeled a functionally dependent use of the floodplain and necessary mitigating measures are incorporated.

3.7 AQUATIC HABITAT

Stream and River Fisheries

The following perennial streams within the proposed project area support fish populations: The South Fork of Muddy Creek (including Black Fork, Mill Fork, Fish Creek, Slide Fork, Reservoir, and two unnamed tributaries), the North Fork of Muddy Creek (including unnamed tributaries), Muddy Creek (mainstem), South Fork Twelvemile Creek (and unnamed tributaries), Twelvemile Creek (mainstem), the South Fork of Sixmile Creek (including the tributaries that enter the South Fork of Sixmile Creek upstream from Sixmile Ponds), Ferron Creek, Mill Stream, Little Horse Creek, Singleton Creek, Indian Creek, Lake Fork, Georges Fork, and Duck Fork Creek. Species that could be directly or indirectly affected by land use activities within the project area are: Yellowstone cutthroat (Oncorynchus clarki), rainbow trout (Salmo gairdneri), red shiners (Notropis lutrensis), fathead minnows (Pimephales promelas), speckled dace (Rhinichthys osculus), redside shiners (Richardsonius balteatus), flannelmouth suckers (Catostomus latipinns), roundtail chubs (Gila robusta) and mountain suckers (Catostomus platyrhynchus) (Manti-La Sal National Forest data summaries, dates unknown; Christopherson, personal communication).

There are several high-value recreational stream fisheries that should be noted within the proposal area. Duck Fork Creek (above the reservoir), Lake Fork, and Indian Creek support naturally-reproducing Yellowstone cutthroat populations. Spawning takes place primarily in the headwater areas below heavily timbered slopes (Burns, personal communication). Angler information from the Muddy and Twelvemile drainages indicates that both streams support small naturally-reproducing populations of Yellowstone cutthroat trout.

Two non-game species, flannelmouth suckers and roundtail chubs, are known to inhabit mainstream reaches below the project area and are currently classified as "Species of Concern" by the State of Utah.

Reservoir and Lake Fisheries

Several reservoirs and lakes could be directly or indirectly affected by land management activities within the proposal area. These are: Slide Lake, Three Lakes, Blue Lake, Henningson Reservoir, Julius Flat Reservoir, Island Lake, Emerald Lake, Emery Reservoir, Spinners Reservoir, Shingle Mill Reservoir, Deep Lake, WPA Ponds, Clyo Lake, Rush Pond, Willow Lake, Ferron Reservoir, Duck Fork Reservoir, and Sixmile Ponds. Twelve of these are intensively managed as "put-and-take" fisheries by the Division of Wildlife Resources (i.e. high density populations with very high angler catch rates). Blue Lake, Henningson Reservoir, and Emery Reservoir are stocked with brook trout (Christopherson, personal communication). Henningson Reservoir, Julius Flat, Island Lake, Emerald Lake, Spinners Reservoir, Deep Lake, Ferron Reservoir, and Duck Fork Reservoir are all stocked with cutthroat trout (Christopherson, personal communication). Ferron and Duck Fork Reservoirs are stocked heavily with cutthroat trout and are heavily used by anglers.

Amphibians

Field inspections of pot-hole habitats in the 1995 field season (Dufour, field notes) found Great Basin Spadefoot toad larvae and egg clusters (Scaphiopus hoplomactus) in pot-hole habitats in the Upper Muddy drainage (approximately 10,000 feet in elevation). No other information is known about amphibian distribution, although suitable habitats exist throughout the project area.

Status of Aquatic Habitats

Muddy and Twelvemile Creeks are unique drainages within the Manti-La Sal National Forest that they support fish but have very low road densities. Lack of easy access has probably protected trout populations from high angler mortality (Christopherson, personal communication). The stream channels appear to be recovering from historic livestock grazing impacts (Burns, personal communication). Stream inventories conducted by Forest biologists in 1981 noted re-establishment of cotton-
CHAPTER 3

woods and willows in riparian areas, unstable banks in places, and silt deposition in pools. Extensive soil movement and channel adjustment was observed by the Forest Fisheries Biologist (Dufour) in response to high runoff in the Upper Muddy drainage in 1995. High fall flows caused substantial channel downcutting and some lateral adjustment in the lower portion of the same drainage (near the Forest boundary) (Dufour, personal observations 1995).

Basin-wide inventories of aquatic habitat conditions in the Upper Ferron drainage were conducted in 1995. Three streams were inventoried: Little Horse Creek, Duck Fork Creek, and Lake Fork Creek. Data from these field surveys show that habitats for all salmonid life history stages, including spawning and rearing, are present. Survey notes indicate that some areas of these channels continue to show evidence of 1983-84 flood events (i.e. signs of channel adjustment and bank-cutting were evident). A study of the role of large woody material in these three streams demonstrated that wood directly creates 43%, 51% and 38% of the pool habitat in Duck Fork, Little Horse, and Lake Fork Creeks; respectively. Wood is therefore a significant contributor to the pool habitat component that provides fish with foraging, resting, hiding and over-wintering habitats in otherwise high-current environments.

Abundant wetlands have been observed throughout the project area. They are critical to aquatic communities in that they act as water reserves and provide base flows during low water periods. Potholes, small ponds and marshy areas provide subsurface flow that supplements direct water sources like springs and run-off. These wet areas support invertebrate and amphibian populations.

The Manti-La Sal Forest Plan directs that aquatic macroinvertebrates be used as management indicator species to assess impacts of projects and management activities on aquatic communities and water quality. Monitoring stations are located at the National Forest boundaries on Ferron, Muddy, and Twelvemile Creeks. Water quality in Twelvemile Creek appears to have improved steadily since the large landslide and flooding events which occurred in 1983 and 1984. The Muddy Creek and Ferron Creek results are so variable that trends are not apparent.

3.8 THREATENED, ENDANGERED, AND SENSITIVE AQUATIC SPECIES

There are no threatened, endangered, or Region 4 (USFS) sensitive fish species found within the proposed sale area. Far downstream from the proposal there are four Colorado River fish species which are currently listed as endangered: the Colorado squawfish (Ptychocheilus lucius), the bonytail chub (Gila robusta), the humpback chub (Gila cympha) and the razorback sucker (Xyrauchen texanus).

There are no threatened or endangered amphibian species within the proposed sale area.

Habitat suitable for supporting the spotted frog (Rana pretiosa), the only Region 4 (USFS) sensitive aquatic amphibian species on the Forest, is not present in the project area (Perkins, UT DWR Herpetologist; Keleher, UT DWR, personal communication). Herpetological staff with the UT DWR indicate that spotted frogs prefer lower elevation sites; usually in floodplains or near springs. The project area is at a much higher elevation than the areas where frogs have been observed.

3.9 FOREST HEALTH, DIVERSITY, AND PRODUCTIVITY

This section describes the existing condition for Forest Health, Diversity, and Productivity by comparing stand development trends of Periodic Annual increment (PAI) and Climatic Mean Annual Increment (CMAI), comparing acres of green spruce treated by alternative to changes in acres of

CHAPTER 3

Schmid and Frye risk classification, and comparing trends in vegetative diversity within the South Manti project area.

Since 1989, extensive Engelmann spruce mortality has occurred on the Ferron/Price and Sanpete Ranger Districts, as the result of epidemic populations of Spruce beetle (Dendroctonus rufipennis) (Figure 3.3). The project area was established to include the Engelmann spruce-Subalpine fir forest type on the Ferron/Price and Sanpete Ranger Districts that were infested or in imminent danger of infestation as a result of the Spruce beetle epidemic that has continued to increase. The Spruce beetle population has expanded from two centers, near Black Mountain and Skyline Drive, and the current infestation extends from the joint Fishlake National Forest and Manti-La Sal National Forest boundary, north to Twelvemile Creek.

Forest Plan direction for insect and disease management or suppression is to "Prevent or suppress epidemic insect and disease populations that threaten forest and/or range land with an Integrated Pest Management (IPM) approach consistent with resource management objectives." In response to Forest Plan objectives and concerns over the health of adjacent Engelmann spruce-Subalpine fir stands that were uninfected or only lightly infected, the project boundary includes those stands near Lake Fork and Blue Meadows which are in imminent danger of infestation. With emphasis on inclusion of stands which are classified as Management Prescription TSB (emphasis is on wood-fiber production and harvest) (Figure 3.1). Although the current infestation of these stands is at endemic (natural, balanced) levels, significant mortality of spruce can be expected if the outbreak remains at current levels.

Based on a timber survey conducted in 1980 Figure 3.4, the project area (24,597 acres) includes five primary forest cover types: 1) Engelmann spruce-Subalpine fir 11,490 acres; 2) Douglas-fir 105 acres; 3) Aspen 2,857 acres; 4) Grass & brush lands 8,762 acres; and 5) Barren lands/rock 856 acres. An additional 527 acres were not classified at the time of survey. Approximately 10,817 acres of the Engelmann spruce-Subalpine fir cover type area was identified as spruce sawtimber. These stands are those in which the dominant overstory trees are Engelmann spruce that are nine inches DBH (Diameter Breast Height measured at 4 1/2 feet above ground level) and larger.
CHAPTER 3
FIGURE 3.3

Annual Spruce Beetle Mortality
Manti-La Sali National Forest
1981-1994

Thousands of Trees
0 5 10 15 20 25 30

CHAPTER 3
FIGURE 3.4

Vegetation

LEGEND

Alpine Fir
Aspen
Douglas Fir
Spruce
Non-forested
No data

1 Miles

South Manti timber Salvage Sales EA, Page 3 - 19

South Manti timber Salvage Sales EA, Page 3 - 20
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About 10,211 acres of Engelmann spruce-Subalpine fir forest within the project analysis area have been identified for consideration for silvicultural treatments as a result of the spruce beetle epidemic, which is killing most of the eight inch and larger DBH Engelmann spruce trees. Within these stands, the epidemic has caused significant mortality in 5,746 acres of spruce since 1989, and is spreading north towards an additional 4465 acres of spruce stands (Figure 3.5). An additional 791 acres of dead Engelmann spruce trees are currently being salvaged under the Twelvemile and Timber Canyon Salvage Sale contracts.

The Manti-La Sal National Forest Land and Resource Management Plan defines those timber stands which can produce 20 cubic feet or more per acre per year; are capable of being restocked within 5 years; or can be harvested within the General Direction, Standards, and Guidelines of the Forest Plan. The stands would be suitable for commercial harvest for timber or wood fiber production.

All of the forested area considered for potential silvicultural treatments, are suitable for timber harvest, based on average stand productivity figures. Within these stands, approximately 2,311 acres have been estimated as nonstockable or unsuitable based on soil suitability and ground conditions that preclude regeneration within five year restocking requirements. Unsuitability does not preclude salvage harvest of dead and dying trees.

The dominant habitat types of the timber stands being considered for silvicultural treatment are classified as Abies lasiocarpa/Ribes montigenum (Subalpine fir/Mountain gooseberry) and Abies lasiocarpa/Berberis repens (Subalpine fir/Oregon grape). Stands vary from uniform tree spacing to clumpy, open conditions. The stands are generally uneven-age and mature with Engelmann spruce (Picea engelmannii) and Subalpine fir (Abies lasiocarpa) dominant in the overstory. Quaking aspen (Populus tremuloides) and Limber pine (Pinus flexilis) also occur in some stands. The understory is generally Subalpine fir and Engelmann spruce. The less tolerant aspen and Limber pine are generally being replaced by the more tolerant spruce and fir species, except in those locations where events have occurred which disrupt spruce-fir encroachment. Undergrowth shrub species include Mountain Gooseberry, Mountain Snowberry, and Red Elderberry. Herbaceous species include Sweetroot, Heartleaf Arnica, European Yarrow, and Rose Sedge.

Stands were mature prior to infestation. The average stand age is approximately 140 years, with individual trees up to 250 years in age. Average trees per acre of live, dead, and dying trees five inches DBH and larger are displayed in (Tables 3.2) and (Figure 3.6). Average merchantable volumes for the area are displayed in (Table 3.3).

### TABLE 3.2
Trees/Acre

<table>
<thead>
<tr>
<th></th>
<th>LIVE TREES</th>
<th>LIVE TREES</th>
<th>DEAD &amp; DYING</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infested Stands</td>
<td>79</td>
<td>35</td>
<td>61</td>
<td>174</td>
</tr>
<tr>
<td>Uninfested Stands</td>
<td>119</td>
<td>69</td>
<td>8</td>
<td>196</td>
</tr>
<tr>
<td>TOTAL - AVERAGE</td>
<td>96</td>
<td>50</td>
<td>38</td>
<td>184</td>
</tr>
</tbody>
</table>

ES = Engelmann Spruce

![Spruce Beetle Infestation](image)

**LEGEND**

- **Infested**
- **Uninfested**

1 0 1 Miles

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CHAPTER 3
FIGURE 3.6

Live, Dead, & Dying Trees

These figures equate to approximately 386,250 dead and dying Engelmann spruce trees, and total dead and dying volume of 65.0 million board feet (MMBF) within proposed treatment units.

An additional 507,031 live Engelmann spruce trees, and total volume of 70.8 MMBF are in imminent danger of attack from spruce beetle at this time within proposed treatment units. These figures include trees uninfested at the time of inventory in infested stands, most of which will die during the next beetle flight, as well as Engelmann spruce in those stands which currently have not been reached by the advancing epidemic.

It should be noted that within the area currently affected, or in danger of being affected by the epidemic, Engelmann spruce within all forest types, whether normally considered suitable or unsuitable for timber harvest are being attacked, or are in danger of being attacked by spruce beetle.

Approximately 2,086 acres (20 percent of proposed treatment area) of Engelmann spruce-Subalpine fir forest stands are not fully occupied (stocked) with live trees as a result of this epidemic (Figure 3.7). Approximately 1,749 acres within the spruce beetle infested area would currently require treatments to promote natural regeneration or artificial planting in order to bring the stands back to normal stocking standards in a short to moderate time-frame.

Stand Development

Stand inventory data indicates that infested stands, and the total average of the Engelmann spruce-Subalpine fir treatment stands, are in a condition comparable to Stage E of the even-aged stand development model. This stage is characterized by high mortality and decreasing growth. As mortality occurs, large gaps are created, and the site or stand cannot be fully occupied until regeneration occurs (natural or artificial). Stand production is significantly below the sites potential to produce. Periodic Annual Increment (PAI) has dropped below the Mean Annual Increment (MAI), with a rapid downward trend continuing as mortality continues. Mean Annual Increment is a measure of the annual cubic foot growth that a stand has achieved through its life. Figure 3.8 display is from RMSTAND inventory data, and are based on 5" DBH and larger trees.
 CHAPTER 3

FIGURE 3.7

Stocking & Reforestation Needs

CHAPTER 3

Uninfested stand conditions are comparable to Stage C and D of the even-aged stand development model. Growth rates and tree health are declining, and density-related mortality is occurring in some areas of the stands. Site occupancy can normally be quickly regained in this stage. Mortality is at a level that as openings are created, the sites are quickly occupied by expanding crowns and root systems of residual trees.

Stand data indicates that the uninfested stands are near, but have not reached Culmination of Mean Annual Increment (CMAI). When MAI = PAI, CMAI has been reached. At this point managed stands are normally scheduled for a regeneration harvest. Average stand productivity (stand potential CMAI level - unmanaged stands seldom achieve this), current stand growth, current stand mortality, current PAI (periodic annual increment = current growth - mortality), and current MAI (mean annual increment) are displayed in Table 3.4 and Figure 3.8 for spruce beetle infested stands, uninfested stands, and overall average of the spruce-fir stands in the analysis area.

| TABLE 3.4 |
| Stand Condition & Productivity |
| (cubic feet/acre/year) |

<table>
<thead>
<tr>
<th></th>
<th>STAND PRODUCTIVE (potential)</th>
<th>CURRENT GROWTH</th>
<th>CURRENT MORTALITY</th>
<th>CURRENT PAI</th>
<th>CURRENT MAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infested Stands</td>
<td>73</td>
<td>29</td>
<td>260</td>
<td>-231</td>
<td>12</td>
</tr>
<tr>
<td>Uninfested Stands</td>
<td>75</td>
<td>43</td>
<td>15</td>
<td>28</td>
<td>19</td>
</tr>
<tr>
<td>Total Stand Average</td>
<td>74</td>
<td>35</td>
<td>153</td>
<td>-118</td>
<td>15</td>
</tr>
</tbody>
</table>

Schmid & Frye Risk Classification

Stand hazard ratings for Spruce beetle have been evaluated for each potential treatment stand. Total acres by risk rating are displayed in Table 3.5 for infested stands, uninfested stands, and the average for all potential treatment stands in the analysis area. Infested stand risk ratings have been reduced one to two classes from preinfestation levels as a result of spruce mortality and corresponding reductions in average Englemann spruce diameter, basal area, and species composition. This reduction is expected to continue to a low to a low-moderate rating as mortality increases in the infested stands.
CHAPTER 3

FIGURE 3.8

AVE Stand Condition/Productivity

<table>
<thead>
<tr>
<th>Cubic Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>-250</td>
</tr>
<tr>
<td>-200</td>
</tr>
<tr>
<td>-150</td>
</tr>
<tr>
<td>-100</td>
</tr>
<tr>
<td>-50</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

A-TOTAL  A-INFESTED  A-UNINFESTED

Under normal population levels, a high rating indicates that immediate preventive action is needed to maintain a healthy vigorous stand relatively free from risk of a serious Spruce beetle infestation. A Moderate-High rating indicates that a stand should be treated within 10-20 years, a Moderate rating indicates that a stand should be treated within 20-30 years, a Low-Moderate rating indicates that a stand should be treated in 30-40 years, and a Low rating would normally require stand treatment in 40 or more years.

Stand density analysis of stand inventory plot data Figure 3.9 indicates that approximately 18 percent of the uninfested stand area has passed the lower limit of self-thinning for Engelmann spruce. This point is approximately 60 percent of maximum SDI (Reineke Stand Density Index), and is indicative of the point where mortality begins in a stand as a direct relationship to its average diameter and number of trees per acre. Schmid and Frye ratings for these high density areas scattered throughout the uninfested stands would be approximately, High. Approximately 37 percent of the uninfested stand area has exceeded 55 percent of maximum SDI. This is the point where individual live crown to stem height ratio for a stand reaches, and begins to decline below 40 percent. Below this level an individual trees ability to respond to natural or artificial thinning declines, and susceptibility to pests increases. Schmid and Frye ratings for this density levels would correspond to a Moderate - High to High Rating.

Vegetative Diversity

The Spruce beetle prefers large diameter trees, but will attack trees as small as 6-8 inches, especially when populations are at epidemic levels. Forest Pest Management surveyed this area in 1993. Results indicated that there was a 52 percent mortality rate in Engelmann spruce in the infected stands, with a corresponding reduction in average Engelmann spruce diameter from 19.9 to 15.3 inches DBH (Diameter at Breast Height - 4 1/2 feet above ground level).

CHAPTER 3

TABLE 3.5
Spruce Beetle Risk Rating

<table>
<thead>
<tr>
<th>ACREs</th>
<th>ACREs</th>
<th>ACREs</th>
<th>ACREs</th>
<th>ACREs</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>MODERATE TO HIGH</td>
<td>MODERATE</td>
<td>LOW TO MODERATE</td>
<td>LOW</td>
</tr>
<tr>
<td>Infested Stands</td>
<td>0</td>
<td>188</td>
<td>3,887</td>
<td>771</td>
</tr>
<tr>
<td>Uninfested Stands</td>
<td>0</td>
<td>1,888</td>
<td>2,566</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>2,076</td>
<td>6,453</td>
<td>771</td>
</tr>
</tbody>
</table>

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It is estimated that as the infestation continues, spruce mortality in affected stands could exceed 50 percent, and in areas of essentially pure, large diameter spruce, mortality could reach 100 percent. This results in loss of the larger (8" + DBH) live spruce trees from the stands, which 1) reduces average stand height and diameter; 2) converts the species composition from a dominant or moderate spruce mix towards Subalpine fir; 3) destroys seed source in some areas and slows the natural regeneration and recovery of those sites to a forested condition, and 4) increases fuel loading and fire hazards.

Figure 3.6, Live, Dead, & Dying Trees shows that prior to infestation Engelmann spruce comprised approximately 50 percent of the overall stand structure. This percentage is declining rapidly as the infestation, and associated mortality occur. Subalpine fir, and to a minor extent Quaking aspen and Limber pine are replacing the more commercially valuable Engelmann spruce.

Table 3.6 portrays a classification diagram which illustrates the successional possibilities of the spruce-fir habitat types in the South Manti Salvage analysis area. Prior to the Spruce beetle epidemic, the majority of the proposed treatment stands fell within the Engelmann spruce tree layer near the peak of the pyramid. Due to the heavy mortality most of these stands have stepped up to the Subalpine fir tree layer, or the successional climax condition for these habitat types. Engelmann spruce, and the more intolerant Quaking aspen and Limber pine will shift into minor roles in the structure of the ecosystem, unless steps are taken to restore the species in deforested areas, and maintain some large diameter Engelmann spruce trees in those areas that have not been significantly affected at this point in time.

TABLE 3.6
Succession classification diagram of the tree layer in ABLA/RIMO or ABLA/BERE habitat type.

<table>
<thead>
<tr>
<th>Time (successional (Age))</th>
<th>Subalpine Fir Layer</th>
<th>Engelmann Spruce Layer</th>
<th>Limber Pine Layer</th>
<th>Quaking Aspen Layer</th>
<th>Potlarch Pine Layer</th>
<th>Populus Tremuloides Layer</th>
<th>Successional Indicator (Amplitude)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Abies lasiocarpa (Subalpine Fir)</td>
<td>Abies lasiocarpa (Engelmann Spruce)</td>
<td>Pinus flexilis (Limber Pine)</td>
<td>Populus tremuloides (Quaking Aspen)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ABLA = Abies lasiocarpa = Subalpine Fir
PIEN = Picea engelmannii = Engelmann Spruce
PFL = Pinus flexilis = Limber Pine
POTR = Populus tremuloides = Quaking Aspen
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3.10 RANGELAND VEGETATION AND NOXIOUS WEEDS

A wide variety of plant communities and plant species occur within the South Manti project area. The broad plant types within this area include: conifer timber types, aspen, riparian, high mountain grass and forbslands and high mountain brushlands.

Conifer Timber Types occur mostly on the North and East aspects, slopes and upper basins. Aspen Types are mostly found on the upper bench lands, mixed with the Conifer on lower North slopes and on the higher South slopes and in the mid-elevation basins. Riparian Types are generally found along the small streams, wet meadows, around small natural lakes and near springs. Grass and Forblands are found mostly on the plateau tops, upper bench lands, and exposed slopes and ridgetops. High mountain Brushlands occur on the high plateau tops and exposed South slopes and ridges.

Forage used by livestock and wildlife is produced mostly in the grass-forb, aspen, mountain brush, and riparian types within the area. Some forage is available in the open timber types that occur in the canyon bottoms and on the gentle slopes. Dense timber stands are used rarely by livestock due to the lack of available forage plants, steep slopes and poor access.

Noxious Weeds

A noxious weed is defined as a plant that is extremely prolific, invasive, competitive, harmful, destruc-
tive and difficult to control. Also it is a plant that has been designated by legislative action to direct its control. About 14,000 acres of the Manti-La Sal National Forest are infested with noxious weeds.

Musk thistle (Carduus nutans), White top (Cardaria draba), Canada thistle (Cirsium arvense) are the three noxious weeds known to occur within the project area. All of these weedy plants have the potential to grow in a wide variety of habitats and can spread rapidly into disturbed sites.

3.11 THREATENED, ENDANGERED, AND SENSITIVE VEGETATION SPECIES

About five to six hundred plant species occur within the project area. Of these, one is listed as a threatened plant species, Heliotrope milkvetch (Astragalus montii), and three are listed as sensitive plants, Maquire campion (Silene petersonii), Carrington daisy (Erigeron carringtoniae) and Musinea groundsel (Senecio musiniensis). These threatened and sensitive plants are found growing on the high elevation limestone outcrops and snowdrift sites within the grass and forbland complex. Approximately 2,000 acres of suitable habitat exist for these plants within the project area.

3.12 FUELS/FIRE

Influence of Fire on Existing Vegetation

The Manti division of the Manti-La Sal National Forest encompasses about 800,000 acres of which approximately 65,000 acres consists of private lands inside the forest boundary. Fire occurrence on the Manti Division averages about 20 fires per year. Of those 20 fires, 3 are caused and the balance (85 percent) are ignited by lightning. There have been an average of 1.25 ignitions per year over the past 20 years within the project area. Typically, due to direct suppression or wet conditions, these fires rarely reach more than 10 acres in size. Historically, severe fire activity in the project area usually resulted in stand replacement, or occurred during wet periods when fire would not carry through the existing fuels. There is no indication that ground fires have burned through this area for several decades. No substantial fires have occurred in this area in the last 75-100 years. There is some indication of small fires that appear to have burned themselves out (less than 0.25 acre in size).

CHAPTER 3

It is important to mention here that there are many grazing allotments within the Manti division. Grazing of the fine flaky grasses and forbs, keep those fuels, if ignited, from spreading fire very rapidly or with very high intensity. Therefore, grazing may have contributed to the small size of fires in the area.

The three primary fire groups represented within the South Manti project area are the Dry Lower Subalpine Habitat Types (Group 10), the Moist to Wet Subalpine Habitat Type (Group 11), and the Colder, Upper Subalpine Habitat Types (Group 12) (Project File). There are 4 basic factors important to forest susceptibility to wildfire and the level of fire impacts. These factors are fire susceptibility of the different species within the project area, stand structure, existing fuel loading, and fuel moisture.

Fire Susceptibility

Bradley (1992) provides a thorough discussion of how fire affects tree species found within the project area (Project File). In general, the relative resistance of a tree species to fire, from highest resistance to lowest, is: Limber pine...Engelmann spruce...Subalpine fir...Aspen. For example, if a stand consists of Aspen and Subalpine fir there will be a high mortality rate even with a low to moderate fire intensity.

Stand Structure

Comparing the successional trend pathways for fire group 10, 11 and 12 to the existing vegetative conditions in the South Manti project area reveals a spruce/subalpine fir overstory (70 percent or more) past mid-successional levels for these fire groups. Forests with a strong component of aspen in the overstory (50 percent or more) coupled with invading Subalpine fir is indicative of stands quickly approaching the mid-successional level. The forested areas currently with heavy spruce mortality due to beetle attack will be converted back to the early mid-successional stages for these fire groups.

The development of more multi-layered canopies creates a high vertical continuity of fuels. This vertical continuity of fuels provides for a potentially high risk of spread from crown fires. This high crown fire risk is a key element to potential stand replacement wildfires. Stands within the project area that are dominated by into a mature Spruce and Subalpine fir have significant amounts of fine fuels in the lateral twigs, which when dead, curl against the larger branches or trunk, frequently along the entire length of the tree. Dead trees are often closely intermingled with live vegetation and easily spread fire to the overstory crowns during dry weather. The increased threat of crown fire remains until the dead needles fall from the host tree.

Fuel Moisture

Fuel moisture in the spruce/fir type is typically higher than either the mixed conifer or pine type, and subsequently is the primary reason for the very long fire frequencies in the project area.

The high canopy closure of the mature forest (prior to the beetle infestation and presently until the dead trees lose their needles) results in the retention of moisture and humidity during normal precipitation years. This higher fuel moisture content results in a lower risk to fire starts. However, in dry years when fuel moisture is low, fire starts will occur, though less frequently than in mixed conifer or pine types.

In areas of heavy spruce mortality there will be accelerated loss of canopy closure thereby creating large openings in the stand. The fuel moisture levels in these openings will be considerably less than normal due to exposure from sunlight and wind gradients.
CHAPTER 3

Dead and Down Fuel Loads

Present fuel loading within the project area is quite variable, with as much as 70 tons per acre of down fuel. The average down fuels loading is about 30 tons per acre. The average size of the existing ground fuels is generally greater than three inches in diameter. This size of material, also referred to as 1,000 hour time lag fuels, usually results in a relatively low rate of spread for ground fires, but an overall high fireline intensity rating; in some cases greater than 400 BTU's/Second/Foot (Project File). Because of the predominantly cold, moist conditions in subalpine forests, even those stands having relatively heavy fuel loads may not experience fires for many decades or centuries. (Table 3.7).

As previously discussed, the stand structure is changing due to the high mortality of the spruce component. Over time as the dead spruce falls to the ground, the average fuel loading will most likely more than double (from 30 tons to more than 70+). Also the average size of the ground fuels will change adding more fine fuels, (size less than 3’ in diameter), which will increase the ROS. This along with the decrease in average fuel moisture and exposure to local wind influences will increase the probability of more frequent high intensity fire occurrences. Low decomposition rates and much higher fuel loadings across major portions of the landscape are expected to result in large, intense wildfires in the future if nothing is done to remove or treat these fuels.

### TABLE 3.7

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3.13 WILDLIFE HABITAT

Regulatory Framework

The Forest Service Manual (2600) and the Forest Land and Resource Management Plan states that wildlife habitat should be maintained to provide for viable populations of existing and approved introduced wildlife species (FP III-22).
CHAPTER 3

Species and Habitats of Concern

The analysis area includes a wide variety of vegetation, geology, and topographical features. In various combinations, these features provide shelter and food sources for numerous species of wildlife. The recent out-break of Spruce bark beetles has drastically altered the habitat for some species of wildlife. This is especially obvious for those species, such as woodpeckers, that acquire food from insect infested trees. For other species, such as deer and elk it is not as obvious. Some of the wildlife species found in the analysis area are found in several categories. These categories are Management Indicator Species (MIS), Endangered (E), or Sensitive (S).

MIS species are "species selected because its population changes indicate effects of management activities on the plant and animal community. A species whose condition can be used to assess the impacts of management actions on a particular area." The Manti-La Sal National Forest Land and Resource Management Plan lists the following MIS that are found in the analysis area: Elk, Mule Deer, Macroinvertebrates, Blue Grouse, and Golden Eagles.

Elk and Mule Deer utilize the analysis area during the late spring, summer and fall. There is no winter range in the proposed project area. The areas with Aspen stands and stands, that are near water, are especially important. In these areas does and cows give birth and the first few critical weeks of the young's life are spent. Another important feature is the hiding, or security, cover that is provided by the stands of trees. Stands of aspen provide both forage and cover, while stands of conifer provide mostly cover and limited food. The Manti-La Sal National Forest Land and Resource Management Plan states that the "optimum habitat mix for the daily normal range is 25 percent hiding cover, 15 percent thermal cover, 10 percent thermal cover and 50 percent foraging. Currently, the analysis area contains 50 percent cover (including both thermal and hiding) and 50 percent forage. During the big-game hunting seasons, in the fall, hundreds of hunters come to the area in pursuit of these two species. At these thick stands of trees and areas with low road density greatly reduce the animals vulnerability to hunting (Lyon and Canfield 1991; and Moroz 1991). Schmid and Frye (1977) state that elk and deer benefit from beetle outbreaks because forage production increases. Such a benefit is important only in areas, and at times, when forage is limiting. Therefore, for the analysis area, the adverse effect of reduced cover (increased vulnerability) likely offsets any benefit from an increase in forage.

Elk found in the analysis area are part of the largest elk herd in the state. Approximately 20 percent of the total elk harvested in the state come from this herd. The Mule Deer found in the analysis area are also part of a larger deer herd. Elk are found on nearly all mountain ranges in the state and Mule Deer are found throughout the state in many varied habitats.

Macroinvertebrates are discussed in the Aquatic Habitat section of this Chapter.

Blue Grouse can be found in much of the area year-round. Open stands of timber that are adjacent to open sagebrush/grass forb vegetative types are especially important during the mating season. Aspen habitats are most important to Blue Grouse as brooding areas during the late summer and fall (Bunnell, 1979). During the winter mature stands of fir (especially Douglas-fir) provide both food and protection from the elements. Because of the preference for Douglas-fir, which is found mostly at mid-elevations, populations of Blue Grouse are denser at lower elevations than they are in the analysis area. The recent beetle outbreak, and subsequent loss of mature conifers has likely adverse-ly impacted grouse habitat and populations (Schmid and Frye, 1977).

During the late spring, summer and fall Golden Eagles can be observed foraging in the area. No eagles eyries have been found in or near the analysis area. It is suspected, that eagles observed in the area come from nesting areas along the cliffs at lower elevations to the west and east. Eagles main sources of prey are rodents or other small mammals such as rabbits. Populations of some of these species increase and some decrease during beetle outbreaks (Schmid and Frye, 1977). In the general area of southeastern Utah Golden Eagle populations appear to be increasing (UDWR, 1990). Therefore, it is not expected that the beetle outbreak will have an impact to Golden Eagle habitat and populations.

3.14 THREATENED, ENDANGERED, AND SENSITIVE WILDLIFE SPECIES

Regulatory Framework

The Endangered Species Act of 1973 (PL 93-205, as amended) requires federal agencies to insure that any activities they authorize, fund, or carry out, do not jeopardize the continued existence of any wildlife species federally listed as Threatened or Endangered (Section 7). Although not required under the Endangered Species Act, it is Forest Service policy to analyze potential impacts to Proposed and Sensitive species as well (Forest Service Manual (FSM) 2670.31-32). Proposed Species are those that are proposed by the U.S. Fish and Wildlife Service to be listed as Threatened or Endangered. Sensitive Species are those identified by the Forest Service Regional Forester as "those for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution." (FSM 2670.5).

Species and Habitats of Concern

There are no Threatened or Proposed species known to occur in the analysis area. The following Endangered (E) and Forest Service Sensitive (S) species have been seen in (or over) the area: Bald Eagle (Haliaeetus leucocephalus) (E), Spotted Bat (Euderma maculatum) (S), Townsend's Big-eared Bat (Plecotus townsendii) (S), Flammulated Owl (Otus flammeolus) (S), Northern Goshawk (Accipiter gentilis) (S), and Three-toed Woodpecker (Picoides tridactylus) (S). Details concerning these species, their habitat preferences, and occurrences are described below.

BALD EAGLE Habitat - During the breeding season Bald Eagles are generally closely associated with water, along coasts, lakeshores, or river banks. During the winter Bald Eagles tend to concentrate wherever food is available. This usually means open water where fish and waterfowl can be caught. They also winter on more upland areas feeding on small mammals and deer carrion. At winter areas, Bald Eagles commonly roost in large groups. These communal roosts are located in forested stands that provide protection from harsh weather (Stalmaster, 1987).

Bald Eagles are occasionally found near the lakes and reservoirs in the analysis area, during the late fall and early winter. Here they prey upon fish and waterfowl. When the lakes and reservoirs freeze over eagles leave the analysis area. No Bald Eagles are known to nest on the Forest. However, there is an active Bald Eagle eyrie near the town of Castle Dale, approximately 24 miles east of the project area. During 1993 the nesting territory was observed to determine the foraging area and fledgling area. None of these activities were observed on National Forest System Lands.

SPOTTED BAT HABITAT - Spotted bats occur in scattered areas throughout Utah. They have been found in a variety of habitat types including open Ponderosa pine, desert scrub, Pinyon-Juniper, and open pasture and hay fields. They roost alone in rock crevices high up on steep cliff faces. Cracks and crevices ranging in width from 0.8-2.2 inches in limestone or sandstone cliffs are important roosting sites. There is some evidence that individuals show fidelity to roost sites. They are terrestrial and avoid each other while foraging. They are thought to migrate south for winter hibernation.
CHAPTER 3

Spotted bats are rare and may be limited by suitable roosting sites. They are found in relatively remote, undisturbed areas, suggesting that they may be sensitive to human disturbance. Little is known of the Spotted Bats food habits. They are thought to feed mainly on moths. Their echolocation call is very effective for fast flight feeding on moths. They forage alone, after dark, and avoid each other by listening to the echolocation calls of others (Leonard and Fenton 1983; Woodsworth et al 1981; and Watkins 1977).

To date the only known sightings of Spotted Bats on the Forest have been on the Moab/Monticello and Ferron/Price Ranger Districts. On the Ferron/Price Ranger District they have been located at Joed Valley Reservoir and at Emerald Lake. Emerald Lake is within the analysis area. It is believed the bats located at this site roost in the limestone cliffs found throughout the area.

TOWNSEND'S BIG-EARED BAT (WESTERN BIG-EARED BAT) Habitat - Townsend's or Western Big-eared Bat use a variety of scrub and forested habitats, throughout western North America. These bats use juniper/pine forests, shrub/steppe grasslands, deciduous forests, and mixed coniferous forests from sea level to 10,000 foot elevation. They utilize colonial nurseries. Cool places such as caves, rock fissures, mines, and buildings are used for roosting and hibernation. Foraging of primarily moths is often done in open woodlands, along forest edges, and over water.

The Townsend’s Big-eared Bat occurs throughout North America including Utah. During the winter they roost singly or in small clusters. They remain at these sites from October to February. Migration for these bats usually means a change in location in the same cave or to another nearby cave.

The Townsend's Big-eared Bat is very sensitive to human disturbance. It readily abandon roosts when disturbed. Activities that will or may disturb caves or mines should be evaluated to determine potential impacts to this species (Kunz and Martin 1982; and Utah Division of Wildlife Resources 1980).

Townsend's Big-eared Bats have been documented using inactive coal mines as hibernaculum on the Ferron Ranger District during 1992. They have also been found roosting in buildings of the Ferron Ranger District in the town of Ferron during late summer of 1992. After limited surveys, no Townsend's Big-eared Bats have been found in the analysis area. However, it is still possible they utilize the area at least seasonally for foraging and roosting.

FLAMMULATED OWL Habitat - Flammulated owls are found throughout the Western United States including Utah. They can be found in the mixed pine forests, from pine mixed with oak and pinyon at lower elevations to pine mixed with spruce and fir at higher elevations. They have also been found in aspen and second growth Ponderosa pine. However, they prefer mature Ponderosa pine-Douglas-fir forests with open canopies. Large diameter dead trees with cavities are important nest site characteristics. They avoid foraging in young dense stands where hunting is difficult. Flammulated Owls are dependant upon mature conifer stands for nesting. They are also known to avoid cut-over areas. Flammulated Owls are almost exclusively insectivorous, preying on small to medium sized moths, beetles, caterpillars, and crickets (Reynolds and Linkhart 1987; Johnsgard 1983; and Bull 1989).

Flammulated owls have been found in the Quilchupah drainage and the head of the Muddy on the Ferron/Price Ranger District. All but one of these locations have been associated with Ponderosa pine. This location, in the head of the Muddy, is within the analysis area. This location or "sighting" was a vocalization believed to be from a Flammulated Owl, heard while conducting owls surveys. This "sighting" was not confirmed visually.

NORTHERN GOSHAWK Habitat - In nesting or foraging, the goshawk is a raptor of the dense forest. Goshawks have been found in a variety of forest ecosystems including lodgepole pine, Ponderosa pine, Douglas-fir, mixed forests throughout much of the Northern hemispheres. They prey upon small mammals and birds (rabbits, squirrels, chipmunks, grouse, woodpeckers, jays, robins, grosbeaks, and etc.). Goshawk nest sites are usually located in mature forests, near water, and on benches of relatively little slope. Nests are often used year after year. Goshawks are often very protective of their young in the nest and loudly defend them to intruders. They are very sensitive to human disturbance and have abandoned nests and young due to human activities that take place too close to their nest (Kennedy and Stahlecker 1989; and Hennessey 1978). Seventeen percent of the analysis area contains suitable goshawk habitat. Three nests are known to exist in the analysis and it is possible others exist as well. The number of goshawks nesting on the forest varies from year to year.

THREE-TOED WOODPECKER Habitat - Three-toed Woodpeckers range across North America. They are found in northern coniferous and mixed forest types up to 9000 feet elevation. Forests containing Spruce, Grand fir, Ponderosa pine, Tamarack, and Lodgepole pine are used. Nests may be found in spruce, tamarack, pine, cedar, and aspen trees. Three-toed Woodpeckers forage mainly in dead trees, although they will feed in live trees. About 75 percent of their diet is wood boring insect larvae, mostly beetles, but they also eat moth larvae. They are major predators of the Spruce bark beetle, especially during epidemics. They forage on a wide variety of tree species depending on location. In Colorado, they prefer to forage on old-growth and mature trees. Fire or insect killed trees are major food sources. Forest fires and areas of insect outbreaks may lead to local increases in woodpecker numbers after 3-5 years (Bull et al 1986; and Scott et al 1988). Surveys for Three-toed Woodpecker have been made throughout the analysis area. The species was found throughout the area, with high concentrations being found in areas where the Spruce bark beetles have killed large numbers of trees.

Many other species of wildlife are known to occur in the analysis area. While all species of wildlife are important, those specifically discussed above are of special interest and concern. When considering, and providing for, the needs of some species of wildlife other species needs are often met as well.

3.15 TRANSPORTATION

The area of analysis for transportation planning contains 96.7 miles of system roads in an area of 38.4 square miles. This count includes arterial, collector, and local roads shown on the travel map. Also included are roads that have been field or photo identified since release of the forest travel map and therefor are not displayed on the travel map.

Road Density

The current road density is 2.3 miles per square mile.

Traffic Uses

The Mayfield Road currently carries between 50 and 170 vehicles per day on the west side and between 24 and 69 vehicles per day on the east side. Use on the west side is 58 percent recreation,
20 percent fuelwood activities, 18 percent range activities and 4 percent timber activities. Use on the east side is 87 percent recreation, 3 percent fuelwood activities and 10 percent range activities. The Skyline Drive currently carries between 10 and 56 vehicles per day on the south side and between 23 and 33 vehicles per day on the north side. Use on the south side is 65 percent recreation, 0 percent fuelwood, 25 percent range, and 12 percent logging activities. Use on the north side is 68 percent recreation, 7 percent fuelwood activities, and 25 percent range activities. The Link Canyon Road currently carries between 1 and 13 vehicles per day with 30 percent recreation, 12 percent fuelwood activities and 58 percent range activities. The Sixmile Road currently carries between 4 and 17 vehicles per day with 71 percent recreation, 10 percent fuelwood activities and 19 percent range activities. The Duck Fork Road, #50049, is a higher volume local road that currently carries up to 17 vehicles per day with 84 percent recreation, 4 percent fuelwood activities and 12 percent range activities. The remaining local roads have traffic volumes of under 10 vehicles per day with peak use occurring from recreation activities during the big game seasons.

Existing Aggregate Sources and Use Status

Three existing aggregate sources are located within the project area. Camel Rock North, located in township 19 south, range 4 east, section 38, occupies approximately 4.5 acres. Camel Rock South, located in township 19 south, range 4 east, section 33, occupies approximately 4.5 acres also. Both sites are currently inactive, but have not been reclaimed. Baseball flat aggregate source is located in township 20 south, range 4 east, section 19, and is accessed for local road improvements. If these sources are used, NEPA analyses will be reviewed and updated as needed.

Travel Time, and Delay

On road #50022, travel time at present is approximately 1 hour from Mayfield to the Twelvemile Campground; a traveler can expect approximately 0.7 minutes delay per hour of travel due to encounters and needing to pull over for passing. Starting at the north end of the general analysis area on road #50150, traveling past Twelvemile Flat, and continuing on to the south end onto Baseball Flat, a traveler could expect a 45 minute trip.

Existing Haul Route

The Ferron-Mayfield Road, #50022, is the arterial serving the Timber Canyon and Twelvemile timber sales. This section of the Ferron-Mayfield Road has aggregate surfacing to Twelvemile Flat; naturally occurring rock surfacing is on the upper 2 miles. The collector road serving the Timber Canyon sale is the Skyline Drive, #50150. In 1994, additional surfacing was placed from the #50051 junction to the #50022 junction.

Forest Development Trails

In addition to roads, there are three established trails with a combined mileage of 3.9 miles in the analysis area used by recreation traffic. Trail #003 resides within potential sale units D4 and D5 (1.6 miles). Trail #022 is adjacent to potential sale units C1 and C2 (0.7 miles). Trail #122 partially resides within potential sale units G1 and G2 (1.4 miles). It is estimated that 2 to 3 people per week use these trails during big game hunting seasons.

CHAPTER 3

User Access

Forest visitors can usually access the higher elevations on the Forest between July 1 and October 31. Snowdrifts can sometimes be found beyond July 1 and early snows can close people out prior to October 31.

Vehicle travel off roads is common during State and Federal holidays and big game hunting seasons. Each year some roads are lengthened or unwarmed roads created by forest users. Based on a 1995 road inventory we estimate there are approximately 17 miles of non-system roads not needed for future resource management within, and adjacent to, the project area.

3.16 RANK/E ALLOTMENTS

There are 4 cattle and 8 sheep allotments that occur partially or wholly within the project area. A total of 5,377 cattle and 6,223 sheep graze on these allotment area's during the grazing season (6/20-9/30) for a total of 32,496 Animal Unit Months, (AUMs) of use. These livestock are owned and managed by 77 permittees mainly from the communities of , Emery, Ferron, Manti, and Mayfield. The livestock grazing allotments potentially impacted by the proposed action are listed below.

Sanpete Ranger District

Twelvemile Cattle Allotment

Sixmile Cattle Allotment

Island Lake Sheep Allotment

Sixmile Sheep Allotment

Ferron/Price Ranger District

Emery Cattle Allotment

Ferron Cattle Allotment

Blue Lake/Lake Fork Sheep Allotment

Peavine Flat Sheep Allotment

Helicopter Sheep Allotment

Indian Creek Sheep Allotment

Duck Fork Sheep Allotment

3.17 VISUAL LANDSCAPE

The Manti-La Sal National Forest Land and Resource Management Plan (Forest Plan) assigned a visual quality objective (VQO) to each area of the Forest reflecting the desired management emphasis of the specific area (Figure 3.10). Some of those objectives assigned by the Forest Plan allow a noticeable degree of change from the existing condition as determined during the visual assessment conducted in 1986. The three VQO’s assigned by the Forest Plan to areas within the project area include retention, management activities are not visually evident to the casual observer; partial retention, management activities remain visually subordinate to the characteristic landscape, and modification, management activities may visually dominate the landscape, but must borrow from naturally established form, line, texture, and color so they appear similar to natural occurrences.

Forest resource uses or activities should meet the adopted VQO as displayed on the Planned Visual Quality Objective Map (FP, III-17). Design and implement management activities to blend with the natural landscape (FP, III-17). Rehabilitation existing projects and areas which do not meet the adopted Visual Quality Objective(s) (VQO) specified for each management unit. Set priorities for rehabilitation, considering the following:

- Relative importance of the site and amount of deviation from adopted VQO. Foreground views have the highest priority.
- Length of time it will take natural processes to reduce the visual impacts so that they meet the adopted VQO.
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- Length of time it will take rehabilitation measures to meet the adopted VQO; and
- Benefits to other resource management objectives gained through rehabilitation.

Achieve landscape enhancement through addition, deletion or alteration of landscape elements. Examples of these include addition of vegetation species to introduce unique form, color or texture to existing vegetation and vegetation manipulation to open up vistas or screen out undesirable views.

Existing Visual Condition

Visual sensitivity usually varies along any travel corridor. Exceptional views are available as seen from Skyline Drive, the Ferron-Mayfield road near Ferron Reservoir and Willow Lake, and at points above lakes and reservoirs, deep or expansive drainages, and steep facing slopes. Views from areas of concentrated recreation use (both dispersed and developed) outside of these travel corridors have been classified relative to those who may be fishing, camping, or enjoying the view from their cabin window. Sites of this type are Duck Fork Reservoir, Emerald Lake, Blue Lake, the Ferron Reservoir Recreation Complex (including views from cabins and residences), and Twelvemile Flat Campground.

In summary, the Skyline Drive and Ferron-Mayfield road viewsheds have high visual value. They are characterized by mountainous terrain which includes rock formations and glacial cirques, panoramic ridge and valley views (some containing lakes or reservoirs), and wildlife; resulting in attractive, yet accessible, alpine scenery. Lands adjacent to these corridor viewsheds also considered for timber salvage possess varying degrees of visual sensitivity due to potential recreation use.

The existing visual condition for all treatment units (10,212 acres) was classified as 3,221 acres of Retention (32 percent), 6,471 acres of partial retention (63 percent), and 520 acres of modification (5 percent). The Forest Plan Visual Quality Objective Standard as applied to all treatment units was classified as 14 acres of Retention (<1 percent), 9,459 acres of partial retention (93 percent), and 739 acres of modification (7 percent).
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3.18 ROADLESS CHARACTER

The Forest Plan does not have a section entitled "roadless" and does not provide direction or a desired condition for the roadless character. The issue involves the effects of road building and associated human activities on the roadless character of the area. This issue is important to many people who may want roadless areas kept roadless, unspoiled by human activities, or recommended for wilderness. It is equally important to others who want roadless areas developed and made easily accessible.

The roadless characteristics associated with this issue come directly from the Wilderness Act of 1964 and are the same measures used to analyze each roadless area's eligibility for wilderness. The level at which each roadless area achieves each of these characteristics portrays the area's condition. The term "roadless character" refers to an area usually of at least 5,000 acres, without developed and maintained roads, and substantially natural. Although the inventoried roadless areas have not been formally recommended for wilderness, they may still possess a roadless character. This EIS does not analyze the wilderness suitability of the roadless areas.

The existing condition for each roadless area has been defined using the Manti-La Sal National Forest Roadless Area Review Evaluation (RARE II) analysis (1982) and the associated briefing guide used for planning efforts related to roadless areas on the Forest. Figure 3.11, illustrates the location of six potentially impacted roadless areas in relation to potential treatment units. The narrative description outlines qualitative attributes for each area and is organized by the roadless characteristics.

FIGURE 3.11
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Roadless Areas

LEGEND

Project Area
Roadless Area

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South Manti Timber Salvage Sales EIA, Page 3 - 44
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Big Bear Canyon
Sanpete County, Utah. Approximately 18 air miles from Castle Dale, Utah. Access is from Skyline Drive (#50150), 25,782 acres.

Natural Integrity - Use has substantially altered the vegetation and created two-track roads and associated campsites. There is 21.8 miles of existing road, 1.0 mile of fence, and eight water developments. Watershed activity has effectively divided the Ferron Creek unit, and the undeveloped portion south of Ferron Creek is not unique and is less than 5,000 acres.

Apparent Naturalness - Consistent with all of the other roadless areas located on the Manti division, this roadless area has been extensively used by man historically for grazing and timber harvest. There is moderate evidence of human disturbance to a trained observer. The lands surrounding the area and some intrusions show the same historic use and much evidence of current mechanized activity of watershed and range restoration.

Remoteness - Parts of the area possess a degree of "remoteness" due to relative inaccessibility north of the McEwan Flats area. This area becomes difficult to reach when access roads are wet or snow covered. The section of Skyline Drive to the west also becomes impassible under these conditions and access must be gained from road #50022 which requires a 48 mile drive to Ferron.

Solitude - Except for during the winter months, the opportunity for solitude is limited due to ease of accessibility, thus primitive recreation opportunities as well as challenging experiences of a wilderness variety are limited.

Special Features - Attractions are limited to aesthetic viewsheds from isolated vista points. As is typical with all six of the roadless areas described in this section, cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the area as roadless is low for the area south of Ferron Creek, due to ease of accessibility to and through the unit. It currently receives moderate use during the summer and fall by off road vehicles and during the winter by snowmobiles. North of Ferron Creek, use could be more easily controlled.

Black Mountain
Sanpete County, Utah. Approximately eight air miles southeast of Manti, Utah. Access via Sixmile Canyon Road (#50047), 6,580 acres.

Natural Integrity - Historic and current use, especially Off-Road Vehicles (ORV) use, has altered the area. There are 10.3 miles of road, 2.0 miles of fence, and two water developments.

Apparent Naturalness - The area shows little evidence of man's presence to a trained observer. Recent slope failures within the area have caused stream channel damage to Sixmile Creek and has impacted community and irrigation water supplies. The lands surrounding the area show the same characteristics, but have had additional use as a result of logging, fuelwood gathering, range improvement, or roading.

Muddy Creek-Nelson Mountain
Sanpete and Sevier Counties, Utah. Approximately 4 air miles southwest of Ferron, Utah. Access from Ferron is via road #50022 and #50043. 54,235 acres.

Natural Integrity - Coal exploration and development have created many intrusions, as have a range of improvements. The intrusions have cut the area into two parts, the Nelson Mountain top and the
CHAPTER 3

upper Muddy. The Muddy drainage below the escarpment has an access road to an old coal mine which reduces the natural integrity to a large extent. The integrity of the rest of the area is diminished by vegetative changes, roadking, and range or mineral intrusions. There are 22.52 miles of existing road.

Apparent Naturalness - This area shows some evidence of human disturbance to a trained observer.

Remoteness - This area in addition to being large, is initially difficult to access. The road through Link Canyon is most suited for 4-wheel drive vehicles and is risky at best when wet or snow covered. Access from other routes is also difficult during similar conditions. An area to the north west on the mesa lands above the escarpment is closed during part of the year as winter refuge for big game. Stands of Ponderosa pine add to one's feeling of being in a unique place. While hiking through these wooded areas to the precipitous edge of the canyon walls or escarpments a strong sense of isolation is felt.

Solitude - Opportunities for solitude are limited except on Nelson Mountain and in the Muddy Creek drainage. This opportunity for solitude is retained in these areas because of the poor accessibility. Primitive recreation can occur in these areas in the form of challenging hiking, climbing, and camping.

Special Features - The Muddy Creek drainage provides some attractive canyon walls and related canyon features. Nelson Mountain provides a unique vegetative composition, containing several plant associations, and is designated a research natural area. Most of the area's recreation use is based on hunting. Many two track roads extend down ridges deeply into the area. Historical values may be present in the form of historic mining facilities.

Manageability - Though the area can be difficult to reach; once there, much of the area is highly accessible via off road vehicles. Intrusions have cut the area into two parts, the Nelson Mountain top and the upper Muddy. Nelson Mountain and the area below the escarpments of the Muddy Creek drainage are readily manageable as roadless.

Twelve Mile
Sanpete County, Utah. Approximately six miles east of Mayfield, Utah. Accessed by the Ferron-Mayfield Road (#50022) and/or the Beaver Creek Road (#50290). 10,600 acres.

Natural Integrity - For the most part, the integrity of the area could be restored by rehabilitating man made intrusions. The area shows some evidence of man's presence in structural range improvements and two-track roads of which there are 12.35 miles.

Apparent Naturalness - Historic and current use, as well as the acts of nature have altered the appearance of the area so that it may appear to be less than natural. Recent slope failures and mass land movements within the area have caused stream channel damage to Twelve Mile Creek and has impacted community and irrigation water supplies. The lands surrounding the area show the same characteristics, and have had additional use in the form of logging, fuelwood gathering, and range improvement.

Remoteness - The rough topography present in the area adds to the visitors sense of remoteness. However, the close proximity to Mayfield and relatively easy access via road #50022 lessens one's sense of isolation.

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Solitude - Opportunity for solitude is currently fair due to existing ease of accessibility and consequent use. Access could be restricted and opportunities for solitude improved.

Special Features - Special features include the large landslide which occurred in the spring of 1983.

Manageability - Manageability of the area as roadless is fair, due to the 4-wheel drive or primitive roads passing through parts of the area and an indefinite boundary in some places. With some effort in closing roads, and with some boundary changes, manageability could be improved.

White Mountain
Sanpete and Sevier Counties, Utah. Approximately 16 air miles west of Ferron, Utah. Access is from Skyline Drive (#50150). 27,700 acres.

Natural Integrity - Non system roads extend into the area from virtually all directions and it currently receives extensive off road vehicle use, especially in conjunction with big game hunting. There are 8.59 miles of road, 17.5 miles of fence, and seven water developments.

Apparent Naturalness - The area still shows some evidence of man's presence from typical historic use to a trained observer. The lands surrounding the area show the same use and much evidence of current mechanized activity.

Remoteness - The area is relatively close to I-70 in Salina Canyon to the south and may be readily accessed from there. There is some sense of isolation at the northern and eastern portions. Due to vegetative openness and topography which allow long-views of more developed areas, one does not have a sense of isolation while in the other portions to the south and east.

Solitude - Opportunities for solitude are limited by ease of accessibility. Increased use would further diminish the opportunity for solitude, due to the spacing of vegetative cover. Primitive recreation/challenging experiences are almost non-existent.

Special Features - Special features in this area include a prospective research natural area and a proposed T and E plant, Astragus monti. There is an outstanding lookout point on the northern boundary above the Three Lakes area.

Manageability - Manageability of the unit as roadless is very low. The only feature that would facilitate a manageable boundary is the cliff face of White Mountain, which forms half of the northern boundary. The area is easily accessible from improved dirt roads which border it on all sides.

3.19 CULTURAL RESOURCES

The goal of cultural and paleontological resource management is to protect and enhance significant archaeological, historical, and paleontological resources. Legislation and agency policy guiding this management can be found in the National Historic Preservation Act of 1966 (NHPA), Executive Order 11593, 36 CFR Part 800, the Archaeological Resources Protection Act of 1979 (ARPA as amended), FSM 2360, the American Religious Freedom Act of 1978, the Native American Graves Repatriation Act of 1990 and others. American Indian traditional uses must be considered as stipulated in the American Religious Freedom Act. The Archaeological Resources Protection Act also requires federal land managers to notify, in advance, the appropriate Indian tribe if a permitted action may result in harm to any religious or cultural site.
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The Forest Plan provides the following goals, direction, and standards for cultural resources.

- Conduct appropriate studies to provide information necessary for an adequate review of the effect a proposed undertaking may have on cultural values (FP, III-16).
- Use a predictive model to determine areas of high and low potential for cultural resources. Design site-specific survey requirements in various areas on the basis of the predictive model after appropriate review and approval (including State Historic Preservation Office) (FP, III-16).
- Locate and determine the significances of paleontological, historical and archaeological sites and, as appropriate, nominate sites to the National Register (FP, III-2).
- Protect cultural, historical and paleontological resources from resource-disturbing activities (FP, III-10).
- Give adequate consideration of modifications or alterations to proposed undertakings that could avoid, mitigate or minimize adverse effects (FP, III-16).
- Manage selected historical and archaeological sites for public use, while still protecting the values of the site (FP, III-2).
- Make scout paleontological, historical and archaeological sites available for study by agencies involved in research and education (FP, III-2).
- Protect cultural, historical and paleontological resources from theft and/or vandalism (FP, III-3).

Cultural resources consist of sites, structures, and objects used by prehistoric and historic peoples. Also included within this broad definition are properties holding special significance to the lifeways, traditions, and social institutions of a local ethnic group, especially Native Americans. Paleontological resources include the remains of ancient plants and animals at specific localities.

Available data for potentially the affected cultural and paleontological resources within the project area consists of previous intensive archaeological surveys, an in-depth review of historical references and maps, and cultural resource surveys from adjacent areas. Historical maps and references dating from 1893 to 1956 have also been used to describe historic sites known and likely to be effected within the project area.

Despite the limited amount of actual survey which has been conducted within the decision area, it is possible, using existing data to make some preliminary statements concerning prehistoric and historic cultural resources expected within the project area. Datasets used in developing these expectations are derived from survey data within the decision area, the results of several other surveys in adjacent, but highly similar areas, and a stratified sample survey completed specifically for this project. The stratified model describes and delineates specific areas deemed to have high, moderate or low potential for containing significant cultural resources that could be effected by the proposed action.

Prehistoric Cultural Resources

The sensitivity model (Project File) suggests most prehistoric sites can be expected in areas of restored western timber (5 percent slope). The predictive model further suggests that slopes of 10-20 percent possess only moderate probability and slopes in excess of 20 percent can be considered as low potential for prehistoric sites. The model suggests that approximately 4,106 acres, or 17 percent of the total project area (24,607 acres) can be classified as high probability, 12,959 acres (52 percent) as moderate probability, and 7,592 acres (31 percent) as low probability for containing cultural resources within the decision area.

There is also evidence to indicate some prehistoric sites have been impacted by historic activities such as surface collecting by recreationists and hunters and erosion induced by historic overgrazing.

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It is expected that illegal surface collection will have adversely affected the ability to date surface artifact assemblages at a large proportion of sites within the project area.

Historic Cultural Resources

We anticipated that a few additional historic sites and their associated roads and trails related to lumbering, livestock ranching, and recreation which were not indicated on historic maps and records will be located within areas deemed high probability for prehistoric cultural resources when field surveys are complete.

Traditional Use and Traditional Cultural Sites

As of this time, members of the Ute or Paiute tribes have not expressed an interest or concern regarding activities in South Manti project area. Further consultation with the Ute and Paiute tribes regarding traditional uses and possible traditional cultural sites is ongoing. Decisions regarding this consultation will be included in the Record of Decision.

Paleontological Resources

The North Horn Formation outcrops in the area and is renowned for its unique and important fossil mammals, dinosaurs, eggs and lizards. Recent evidence also suggests that the high elevations of the Wasatch Plateau may have served as a refuge for large extinct species of mammals during the Late Quaternary geologic period around 10,000 to 15,000 years ago.

3.20 ECONOMICS

Introduction

The FEIS completed for the Forest Plan (FP EIS, III-15, V-6) includes a socioeconomic analysis of effects of timber harvest on communities surrounding the National Forest. The analysis area for this project includes Sanpete and Sevier counties and indirectly Carbon and Emery counties. Timber sales and their associated activities, such as road construction, reconstruction, and post harvest tree planting have an effect on local communities through their impact on employment. Forests influence the wood products, government, construction, and recreation sectors. Indirect impacts occur as these sectors transact additional business with other sectors.

By law, counties receive 25 percent of revenues from Forest Service timber sales. These receipts are designated for use on schools and roads. Local government receipts fluctuate annually dependent upon actual volume harvested and the price received for the timber. Prices bid for National Forest timber are influenced by a number of factors including the value of the wood products and operating costs associated with removing the timber. Operating costs vary by sale depending on characteristics of the timber, yarding distances, and yarding systems. Timber sales with higher operating costs reduce sale revenues and, as a result, reduce payments to counties.

The analysis for this project will use net sale volumes, estimated costs and revenues, and estimated appraised values as evaluation criteria of the alternatives on local economies and payments to counties. The multiplier for total jobs and income to communities generated as a result of timber harvest is 10.8 jobs per year per million board foot (MMBF) and an income multiplier of 55.5,000 dollars per MMBF. This information is based on the Manti-La Sal National Forest 1994 fiscal year timber sale program information reporting system (TSPIRS) report.
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The economic analysis is intended to show a relative difference between the alternatives. Operating costs and wood product values are influenced by a variety of factors which can fluctuate unexpectedly and significantly increase or decrease the bid value of a timber sale. For example, in September 1992, 2.9 million board feet (MMBF) of dead Engelmann spruce sawtimber was sold for 115 dollars per MBF. In September 1993, the high bid on 2.2 MMBF of dead Engelmann spruce sawtimber was 163 dollars per MBF. Nationally and regionally, the reduced availability of Federal timber supplies has led to an increasing amount of privately owned timber being harvested by both local wood products manufacturers and companies from outside of Utah. Sawtimber is being harvested for both local processing and shipment by railroad to other processing facilities outside of Utah. Some private land sawtimber is being shipped to ports in Portland, Seattle, and Los Angeles for export.

A new lumber manufacturing facility is planned to be in production spring 1996 near Price, Utah. Sawlogs could be purchased from local sources within a 100-mile radius of the mill. Lumber, pulp, and other by-products would be placed in the local markets or shipped by truck or railroad to Salt Lake City, Denver, Phoenix, or the West Coast. Initially the sawmill could employ 30 people with an additional 30 to 40 employees in the logging phase of the operation. Mill capacity could be about 20 MMBF annually. Total employment could eventually total 100 employees.

3.21 ENERGY

For the existing traffic and timber activity, an energy analysis was performed using "Methods for Evaluating Energy Effects of Forest Management Alternatives" (Schwarzbart and Schmitz, 1982). The following categories were used in this analysis; Forest management, extraction (logging), construction and maintenance, transport to mill, processing, and non-logging traffic. Existing energy consumption within the project area was estimated at 35,843 MMBTU per year.
CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

Chapter 4 discloses the potential environmental effects and consequences that could result from implementation of the alternatives considered in Chapter 2. The discussion forms the scientific and analytical basis of comparison between alternatives. The environmental effects focus on the lands in the decision area and in some cases on the surrounding lands. The effects narratives account for all proposed activities and mitigations as described in Chapter 2 and therefore represent a total, net effect of the alternative on the resource.

This Chapter is organized in the same order as issues addressed in Chapter 2 and the affected area and in some cases on the surrounding lands. The effects narratives account for direct and indirect effects: Direct effects are caused by the action occurring at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable.

Cumulative Effects: Cumulative effects result from the incremental change over time where effects of the proposed action are added to effects of other past, present, and reasonably foreseeable future actions (regardless of what agency or person undertakes such actions).

Possible Conflicts with Plans and Policies of Other Jurisdictions: Possible conflicts with plans and policies of other jurisdictions, such as State or County plans, is considered and disclosed.

Probable Environmental Effects That Cannot Be Avoided: Discussion considers and discloses probable effects that can not be avoided.

Relationship Between Short Term Use and Long Term Productivity: Relationships between short-term vs long-term effects and/or productivity are complex. The Forest Plan EIS (IV-105) defines short-term to be generally less than one year and long-term to be generally longer than 10 years. These time frames may vary by resource issue from the Forest Plan and are defined in the text.

Irreversible and Irretrievable Commitments of Resources: Irreversible: A term that describes the irreversible loss of future options; primarily the extraction or use of nonrenewable resources, such as minerals, cultural resources, or soil productivity. Irretrievable: A term that applies to the loss of production or use of natural resources. For example, timber production is lost irretrievably while an area is serving as a winter ski area. The production is irretrievable, but the action is not irreversible. If the land-use changes, it is possible to resume production.

Consistency with Forest Plan: Refers to the degree which the implementation of an alternative and anticipated effects conforms or conflicts with 36 CFR 219 (NFMA) regulations and Forest Plan goals, direction, and standards.

Potential Effects From Catastrophic Fire:
Relates to the potential compounding of effects caused by high intensity, stand replacement wildfire.

Analysis Methodology
The methodology used to analyze each alternative was based primarily on the most current mapped resource information for the various resources that may be affected. The map information for each resource was initially entered into a geographic information system (GIS) and database. Effects were analyzed spatially and comparatively and then summarized and displayed by resource and by alternative. A description of each resource map and the GIS methods used to develop the computer generated maps and related database is contained in the project file.

Resource reports developed for this analysis contain more information than what is presented in this chapter. These reports are part of the project file, and are available for review at the Manti-La Sal National Forest Supervisor's office in Price, Utah.

4.1 LAND STABILITY
Introduction
In order to identify potential effects to land stability, a land stability map was prepared for the project area using available geologic information (see Chapter 3 discussion of geology/land stability). Four categories of land stability were identified and delineated (unstable, moderately unstable, moderately stable, and stable) and displayed on Figure 3.2.

The relative risk of landslides occurring naturally in the project area is a function of geologic and climatic conditions and is common to all alternatives. The risk of human activities in the project area triggering landslides or accelerating movement on existing landslides is dependent on the existing stability and the changes to existing conditions caused by specific activities or facilities.

As described in Chapter 3, mortality of spruce trees in the project area is causing a decrease in land stability. As the trees die, soil moisture is increased because the amount of moisture absorbed by the trees and evaporated into the air (transpiration) is decreased. The resulting increase in the amount of water retained in the ground generally decreases land stability by causing increased pore pressures, decreased cohesion, lubrication, and increased weight. Another factor that decreases land stability is the loss of support or buttressing as the tree root systems decay.

It is assumed that the removal of dead and dying trees would not, in itself, affect land stability. Increases in soil moisture are already occurring due to tree mortality. Stumps and root systems would remain in-place, providing support. The decrease in weight or loading on the land (tree surcharge) by removing dead and dying trees is expected to be a negligible change. Dead and dying trees rapidly decrease in weight by loss of moisture and deterioration.

The accelerated decrease in evapotranspiration rates associated with the removal of live "high risk" trees proposed under alternatives 3 and 4 is generally expected to be negligible because the trees are expected to live for 5 years or less based on the rate of infestation advance (personal communication, Greg Montgomery). Changes in evapotranspiration rates caused by damage to understory vegetation by skid roads, new road construction, and reconstruction of existing roads is also expect-
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ed to be negligible. Disturbance to understory vegetation is expected to be 15-21 percent for ground-based logging and 3-4 percent for helicopter logging (Megahan, 1980) and would recover within 3-5 years.

The potential for log decks and equipment to load the heads of existing landslides and reactivate them is considered to be negligible because existing slides will be avoided and operations will be confined to working in dry conditions. Typically the dry field season is July 1 to October 1. New landslides and renewed movement of existing slides is rare during this time.

Activities that have the greatest potential to affect land stability include the construction of new roads and staging areas, reconstruction of existing roads, and efforts to accelerate reforestation by plantings. Construction of new roads and staging areas and reconstruction of existing roads would change topography, slope support conditions, and drainage. Accelerated reforestation by plantings of spruce under the action alternatives could facilitate re-establishment of evapotranspiration and change conditions that existed prior to the insect infestation. The potential for these activities to affect land stability would be greatest in areas mapped as unstable and least in areas mapped as stable.

The area affected by a landslide can range from the landslide area itself to several miles downstream within the affected watershed. Damage to facilities and the potential loss of vegetation would usually be localized, while the effects to water quality from additional sediment production could extend several miles downstream. Landslides generally occur in late winter and spring during wet conditions associated with snowmelt and runoff. Shallow landslides such as rock falls and debris flows occur very rapidly. The area usually becomes stable later in the summer under drier conditions. Deep-seated landslides such as earth flows and complex slides and slumps move more slowly but reach a general state of equilibrium and stabilize during the summer months. Movement can be renewed each spring during wet conditions for many years until the system reaches overall equilibrium.

EFFECTS COMMON TO ALL ALTERNATIVES (No Action and Action Alternatives)

Direct and Indirect Effects

If the insect infestation continues to kill trees as expected, the decreasing number of live spruce could increase landslide potential and frequency. Tree mortality would decrease the rate of evapotranspiration and increase the proportion of water retained in the ground. The loss of soil support or anchoring, provided by the tree root systems would also decrease land stability as the root systems decay. Reports by the Forest Service from southeast Alaska (Swanson, 1974) indicate that the number of landslides from cut-over areas (live harvest) increases within 3 to 5 years after logging. The results from large areas of tree mortality are expected to be similar. Root decay rates are probably slower in the South Manti area due to lower precipitation.

The potential for low magnitude/high frequency landslides (isolated landslides that occur due to changes in localized conditions) would increase. The potential for human activities to trigger landslides could also increase. The potential for low frequency/high magnitude landslide events, which are attributed to severe regional high precipitation cycles, could also increase slightly. Increased soil moisture and loss of support could decrease the amount of precipitation and duration of wet cycles needed to trigger such an event. The recurrence frequency of an event similar to the 1983/1984 flood/landslide event is estimated at approximately 125 years.

New landslides and renewed movement of existing landslides would most likely result in increased sediment production within the affected watersheds. Existing vegetation would be removed, increas-

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ing erosion in the landslide area. The vegetation would be lost until it is restored by natural processes. Sediment could reach drainages where the landslides extend into them or where vegetation buffers are not adequate to provide an efficient filter. The project area contains many existing and ancient landslides. The effects of land instability are common to the area. It is not possible to calculate how much sediment production could increase or how much sediment would reach streams.

Landslides could damage existing roads and trails requiring repair and increased maintenance.

Cumulative Effects

Human activities and alterations to the land since European settlement have had the general cumulative effect of decreasing land stability.

Overgrazing and extensive man caused fires in the late 1800s caused extensive decreases in vegetation cover and diversity that have most likely increased the potential for landslides. These changes resulted in increased runoff, severe erosion, and frequent severe flooding and mudflows during the late 1800s and early 1900s (Reynolds, 1911). There is no written information on the occurrence of landslides during this time, but it can be assumed that shallow landslides such as debris flows were extensive. This would be the expected outcome of the vegetation changes described in early literature and would account for the severe mudflows in the canyons. Intensive management since establishment of the Manti Forest in 1902 and 1903 has resulted in significant increases in vegetation diversity and biomass (Manti-La Sal N.F., 1992). The decrease in frequency of severe floods and mudflows, especially during the dry summer season, indicates that improved vegetation conditions have decreased the frequency of shallow high magnitude landslides such as debris flows, but the potential is probably greater than it was before European settlement. The potential for low frequency/high magnitude landslide events has most likely also increased but to a lesser degree.

Development of a network of roads in areas mapped as unstable and moderately unstable within and adjacent to the project area has increased the potential for landslides. The increased potential is due to changes to natural slope support conditions and drainage.

 Specific projects completed within and adjacent to the project area in the last 15 years are listed in Appendix A.1. Of these, the projects that could have caused changes to land stability include the live timber sales and prescribed burns. The live timber sales have been small isolated sales totaling approximately 120 acres. The majority of the harvested area has been on stable and moderately stable lands. Monitoring has not shown any new landslides in the project areas. The prescribed burns could have increased the potential for landslides. Once understory vegetation and aspen recover in these areas, land stability should increase. No new landslides are evident in the burned areas.

The numbers of prescribed burn (2,000 acres) is planned within an unstable area and could increase the potential for landslides, especially high frequency/low magnitude landslides. The risk would likely decrease as understory vegetation and aspen recover.

Ongoing and planned tree plantings in live and salvage harvest areas should accelerate reforestation, therefore, increasing land stability.

Possible Conflicts with Plans and Policies of Other Jurisdictions

There would be no conflicts. The infestation and associated decrease in land stability is naturally occurring.
CHAPTER 4

Probable Environmental Effects That Cannot be Avoided

Increased potential for landslides caused by the insect infestation and tree mortality cannot be avoided.

Relationship Between Short-Term Use and Long-Term Productivity

The effects on land stability would be long-term. They would last until the insect killed trees are replaced by natural regrowth. It would take 30 to 100 years for this to occur, depending on site-specific conditions.

Irreversible and Irretrievable Commitments of Resources

Increases in landslide potential caused by human activity are irretrievable but probably not irreversible because actions can be taken to increase land stability. The occurrence of a landslide would be irreversible. Decreases in land productivity and water quality due to landslides would be irretrievable but not irreversible because actions could be taken to replace productivity.

Consistency with NFMA/Forest Plan Standards

All of the alternatives would be consistent with NFMA and Forest Plan standards. The infestation and related tree mortality that is decreasing land stability is naturally occurring. A land stability analysis has been completed and planned facilities and activities would be designed to minimize the potential for inducing landslides.

ALTERNATIVE 1

 Continued tree mortality would increase the potential for landslides as described above. If extensive wildfires occur due to the increase of dry fuels (dead trees), land stability would be decreased. The loss of understory vegetation and remaining live trees (Spruce, Subalpine fir, and Aspen) would compound the decrease in evapotranspiration caused by the insect infestation.

Under this alternative there are no specific plans to replace insect killed stands by tree planting. Rehabilitation of burned areas would probably be limited to seeding of understory species. It is therefore assumed that reforestation would occur very slowly by natural processes. It is estimated that in well stocked areas (areas with some live immature spruce that survive) about 30 years (see watershed description for the no action alternative in this chapter) would be needed for tree growth and reforestation to establish evapotranspiration levels similar to those that existed prior to the recent insect infestation. In other areas this recovery would take 30 to 100 years, and some formerly timbered areas would revert to meadows.

ALTERNATIVE 2

Direct and Indirect Effects

Land stability has been decreased by the insect infestation as described above. The removal of dead and dying trees would not, in itself, cause further decreases. Land stability could be increased. Removal of dead and dying trees (dry fuels) on 5,649 acres could decrease the potential intensity, and size of wildfires (Chapter 4, Fuels/Fire). This would in turn decrease the potential for fire related damage to remaining soil-protecting vegetation and resulting landslides.

CHAPTER 4

Construction of new roads and staging areas and the reconstruction of existing roads in unstable and moderately unstable areas (Table 4.1) could induce localized landslides (high frequency/low magnitude), especially on steep slopes and wet areas fed by springs. Deep cuts and fills on slopes could result in loss of support, loading, and alteration of natural drainage. Fill slopes could become unstable if not adequately drained. The potential for inducing landslides would be minimized by avoiding unstable areas, slopes greater than 40 percent, and existing landslides where practicable. Where these areas cannot be avoided, roads would be designed to minimize changes to topographic and drainage conditions.

Locating log deck areas at the head of existing landslides could load these areas, changing the equilibrium of the landslide and increasing the potential for reactivation. This would be of greater concern during wet conditions in the spring and fall. The potential for inducing new landslides or reactivating existing landslides would be minimized by confining operations to the dry summer months.

If annual precipitation remains near or below average levels, the potential for inducing landslides or for facilities to be damaged by naturally occurring landslides would be minimal. During cycles of above average precipitation, causing saturation of unstable slopes and associated surficial materials, the risk of inducing landslides or for facilities to be damaged by natural landslides would be significantly higher.

The risk of facilities triggering landslides or to be damaged by natural landslides would be high in the areas delineated as unstable. The risk in moderately unstable areas would be moderate. It would be moderate to low in moderately stable areas and low in stable areas. The risk of these facilities to be damaged by natural landslides would be only slightly lower.

Table 4.1 displays the amount of new road construction and reconstruction of existing roads in miles and acres of disturbance in unstable and moderately unstable zones. There would be 10.2 miles of new construction and 16.6 miles of reconstruction on stable and moderately stable (low risk) land stability zones.

<table>
<thead>
<tr>
<th>TABLE 4.1 Length and Area of Road Disturbance by Unstable and Moderately Unstable Land Stability Categories For Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>New Road Construction</td>
</tr>
<tr>
<td>Miles</td>
</tr>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>Road Reconstruction</td>
</tr>
<tr>
<td>Miles</td>
</tr>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
<tr>
<td>MILES</td>
</tr>
<tr>
<td>ACRES</td>
</tr>
</tbody>
</table>
CHAPTER 4

Cumulative Effects
The effects of tree mortality and other activities on land stability common to all alternatives and those discussed specific to this alternative above could occur.

Possible Conflicts with Plans and Policies of Other Jurisdictions
There would be no conflicts since roads would be located, designed, and constructed to minimize the potential for inducing landslides.

Probable Environmental Effects that Cannot be Avoided
It is not likely that this alternative could be implemented without the discussed effects.

Relationship Between Short-Term Use and Long-Term Productivity
Table 4.1 displays the length and area of disturbance for construction and reconstruction of roads in the unstable and moderately unstable stability zones. Existing roads, including those portions of roads that are reconstructed for the project, would remain indefinately. New project roads would be used by timber operators and the Forest Service for the life of the sales and reforestation efforts (estimated at 10 years). They would then be partially rehabilitated. This would include replacing existing drainages, scarifying and seeding the road surface, and installing water bars to prevent erosion. Successful revegetation of understory vegetation would take approximately 5 years. Reestablishment of mature trees would take at least 30 years. In terms of land stability, changes in slope configuration that could decrease stability would be permanent. Replacement of natural drainages could decrease landslide potential by allowing unrestricted drainage across the road prism. Replacement of tree root systems to provide soil support and decrease soil moisture would not take place.

Irreversible and Irretrievable Commitments of Resources
Increased potential for landslides would be irreversible but not irretrievable because actions can be taken to increase stability. The occurrence of a project induced landslide would be irreversible.

The loss of vegetation and soil due to a project induced landslide would be irretrievable. Landslide caused sediment increases in streams, ponds, and reservoirs would also be irretrievable. The loss of topsoil could be considered irreversible because replacement of soils by natural processes is very slow.

ALTERNATIVE 3

Direct and Indirect Effects
This alternative could increase the potential for landslides in the E, F, and G units for a period of 5 years or less. If attempts to disrupt the insect epidemic are unsuccessful, it is estimated that the live spruce would live for an additional 6 years (personal communication Greg Montgomery). If successful, land stability would be increased in the long-term by saving some portion of the existing live stands of Engelmann spruce. This would provide higher evapotranspiration rates and soil support by live tree root systems.

CHAPTER 4

Helicopter logging on slopes greater than 40 percent is not likely to increase the potential for landslides. Only about 3-4 percent of the understory vegetation would be disturbed in the areas helicopter logged (Megahan, 1980).

The potential for landslides in unstable and moderately unstable areas caused by wildfires would be decreased. Removal of dead and dying trees could decrease the potential intensity, and size of wildfires over 10,212 acres.

As compared to Alternative 2, this alternative would require no new additional roads in unstable (high risk) or moderately unstable (moderate risk) areas. It would require additional road construction of 0.2 mile in unstable areas and 0.8 mile in moderately unstable areas. Table 4.2 shows the length and area of disturbance for construction of new roads and reconstruction of existing roads within the unstable and moderately unstable land stability categories. There would be 10.2 miles of new construction and 19.7 miles of reconstruction on stable and moderately stable (low risk) land stability zones. The additional disruption of vegetation by skidding and use of helicopter loading areas would be insignificant from a land stability standpoint.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Unstable High Risk</th>
<th>Moderately Unstable Moderate Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Road Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles</td>
<td>4.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Acres</td>
<td>11.5</td>
<td>20.1</td>
</tr>
<tr>
<td>Road Reconstruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles</td>
<td>2.8</td>
<td>6.2</td>
</tr>
<tr>
<td>Acres</td>
<td>6.8</td>
<td>15.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7.4</td>
<td>14.4</td>
</tr>
<tr>
<td>MILES</td>
<td>18.3</td>
<td>25.1</td>
</tr>
</tbody>
</table>

ALTERNATIVE 4

Direct and Indirect Effects
The impacts would be the same as Alternative 3 except they would not occur in the inventoried roadless areas and the potential for road construction and reconstruction to induce landslides in the remaining project area would be reduced. The potential for landslides in unstable and moderately unstable areas would be decreased. Removal of dead and dying trees could decrease the potential intensity, and size of wildfires over 7,015 acres of the project area.

As compared to Alternative 3, new road construction would be reduced by 0.4 mile in unstable (high risk) areas and 3.0 miles in moderately unstable (moderate risk) areas. Road reconstruction would be reduced by 2.5 miles in moderately unstable areas.
As compared to Alternative 2, new road construction would be decreased by 0.4 mile in unstable (high risk) and 3.0 miles in moderately unstable (moderate risk) areas. Road reconstruction would be increased by 0.2 mile in unstable areas and decreased by 1.7 miles in moderately unstable areas. Based on research by Megahan, the action alternatives and what the needed. Estimates were made of the type and intensity of soil disturbance of logging systems to be used, the acres of harvest, landings and pads, and the amount of roads.

4.2 SOILS

Introduction

The Forest Service has the responsibility, and is regulated by law, to maintain soil productivity and not to irreversibly damage the soil by management activities. Mitigation measures and stipulations will be applied to each action alternative to assure that soil productivity is maintained.

Alternatives were evaluated by comparing the type of lands (soil map units) to be harvested, the type of logging systems to be used, the acres of harvest, landings and pads, and the amount of roads was increased by 0.2 mile in unstable areas and decreased by 1.7 miles in moderately unstable areas. Table 4.3 shows the length and area of disturbance for construction of new roads and reconstruction, be 7.9 miles of new construction and 20.4 miles of reconstruction on stable and moderately stable (low risk) land stability zones.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

The action alternatives will result in soil disturbance from the contact of logs and equipment with the land surface. Based on research by Megahan, 1980 (in Guides for Predicting Sediment Yields) it is estimated that about 15 to 20 percent of the area will have bare soils after ground-based logging. It is estimated that soil erosion rates would range from about 0.1 to 2.0 tons per acre per year over the ground-based logged areas, and would decrease over time as vegetation is increased.

Although exposing bare soil may increase the soil erosion potential, it may also be a benefit in preparing a seed bed for new regeneration to get started.

Table 4.4 displays the number of acres that would be ground-based logged on the different soil map units (described in Chapter 3), by soil erosion hazard rating, and by each action alternative. This table will be referred to under each action alternative.

**Table 4.4**

<p>| Acres Ground-Based Logged by Soil Map Unit, Erosion Hazard, and Alternatives |
|---------------------------------|-------------------------------|-------------------------------|-------------------------------|</p>
<table>
<thead>
<tr>
<th>Soil Map Unit</th>
<th>Erosion Hazard</th>
<th>Alternative 2 Acres</th>
<th>Alternative 3 Acres</th>
<th>Alternative 4 Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>46</td>
<td>46</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>18</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>Low</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Moderate</td>
<td>337</td>
<td>337</td>
<td>326</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
<td>21</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Moderate</td>
<td>420</td>
<td>420</td>
<td>359</td>
</tr>
<tr>
<td>8</td>
<td>Moderate to Low</td>
<td>2,179</td>
<td>2,179</td>
<td>1,510</td>
</tr>
<tr>
<td>9</td>
<td>Low</td>
<td>1,323</td>
<td>1,323</td>
<td>957</td>
</tr>
<tr>
<td>10</td>
<td>Moderate</td>
<td>924</td>
<td>924</td>
<td>439</td>
</tr>
<tr>
<td>11</td>
<td>Moderate</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Moderate</td>
<td>359</td>
<td>359</td>
<td>232</td>
</tr>
</tbody>
</table>

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CHAPTER 4

Cumulative Effects
Soil impacts would be added to two previous timber sales, recreational use, range use, and an existing watershed improvement project in the area. The total effect would be within soil productivity standards for the overall area.

Possible Conflicts with Plans and Policies of Other Jurisdictions
There would be no conflicts with plans and policies of other jurisdictions for soil management.

Probable Environmental Effects That Cannot Be Avoided
There would likely be some local spots where soil disturbance, erosion, or burning would cause soil damage. These cannot be quantified here because management effort will be toward avoiding and mitigating damages through the application of best management practices.

Relationship Between Short Term Use and Long Term Productivity
The predicted soil erosion rates are within soil loss tolerance limits to maintain long term soil productivity. Soils would be taken out of production where nonproductive use is dedicated for roads, landings, and service areas. Upon rehabilitation the soils would again be productive.

Adequate amounts of organic materials would be left for nutrient cycling and surface protection. The 10 to 15 tons per acre of coarse woody debris to be retained is consistent with requirements found in research (Graham and others, 1994).

Some soil compaction from ground-based logging would not be treated but the soil will return to near natural density in a few years (estimated within 5 years).

Irreversible and Irretrievable Commitments of Resources
Soil lost by soil erosion would be considered irreversible and some may be considered irreversible. In general, the soil lost by this project would not cause an irreversible impact because the amount lost would be less than the amount of natural soil formation required to maintain long term productivity.

Consistency With Forest Plan Standards
Soil management related to this project is consistent with Forest Plan standards and guidelines.

ALTERNATIVE 1

Direct and Indirect Effects
Under the no action alternative there would be no new soil disturbance from management activities, and the soil would develop in a near natural setting. Large amounts of woody organic materials would be added to the surface and contribute to soil protection and development. Some nutrients would be held in the woody materials until decomposed or released by fire. A potential problem would exist from the fuel buildup that could result in an intense fire which could cause significant soil damage.

Possible Conflicts With Plans and Policies of Other Jurisdictions
There would be no conflicts related to soils.

Probable Environmental Effects That Cannot Be Avoided
There would be an increased chance for intense wildfire which could damage the soil resource.

Relationship Between Short Term Use and Long Term Productivity
Long term productivity would be maintained unless a wildfire caused severe soil damage.

Irreversible and Irretrievable Commitment of Resources
There would be no irreversible and irretrievable commitment of soil resources under the no action alternative.

Consistency With Forest Plan Standards
No action would be consistent with the Forest Plan standards to protect the soil.

ALTERNATIVE 2

Direct and Indirect Effects
Most of the ground-based logging activities would occur on soil map units 414 and 415, which have a low to moderate soil erosion potential (Table 4.4). This would represent 3,502 acres of the total 5,640 acres. Only 23 acres would be on soil map units with a high soil erosion potential rating for bare soil. On these units, map units 8 and 45, the ground-based logging activity would be on the low end of the slope range for the units.

About 23 miles of new roads would take about 56 acres of land out of production for varied periods. About 9.4 miles of new road would remain open for use after the timber sale has been completed. In addition, 10.4 miles of existing roads would receive major reconstruction, of the reconstructed roads 8.6 miles would remain open for use after the timber sale.

Risk of soil damage from an intense wildfire would be reduced across 5,640 acres following harvest because of reduced fuel loading. The remaining acres would have the same risk of potential damage to soils as Alternative 1.

ALTERNATIVE 3

Direct and Indirect Effects
The area logged by ground-based methods in this alternative would be the same as in Alternative 2, (Table 4.4). There would be slightly more surface disturbance, however, due to the additional
CHAPTER 4

harvest of some green spruce trees. Road systems would be about the same as in Alternative 2 with about 56 acres being taken out of production by new roads.

The 4,572 acres logged by helicopter would receive very few soil impacts. There would be an estimated increase in bare soil of three to four percent based on research (Megahan, 1983), in Guides for Predicting Sediment Yields. This would result in an insignificant increase in soil erosion. Helicopter logging would require the addition of 22 pad sites that would temporarily take land out of production until rehabilitated.

Risk of soil damage from an intense wildfire would be reduced across 10,212 acres following harvest because of reduced fuel loading.

ALTERNATIVE 4

Direct and Indirect Effects

This alternative would have 3,928 acres logged by ground-based methods (Table 4.4) and 3,087 acres logged by helicopter. An increase of up to 20 percent bare ground could be expected on the ground-based logged lands, and an increase of three to four percent bare ground on helicopter logged lands. Since most of the forested sites have nearly 100 percent ground cover to start with, there would generally be at least 80 percent ground cover after tractor logging. This amount of ground cover is likely to offer adequate soil protection; and coupled with erosion control practices, soil erosion should be minimal. The little amount of soil exposed from helicopter logging would relate to an insignificant change in soil erosion rates. Soils would be altered along 17.3 miles of new roads and 8.8 miles of reconstructed roads. After completion of the timber sale, 5.6 miles of new road would be added to the system. This would result in a loss of soil available for vegetative production.

Risk of soil damage from an intense wildfire would be reduced across 7,015 acres following harvest because of reduced fuel loading. The remaining acres would have the same risk of potential damage to soils as Alternative 1.

4.3 AIR QUALITY

Introduction

Elevations within the project range from about 8,500 ft to nearly 11,000 ft above sea level and are dominantly above 10,000 ft. Wind velocities are often high across the Skyline Ridge. The potential for dispersion of smoke, engine emissions and dust that might be produced during this project is high.

EFFECTS COMMON TO ALL ALTERNATIVES (No Action and Action Alternatives)

Cumulative Effects

There are no cumulative effects on air quality when considered with the list of past, present, and reasonably foreseeable future actions.

CHAPTER 4

Consistency with the Forest Plan and NFMA

All alternatives comply with the requirements of the Clean Air Act and the Memorandum of Understanding (MOU) with the State of Utah. All alternatives are consistent with the Forest Plan and NFMA.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES (Alternatives 2,3,4)

Direct and Indirect effects

No violations of the applicable air quality standards are anticipated since the applicable regulations and agreements would be implemented. This project is likely to produce engine emissions from the equipment used, smoke from slash disposal and fugitive dust. Most of these pollutants are smaller than PM10, which is a health concern, and are regulated by all current standards. The Affected Environment Section provides values for many of the components of exhaust from internal combustion engines that may be exaggerated by the emissions from engines associated with the project and smoke from prescribed fires. Nearby areas of the Ferron Reservoir Valley, Duck Fork Reservoir Valley and the Forest road network may be affected by burning and/or dust for a short duration.

Number of motors: The addition of many vehicles and motors associated with logging equipment could increase the levels of pollutants in the air. This will vary by the number of motors and fuel consumption. Because of the remote location, and high elevation no adverse affects are anticipated.

Dust: Dust may affect recreation use, including visibility at the reservoirs and along the roads. These effects would be short duration.

Smoke from fires: Some slash will be burned. All prescribed burning will be in accordance with the air quality regulations. A burning plan is to be prepared at the time of burning. The plan will be in compliance with the Memorandum of Understanding between State of Utah Air Conservation Committee and the U.S. Department of Agriculture Forest Service dated 1989. The MOU describes the conditions and procedures for prescribed fires within the National Forest. Wildfires may occur during times of poor dispersion and/or may contribute to regional haze.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could compound the adverse effects to air quality. The degree of effect will depend on the time of year, the amount of smoke, duration of fire, and alternative selected. All action alternatives reduce the risk of large, intense wildfire by treating mortality created fuels to varying degrees. Alternative 2 would treat fuels over 5,640 acres, alternative 3 over 10,212 acres, and alternative 4 over 7,015 acres.

Chemical spraying: Chemicals used to protect spruce trees in and around developed and dispersed recreation areas could become air-born and affect human health as well as kill other insects within about one quarter mile of the spraying activities. Risk to humans and other insects is reduced by proper application under specific conditions specified in the contract.

Irreversible and Irretrievable Commitments of Resources

Smoke from prescribed fire, emissions from motors, and fugitive dust could contribute to regional haze and localized air pollution. The effects would be within Air Quality Standards.
CHAPTER 4

ALTERNATIVE 1
Direct and Indirect Effects

Wildfires may occur during times of poor dispersion and/or may contribute to regional haze.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment. This alternative is the greatest threat to air quality from smoke.

Probable Effects That Cannot Be Avoided

There would be an increased potential for wildfire which could occur when smoke dispersion is poor.

4.4 WATER QUANTITY

EFFECTS COMMON TO ALL ALTERNATIVES

Direct and Indirect Effects

Water yield will increase as a result of the beetle epidemic killing the spruce. Using an average annual increase of 4.7 inches of water for the areas infected with beetles, the increases by watershed will be about:

- Muddy Creek by 860 acre feet or 3 percent of the mean annual flow at the Forest Boundary.
- Ferron Creek by 860 acre feet or 2 percent of the mean annual flow at the Forest Boundary.
- Six mile Creek by 360 acre feet or 2 percent of the mean annual flow at the Forest Boundary.

Total 2,350 acre feet

Muddy Creek gage is rated as fair which means that the measurements are plus or minus 15 percent. Ferron Creek is rated as poor which is less than 15 percent; The Twelvemile gage was discontinued; Six Mile Creek is estimated from the State Hydrologic Atlas. The mean annual flow of Muddy Creek is reported at 28,020 acre feet per year plus or minus 4,203 acre feet per year. 4,203 acre feet per year far exceeds the increase of 860 acre feet above for Muddy Creek. The increase therefore, is not measurable within the precision of the gage.

The increased flows from the epidemic in seven streams will probably cause severe channel alterations (bed and bank erosion). When the increases are compared with normal water yield as shown in the Hydrologic Atlas for Utah and assessed on a subwatershed basis, seven streams will have increased flows of more than ten percent (Project File). These are: Duck Fork and Little Horse Creeks in the Ferron Drainage and Greens Hollow, Mill Fork, Black Fork, Emerald Creek and North Fork of Muddy Creek in the Muddy Creek Drainage. Ten percent is a rule of thumb that says that when water yield is increased by about 10 percent then the channel is likely to change. Some research indicates that in some instances less than ten percent increase in flow has caused channel changes.

CHAPTER 4

Hydrologic recovery, the return of streamflow to pre-epidemic conditions, will take about 30 years. (Potyondy and Stender, 1982; Hibbert, 1979; and Aygarn, 1971). The increases in flow will occur because the evapotranspiration rates are reduced as the trees die. The lack of leaves and the openings in the forest allows snow to be blown off of the trees and settle on the ground. The snow piles deeper, takes longer to melt and has less exposure to the wind. Less snow sublimates. Less water is transpired by the plants. More water infiltrates and then reappears as streamflow. These increases will gradually diminish as the forest reoccupies the site.

The changes in the timing of water yield are more water later in the summer due to delayed snowmelt. The peak flows from snowmelt are not expected to be increased.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could compound the adverse effects to water quantity caused by increased streamflow as previously mentioned.

Cumulative Effects

Several thousand acres of prescribed fires have been identified as past actions. By the time this salvage sale is in operation the burn areas should have recovered and no cumulative effects are anticipated. These fires were intended to remove Subalpine fir and release aspen as the dominate vegetation on the sites. This change should have a small effect on the water yield for a period of about 5 years. The hydrologic recovery is shorter than for spruce because the vegetation types are different and the aspen component is expected to quickly occupy the site.

Probable Environmental Effects That Cannot Be Avoided

The average water yield increases from this epidemic probably exceed ten percent for several of the subwatersheds analyzed. In Duck Fork Creek and Little Horse Creek in the Ferron Creek Drainage and Greens Hollow, Mill Fork, Black Fork, Emerald Creek and North Fork of Muddy Creek the average water yield increases without logging are likely to cause an adjustment of the channels which would increase the sediment loads.

Irreversible and Irretrievable Commitments of Resources

The water yield increases are irreversible and irretrievable for 30 years.

Consistency With NFMA/Forest Plan Standards

All Alternatives are consistent with the Watershed Management sections of the Forest Plan and NFMA which requires that water yield augmentation will only be attained incidentally from other projects.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

There will be slightly more water available for downstream use. The amount will not be measurable (see water quantity discussion, effects common to all alternatives above, regarding gage precision). Models of the logging and road construction show minimal changes in water yield. Logging and road
CHAPTER 4

The amount of sediment in a stream is the sum of sources from surface erosion, stream channel erosion, and mass movements. Surface erosion is mostly affected by management activities that reduce ground cover. The estimates of existing and changes in sediment yield are based on an early assessment of conditions. Later evaluations found additional existing sediment sources (additional

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

ALTERNATIVE 2

Direct and Indirect Effects

Logging and road construction will remove green trees from 188 acres with minor increases in water yield. 5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects

Logging, road construction and helipads will remove green trees from 206 acres with minor increases in water yield. Removing green trees would reduce transpiration and increase water yield for as long as the trees would have lived. If the trees are killed by beetles before the logging, then there would be no effect on water yield.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

ALTERNATIVE 4

Direct and Indirect Effects

Logging, road construction and helipads would remove green trees from 161 acres with minor increases in water yield. Removing high risk trees will reduce transpiration and increase water yield for as long as the trees would have lived. If the trees are killed by beetles before the logging, then there would be no effect on water yield. 7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

4.5 WATER QUALITY

Introduction

The amount of sediment in a stream is the sum of sources from surface erosion, stream channel erosion, and mass movements. Surface erosion is mostly affected by management activities that reduce ground cover. The estimates of existing and changes in sediment yield are based on an early assessment of conditions. Later evaluations found additional existing sediment sources (additional

2 track roads). The effect would be to increase the existing sediment loads and to reduce the percent change as a result of logging. Bed and bank erosion are mostly affected by increased water yield and/or activities that remove vegetation from the riparian areas. Mass movements are related to the geologic conditions and climatic wet cycles.

EFFECTS COMMON TO ALL ALTERNATIVES

Cumulative Effects

The past land management practices have greatly reduced the surface erosion and sediment loading that began with grazing and logging practices of the early 1900's. (Rapin, 1976). Continued improvements in grazing practices have resulted in reduced erosion on many areas that had been identified as needing erosion control work and a final recommendation that erosion is now within acceptable levels. (Bare, 1994).

The Mill Creek project described in Appendix A.1 was a part of a larger PL-566 Watershed Restoration Project that reduced erosion and sediment yields from the Ferron drainage. The PL-566 project was implemented between 1965 and 1977. The work in Mill Creek was completed in 1966. Erosion control work completed in Mill Creek in the 1960's has greatly reduced the erosion and sediment loads in Mill Creek and downstream. This project could add additional sediment to the stream but would not approach the sediment loads prior to the Mill Creek project.

The Forest has a program of prescribed fires to change the dominant vegetation from Subalpine fir to Aspen. The effects of the fires should be minor. Usually the fires are spotty. The total acres actually burned is small. Any increases in sediment yield should be negated by the sprouting aspen within 5 years.

Probable Environmental Effects that Cannot be Avoided

The bed and banks are likely to erode severely along seven streams. Logging will not change this to any important degree. In Duck Fork Creek and Little Horse Creek in the Ferron Creek Drainage and Greens Hollow, Mill Fork, Black Fork, Emerald Creek and North Fork of Muddy Creek in the Muddy Creek Drainage, the average annual water yield, even without logging, will exceed ten percent as a result of the epidemic and will likely cause an adjustment of the channels and increase the sediment loads.

Irreversible and Irretrievable Commitments of Resources

The epidemic and associated water yield increases are irreversible and irretrievable. The channels will be altered in seven streams. Sediment from these sources will move downstream.

Consistency with NFMA/Forest Plan Standards

All alternatives are consistent with the watershed portions of the Forest Plan, NFMA and the Clean Water Act.

The Clean Water Act requires that the State of Utah compile a 303(d) list with includes water bodies within the State that do not attain the current water quality standards. This list includes:
CHAPTER 4

1. San Pitch River and tributaries from mouth to Gunnison Reservoir (which includes Twelvemile Creek). The State of Utah is petitioning EPA to remove the references to the tributaries from this designation. Twelvemile Creek would be removed from the designation.

2. San Pitch River and tributaries from Gunnison Reservoir to US23 crossing near Moroni (which includes Sixmile Creek). The State of Utah is petitioning EPA to remove the references to the tributaries from this designation. Sixmile Creek would be removed from the designation.

3. Muddy Creek from Highway U-10 to headwaters (which includes Muddy Creek within the National Forest.) The data used to make this determination was collected at the Highway U-10 crossing of Muddy Creek, more than 2 miles below the National Forest boundary (personal communication with Tom Toole, Utah State Division of Water Quality, May 17, 1995). Ferron Creek is not included.

The parameters of concern for the two listings for the San Pitch River include Total Dissolved Solids and iron. The parameters of concern for Muddy Creek include Total Dissolved Solids and Total Suspended Solids.

Logging and road construction should have no effect on the parameters of concern in the San Pitch River. Dissmeyer (1994, pg 14) lists the parameters that might be affected by logging and road construction. Conductivity could be a surrogate for Total Dissolved Solids and is listed as not very sensitive. Iron is not listed as an affected parameter.

Changes to Total Suspended Solids (sediment) in Muddy Creek would be small and not measurably affected by the proposed action. Sediment is likely to be affected by both road construction and timber harvest (ibid). However, the total change in sediment yields from surface erosion attributed to this proposal is estimated to be less than two percent where the South Fork of Muddy Creek joins Horse Creek to form the main stem of Muddy Creek. Sediment is generated from landslides as well as surface erosion. The Muddy Creek drainage contains many large and small landslides including three active landslides that are continuing to contribute large quantities of sediment to the stream. This tends to further dilute the effects of the project. All of these sources of sediment contribute to the total sediment loads and add to the high values recorded at the data collection site. The State of Utah has no standard for Total Suspended Solids. Rapin, (1976) estimated sediment yields in Muddy Creek at the Forest Boundary to be about 168 acre feet per year.

The data collection site that was used to make the 303(d) list determination for Muddy Creek is more than two miles below the National Forest boundary. At this point, the stream has been influenced by flowing over several miles of Mancon Shale formation. Streams flowing over the Mancon Shale pick up hundreds of parts per million in TDS per mile of flow. The sediment yields per square mile also increase greatly.

All action alternatives would add minimal amount of sediment to the headwater streams of Ferron, Muddy, Sixmile and Twelvemile creeks. The road systems into these areas is already in place and the new roads and other construction required for this project would not appreciably change the existing sediment loads.

Due to the large natural variation in sediment loads, the small anticipated changes in sediment would not adversely effect any existing beneficial use of water. Sediment loads in streams from surface erosion could be increased in Little Horse Creek within the Ferron Creek Watershed by about 11% in the worst case analyzed. Other streams would have a smaller percentage increase in sediment.

CHAPTER 4

These effects would be most intense at first and decrease rapidly over about five years. The application of best management practices for erosion and sediment control would reduce this amount.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

Chemicals: Chemicals used to protect spruce trees in and around developed and dispersed recreation areas could affect human health as well as kill other organisms if accidentally introduced into adjacent lakes or streams. Risk to humans and other insects is reduced by proper application under specific conditions specified in the product labels and contract.

There is some hazard in all action alternatives of accidental spills that could cause water pollution. The hazards remain throughout the life of the project, and increase as the area and number of operations increase. The materials that might be spilled include fuels and other petroleum products. No other chemical pollution is anticipated.

Sediment: Ground-based logging would create additional runoff from roads, skid roads and compaction. The additional runoff would not cause increased erosion of stream beds and banks because the application of Best Management Practices will be employed so that the activities are kept away from the stream beds and banks.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in intensively burned areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires would compound the adverse effects to water quality mentioned above. The degree of affect would depend on the amount of runoff until the area is revegetated.

Probable Environmental Effects that Cannot be Avoided

Some small amounts of sediment from the project will reach the stream channel. These amounts are not expected to affect any existing water use. Best Management Practices would be implemented so that sediment and other forms of pollution from the project would be minimal.

ALTERNATIVE 1

Direct and Indirect Effects

Sediment: The amount of sediment from surface erosion that reaches the streams would be unaffected because the trees are likely to stand for at least 25 years. The amount of sediment from channel erosion is likely to increase where the increase in water yield causes an adjustment of the stream channels.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment. Soils exposed after an intense fire could erode and enter adjacent streams.

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ALTERNATIVE 2

Direct and Indirect Effects

Sediment: Sediment loads in streams from surface erosion would be increased by a maximum of eight percent above the pre-epidemic conditions in Little Horse Creek within the Ferron Creek Watershed. Because of the large natural variation in the sediment loads, eight percent is considered to be no change.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects

Sediment: Sediment loads in streams from surface erosion could be increased by a maximum of 11 percent above the pre-epidemic conditions in Little Horse Creek within the Ferron Creek Watershed. The Helicopter logging would add helicopter pads and roads as disturbances in addition to the impacts from ground-based logging. Helicopter logging would increase the acres harvested, but the amount of compaction would not change. Road construction and sediment yields would change in proportion to the amount of new and reconstructed roads.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

ALTERNATIVE 4

Direct and Indirect Effects

Sediment: Sediment loads could be increased by a maximum of six percent above the pre-epidemic conditions in Mill Fork Creek within the Ferron Creek Watershed. Because of the large natural variation in sediment loads, six percent is considered to be no change. Helicopter logging would add helicopter pads and more road construction as disturbances in addition to the impacts from ground-based logging. Helicopter logging would increase the acres harvested, but the amount of compaction would not change. Road construction and sediment yields would change in proportion to the amount of new and reconstructed roads.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

4.6 RIPARIAN/WETLANDS/FLOODPLAINS

EFFECTS COMMON TO ALL ALTERNATIVES

Direct and Indirect Effects

Riparian and wetlands: There could be a small, temporary (30 years) enlargement of riparian and wetland areas as a result of the water yield increases discussed in the Water Quantity section.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wildfires. Intense (stand replacement) fires could have adverse effects on riparian/wetlands and floodplains. The degree of affect will depend on the amount of vegetation destroyed (short term), and whether or not the area is flooded following the fire. Flooding may cause scouring, and deposition in the riparian system, which would increase the amount of time for recovery (long term).

Probable Environmental Effects that Cannot be Avoided

The direct and indirect effects can not be avoided.

Irreversible and Irrecoverable Commitments of Resources

There are no irreversible or irretrievable commitments of riparian, wetland or floodplain resources.

Cumulative Effects

There are no cumulative effects on riparian, wetlands and floodplains when considered with the list of past, present and reasonably foreseeable future events.

Consistency with NFMA/Forest Plan Standards

All alternatives are consistent with the forest plan and NFMA for watershed management since the imposed mitigations will protect these areas within the scope of the executive orders and regulations. Log landing and decking areas are not within the riparian units. Water quality is protected by implementation of the mitigation measures.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

Riparian: The effects of the alternatives to the Riparian units will be evaluated by counting the number or road crossings of RPN (riparian) units, the acres of RPN units within the boundaries of treatment areas and acres of Wetlands within the boundaries of treatment areas.

Tables 4.5, 4.6 and 4.7 compare these effects by alternative. The road - stream crossings are displayed in Figures 4.1, 4.2, and 4.3.
CHAPTER 4
FIGURE 4.3

Stream Crossings
Alternative 4

LEGEND

STREAMS AND LAKES
PROJECT BOUNDARY
ROADS

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The wetlands/riparian/floodplains analysis is based on an inventory created in support of this project from aerial photo and topographic map interpretations. Limited field reviews in 1995 found no wetlands in Unit B4 except around Island Lake. At Unit A2 3 potholes, 3 small stair-step meadows and wet areas were found in the east end of the unit (J.Dufour 8/3/95 field notes) and one spring was found above Oleys Lake (J.Dufour 9/20/95 field notes). Unit G4 includes a wet meadow, stream and beaver ponds. Several springs and seeps are reported within Unit F2 (J.Dufour, Personal Communication). The marking guides prescribe a 100 foot buffer around perennial waters. The mitigations prescribe avoidance of wetlands where avoidance is possible and rehabilitation where avoidance is not possible.

Wetlands: The mitigations that are a part of the alternatives would avoid any permanent effect on wetlands. During each season of operations, there could be some temporary changes to wetlands. Table 4.6 compares the acres of wetlands within the treatment units by alternative.

Floodplains: The logging operations, including roads, would cause a small unmeasurable increase in the magnitude of floods. The crossing of riparian areas identified in Table 4.7 would also constitute the crossing of floodplains. The road crossing of streams would constitute a functionally dependent use of floodplains. There are no practicable alternatives.

Probable Environmental Effects that Cannot be Avoided

Most of the effects described above are the result of the vegetation changes that have already occurred. The implementation of logging would make little difference to total changes.

ALTERNATIVE 1

Direct and Indirect Effects

As shown in Table 4.7 there would be no new road crossings of streams, no new disturbances by roads in riparian areas and wetlands.

Riparian and Wetlands: As the beetle killed spruce topple to the ground, they would supply large and small woody debris to the stream that would help in the recovery of the stream system from the impacts of severe overgrazing of many years ago. The woody debris in the streams helps to support aquatic organisms that are beneficial to the fish. The large woody debris in the streams will help to form step-pool features in the channel to help dissipate energy and reduce erosion by the flowing water. The large woody debris will help to trap sediment on site to provide a growth media for riparian plants. The large woody debris will tend to trap more water on the site and allow more infiltration which will tend to destabilize the slopes.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn riparian vegetation until either fuels have been consumed or the conditions change to aid in extinguishment.

ALTERNATIVE 2

Direct and Indirect Effects

Riparian: The areas proposed to be logged include 245 acres of RPN units. The amount of disturbance will be minimized by the mitigations. No trees are to be logged from RPN units except at road crossings.
The decrease in transpiration and consequent increase in ground water

The epidemic and road construction

Wetlands: The decrease in transpiration and consequent increase in ground water would tend to temporarily cause a slight increase in the size of wetlands. With the implementation of the mitigations there would be no permanent effect on wetlands. During each season of operations, there could be some temporary changes to wetlands.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

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<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
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<th>Alternative 2</th>
<th>Alternative 3</th>
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CHAPTER 4

An Evaluation Of Disturbances In Riparian Areas And Wetlands

TABLE 4.7
# of Occurrences

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<th>Event</th>
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<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
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</thead>
<tbody>
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<td>2</td>
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<tr>
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</table>

* Road means a new road or the major reconstruction of an old road. Existing roads are not included.

4.7 AQUATIC HABITAT

Introduction

Primary effects of concern when assessing timber sale proposals are sediment addition to the stream, changes in stream temperature, introduction of contaminants, and channel degradation that results in loss of important habitat features like pools, spawning riffles, and bank undercuts. New or improved road access to drainages could also result in fish death from anglers and harassment of spawning adults. Improper culvert design or placement can interfere or prevent fish passage and isolate subpopulations of aquatic species. Implementation of riparian protection measures, travel management, and carefully-designed roads and timber sale layout can prevent all of these effects.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

All of the Action Alternatives would result in a removal of woody debris from the watershed. Woody debris within stream channels provides essential habitat, nutrients, and food items for aquatic vertebrates and invertebrates. In upland areas, woody debris on slopes intercepts runoff and provides a slow release of nutrients to aquatic ecosystems. Removal of wood from both types of areas can change the character of the watershed; both in terms of nutrient balance and hydrology. The range of natural variability for woody material in Manti Division watersheds and subsequent influences of this material on nutrient balance and hydrology are unknown. Thresholds for minimum amounts of such materials for Forest streams have not yet been determined.

Best Management Practices ensure that fuel (gas and diesel) or fueling activities will not take place in riparian zones. There will be no chemical contamination of soils or water quality within the sale area and therefore aquatic species will not be affected by such pollutants.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could have serious adverse effects to aquatic habitat. The primary effects of concern would be sedimentation, introduction of contaminants (ash), changes in stream temperature, and channel degradation.

Cumulative Effects

Livestock grazing and wildlife foraging affect all of the drainages within the project area. Both can reduce vegetation cover, vegetation vigor, and result in increased erosion on streambank areas and upland slopes. Both can also result in mechanical damage to bank undercutters and channels. All of these effects can contribute to sediment loading and result in aquatic habitat degradation.

Vehicle transportation, including recreation all-terrain vehicles, causes soil compaction, vegetation loss and degradation of riparian areas. Off-road vehicle use (an illegal activity) has impacted riparian areas in the Upper Muddy and Upper Twemvelite drainages (Dufour, field notes 1995). Dispersed recreation sites in Upper Twemvelite, Little Horse Creek, Duck Fork Creek, Upper Muddy Creek, and in proximity to every lake and reservoir in the project area have degraded riparian areas and some aquatic habitats (Dufour, field notes 1995).

Erosion from all of these cumulative actions increases the amount of sediment moving through aquatic habitats and has subsequent effects on aquatic organisms. Excessive sediments in streams can affect fish of all life history stages. Sediment in stream can overlay eggs or pre-emergent fry in gravels and can clog gills; all of which can result in direct mortality. If habitats become degraded and unsuitable, fish and other aquatic organisms can be temporarily displaced.

Possible Conflicts with Plans and Policies of Other Jurisdictions

Minor degradation of aquatic habitats would be in conflict with the plans and policies of the Utah Division of Wildlife Resources but these impacts are negligible relative to the hydrologic impacts of the insect infestation (4.6). Current policies direct that fishing opportunities within the project area be maintained or improved. New and improved road access to some areas could increase angler harvest success and fishing opportunities.

Probable Environmental Effects That Cannot Be Avoided

Aquatic habitat is in close proximity to proposed timber harvest activities. Some changes in watershed character, stream flow yields, and aquatic habitat are unavoidable. Riparian buffer zones and transportation design will minimize such disturbances.

Relationship Between Short Term Use and Long Term Productivity

The impacts to aquatic habitat will be short term (less than ten years). Recovery will be dependent upon re-establishment of vegetation on disturbed areas and precipitation events.

Irreversible and Irretrievable Commitments of Resources

There are no irreversible commitments of aquatic habitats. Woody debris removal and temporary soil disturbance will result are irretrievable.

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Consistency with NFMA/Forest Plan Standards

Yes.

ALTERNATIVE 1

Direct and Indirect Effects

Erosion, channel adjustment, and sediment deposition are predicted in seven streams due to increased water yields (10 percent or greater increase) following insect infestation (Section 4.4). All of these drainages support recreational salmonid fisheries; particularly Duck Fork Creek. Increased water yields result in channel down-cutting, increased movement of soils into the stream, and loss of aquatic habitat as bank overhangs (hiding cover) are cut away and pools are filled. Excessive sediments in streams can affect fish of all life history stages. Sediment in streams can overlay eggs or pre-emergent fry in gravels and can clog gills; all of which can result in direct mortality. As inputs of sediment migrate through the drainages, fish could be temporarily displaced. Fish densities could increase in some areas and decrease in other areas in response to the potential habitat changes discussed above.

Increases in erosion and water yields may also have minor effects on flatwater aquatic habitat. Increased sediments moving through affected drainages are deposited where flows are slow; accelerating filling of reservoirs, lakes, ponds, and deposition of sediments on inlet and outlet spawning areas.

Insect-killed dead timber would provide a temporary increase in large woody debris in the stream channel, increased hiding cover, some debris dam-type pools, and an increase in wood-digesting macroinvertebrate communities. Fish densities could increase in response to the potential habitat changes discussed above.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

Cumulative effects

Some bank damage, vegetation loss or disturbance, and accelerated erosion exist in the sale area from livestock grazing and wildlife forage use. Existing roads contribute sediments to streams and flat-water habitats.

Dispersed recreation impacts to riparian environments (soil compaction, vegetation loss, increased erosion) is evident in portions of the Upper Muddy, Duck Fork, Little Horse Creek, Twelvemile Creek, and major portions of the shorelines of every lake and reservoir in the project area (Dufour, field notes 1995). All terrain vehicle crossings are evident in the Twelvemile Basin below Proposed Cutting Unit G-4. Degradation of riparian habitats renders them ineffective at buffering upland run-off and results in increased sedimentation of stream environments. Aquatic organisms, particularly sediment-sensitive species like salmonids, can become temporarily displaced or may experience higher mortality rates and lower growth rates.

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Possible Conflicts with Plans and Policies of Other Jurisdictions

None.

Probable Environmental Effects That Cannot Be Avoided

See Direct and Indirect Effects.

Relationship Between Short Term Use and Long Term Productivity

None.

Irreversible and Irretrievable Commitments of Resources

None.

Consistency with NFMA/Forest Plan Standards

Yes.

ALTERNATIVE 2

Direct and Indirect Effects

Removal of insect-killed wood using ground-based harvest techniques will cause small increases in water yield, erosion, and subsequent impacts to channel morphology and aquatic habitat; but the effects of harvest will be negligible relative to the effects of the increased water yields resulting from effects of harvest will be negligible relative to the effects of the increased water yields resulting from the insect infestation (4.4). The risk and magnitude of such impacts would increase if a large precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities. One hundred foot riparian precipitation event immediately followed ground-disturbing activities.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

Implementation of Alternative 2 would require ten riparian road crossings, eight road placements within wetlands, and two road alignments parallel to the stream channel within riparian areas. The increased erosion would result in temporary filling of the stream channel within riparian areas. The increased erosion would result in temporary filling of the stream channel within riparian areas. The increased erosion would result in temporary filling of the stream channel within riparian areas. The increased erosion would result in temporary filling of the stream channel within riparian areas.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects

This alternative would result in the removal of the largest amount of woody material from the project area and the greatest soil disturbance compared to other action alternatives. Removal of woody debris will increase water yield, accelerate erosion, and impact
CHAPTER 4

channel morphology and aquatic habitat; although changes attributable to harvest would be negligible relative to those resulting from hydrologic effects from the insect infestation (4.4). Increased water yield will result in channel down-cutting, changes in stream morphology, temporary filling of pools in some reaches, and possible sedimentation of spawning gravels. The risk and magnitude of these effects would depend on the magnitude of precipitation events during periods of high ground disturbance. In low-water years, little disturbance to aquatic habitat over and above that caused by increased water yields from the insect infestation would be observed. Should a high precipitation event occur (or high runoff) during times of high ground disturbance, there could be a temporary loss of habitat that would result in decreased fish densities for all life history stages. Declines in filter-feeding macroinvertebrate species would be observed.

Implementation of Alternative 3 would require fourteen riparian road crossings, seven road placements within wetlands, and three road alignments parallel to the stream channel within riparian areas. The soil disturbance and compaction that would result from such construction would increase soil movement. Increased erosion would result in temporary filling of pools downstream and in proximity to these alignments, and possible sedimentation of spawning gravels.

Some green timber harvest could occur within RPN areas, but interdisciplinary review of potential sites prior to the contract would ensure implementation of mitigation measures and Best Management Practices designed to minimize impacts to riparian and aquatic habitats for game and non-game species. Mechanical disturbance of riparian areas would not occur. No changes in wood-processing invertebrate populations or wood-dependent amphibian populations would be observed.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire. ALTERNATIVE 4

Direct and Indirect Effects

This alternative would result in the removal of less woody material from the subwatersheds and less soil disturbance than Alternative 3. Implementation would require thirteen riparian road crossings, seven road placements within wetlands, and two road alignments parallel to the stream channel within riparian areas. The soil disturbance and compaction that would result from such construction would increase soil movement within the subwatersheds. Removal of woody debris and road construction will cause small increases in water yield, erosion, and impact channel morphology and aquatic habitat.

The risk and magnitude of these effects would depend on the magnitude of precipitation events during periods of high ground disturbance. Changes in aquatic habitats that would be attributable to harvest activities would be negligible in comparison to the hydrologic effects of the insect infestation (4.4). High runoff and erosion could cause a temporary loss of habitat over and above that caused by increased water yields from the insect infestation would be observed. Should a high precipitation event occur (or high runoff) during times of high ground disturbance, there could be a temporary loss of habitat that would result in decreased fish densities for all life history stages. Declines in filter-feeding macroinvertebrate species would be observed.

Some green timber harvest could occur within RPN areas, but interdisciplinary review of potential sites prior to the contract would ensure implementation of mitigation measures and Best Management Practices designed to minimize impacts to riparian and aquatic habitats for game and non-game species. Mechanical disturbance of riparian areas would not occur. No changes in wood-processing invertebrate populations or wood-dependent amphibian populations would be observed.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire. 4.8 THREATENED, ENDANGERED, AND SENSITIVE AQUATIC SPECIES

Introduction

There are no threatened, endangered, or Region 4 (USFS) sensitive fish species found within the proposed sale area. Downstream from the sale, however, there are four Colorado River fish species which are currently listed as endangered: the Colorado squawfish (Ptochocheilus lucius), the Bonytail chub (Gila robusta), the Humpback chub (Gila cypha), and the Razorback sucker (Xyrauchen texanus). Primary effects of concern for these fisheries are excessive sediment additions, changes in water temperature, introduction of contaminants, and changes in water quantity.

There are no threatened or endangered amphibian species in the Manti Division of the Manti-La Sal National Forest. Habitat suitable for supporting the spotted frog (Rana pretiosa) (currently listed as a Sensitive species by Region 4 - USFS) is not present within the proposed sale area (Perkins, UT DWR Herpetologist; Keilhe, UT DWR, 1995 personal communication). UT DWR surveys indicate that spotted frogs prefer lower elevation, floodplain-type environments.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

There are no known populations of spotted frogs in the project area, so no effects are anticipated and this species will not be discussed further in this document.

The Action Alternatives would be implemented far upstream from the habitat of federally-listed Colorado fish species. In the context of the Colorado Basin, the effects of this project would be unmeasurable. The effects on these populations are therefore not discussed for the individual alternatives.

Cumulative Effects

Diversions of water for culinary use, agriculture, and hydropower are probably the most important factors affecting the endangered fish species of the Colorado. The timber salvage alternatives analyzed in this document would not contribute any measurable effects to these fish or their respective habitats.

Possible Conflicts with Plans and Policies of Other Jurisdictions

None.

Probable Environmental Effects That Cannot Be Avoided

None. There are no aquatic threatened, endangered or sensitive species in the project area or affected by the proposal.
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Relationship Between Short Term Use and Long Term Productivity
None.

Irreversible and Irretrievable Commitments of Resources
None.

Consistency with NFMA/Forest Plan Standards
Yes.

4.9 FOREST HEALTH, DIVERSITY, AND PRODUCTIVITY

This section describes the effects that implementation of each alternative would have on Forest Health, Diversity, and Stand Productivity. This issue will be addressed by comparison of 1) Stand development and growth trends (PAI - Periodic Annual Increment or 10 year average growth, MAI - Mean Annual Increment or average annual growth through the life of the stand, and GMAI - Cumulative Mean Annual Increment or the point at which stand average annual growth peaks and begins to decline); 2) Stand acres of spruce treated relative to changes in Schmid and Frye Spruce beetle risk rating levels; and 3) Trends or changes in vegetative diversity.

Alternatives were analyzed by use of existing stand inventory data, and through use of the Utah Forest Vegetation Simulator (FVS). Detailed analysis information and documentation relative to this issue is available in the project analysis file.

EFFECTS COMMON TO ALL ALTERNATIVES (No Action and Action Alternatives)

Direct and Indirect Effects

Stand Development: 5,746 acres within the 31 spruce beetle infested stands (Figure 3.3), as well as other areas not proposed for treatment, are experiencing high levels of mortality of the sawtimber size (eight inch DBH and larger) spruce trees. Average mortality exceeding 50 percent in the sawtimber size spruce has occurred in these areas (Munson, 1994). In some pure, mature spruce stands mortality of the sawtimber size spruce trees may approach 100 percent.

Current and projected mortality could eventually result in natural replacement of existing sawtimber size spruce trees within stands of the analysis area. This will occur as regeneration (through natural seedling or artificial planting) fills in the large open areas which were previously stocked with large diameter spruce trees. The mature, large diameter live trees that will remain in the currently infested portions of the study area as the epidemic passes are Subalpine fir, localized clones of Aspen, and minor amounts of Limber pine, Douglas-fir, and Engelmann spruce.

These mortality levels will occur under all alternatives 1, 2, 3, and 4 within stands already infested by epidemic Spruce beetle populations. Alternatives 2, 3, and 4 would remove dead and infested trees (includes spruce infested at the time harvest occurs) in these areas.

Stand development, growth, and production has been significantly reduced from pre-epidemic conditions in the infested stands. The loss of large diameter spruce will continue in infested sites as long as susceptible hosts and viable spruce beetle populations remain in the stands. Stand inventory

and Forest Vegetation Simulator (FVS) projected average periodic annual increment (PAI) and mean annual increment (MAI) growth values are displayed in Table 4.8 for infested stands, uninfested stands, and the total treatment units. Cummation of mean annual increment (stand potential growth calculated from inventory data) is displayed to depict the relationship between the potential average growth per acre growth in cubic feet, current growth, and projected stand growth.

FVS projected average PAI and MAI is also displayed in Figure 4.4 (Infested Stand Average PAI and MAI), Figure 4.5 (Uninfested Stand Average PAI and MAI), and Figure 4.6 (Total Average PAI and MAI).

Schmid and Frye Risk Rating: Within the currently infested stands, implementation of any alternative will not change current Spruce beetle risk levels (assumes that spruce beetle populations do not collapse, and that mortality associated with stands infested early in the outbreak is characteristic of expected mortality). Neither will post-epidemic or post-harvest stand risk ratings change in these stands between alternatives. The infested stands, under all alternatives will be reduced to a low or low-moderate risk as a direct result of 50 percent or greater mortality of spruce trees eight inches DBH and larger (Table 4.9). Spruce trees which remain in the infested stands following the epidemic or harvest will consist of immature seedling, sapling, and sawtimber size trees. Chemicals used to protect spruce trees in and around developed and dispersed recreation areas would increase the treated trees resistance to beetle attack.

Vegetative Diversity: Inventory data, studies (Munson, 1994), and experience indicate that as a direct result of the Spruce beetle epidemic, a majority of the sawtimber size spruce, including the large, mature spruce trees, in the infested stands have been killed. This will result in 1) A reduction in genetic diversity; 2) A reduction in the abundance of spruce trees; 3) A reduction in diameter, height, and age class diversity (structural); and 4) A reduction in the abundance of spruce and spruce-fir forest types within the infested stands.

Genetic diversity has been reduced throughout the treatment units and other portions of the study area which have been affected by the Spruce beetle epidemic at this time. This is the result of the loss of many of the genetic characteristics associated with the large diameter spruce trees which have been or may be attacked by spruce beetle.

Genetic populations have been reduced. Some stands or areas of almost pure, large diameter spruce have experienced, or will experience almost total mortality of trees within the local ecosystem structure; resulting in loss of the mature and more competitive trees (prior to current epidemic) from the genetic pool. Remaining large diameter spruce are more fragmented and isolated in structure, which could limit interaction of gene pools, and increase inbreeding.

From a timber production perspective, the remaining spruce trees may exhibit many undesirable characteristics (i.e. slower or reduced height and diameter growth, forking, poor ability to naturally prune limbs, susceptability to disease and insects, crooking or stem spiral, and others) which could result in lower quality wood and production capability.

Although species diversity (richness) has not changed (Engelmann spruce will remain as a component of the ecosystem), the abundance (number) of spruce trees (especially sawtimber size trees) has been reduced within the infested stands. Individual stand conditions vary, but between 50 and 100 percent of sawtimber size preinfestation spruce trees may die before spruce beetle populations collapse.
Inventory data indicates that the dominant forest (cover) type of infested stands prior to the epidemic and up to the time of inventory was 98 percent (85,569 acres) spruce-fir. The remaining two percent (87 acres) was classified as spruce. FVS projections indicate that current and projected mortality in these stands, under all alternatives, may result in forest types which are six percent (344 acres) spruce-fir, less than one percent (20 acres) spruce, and 94 percent (5,382 acres) Subalpine fir (Table 4.10).

Inventory data indicates that the dominant structure of infested stands prior to the epidemic and up to the time of inventory was uneven-aged and multi-storied (several age and height classes). Although some uneven-age conditions will exist following the epidemic and proposed salvage harvest, generally, the infested stands could shift towards a more open, even-aged, and single-storied structure as a result of the loss of the overstory spruce component. Exceptions will occur in stands and areas where subalpine fir is a major component of the stand structure. Stand structure of proposed infested treatment units at time of inventory was 17 percent (868 acres) open, three percent (97 acres) single-storied, and 80 percent (4,554 acres) multi-storied. FVS projections indicate that following stand treatments and the passing of the current epidemic 64 percent (3,711 acres) of the infested treatment stand area may be classified as open, seven percent (384 acres) as single-storied, and 29 percent (1,651 acres) as multi-storied (Table 4.11).

Although fire hazards are not considered to be a major concern in these forest types, except during periods of drought and high wind conditions (Bradley, Noste, and Fischer, 1992), fire is a natural part of the ecosystem. High mortality of spruce in infested stand areas, and in stands affected as the epidemic spreads will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels (limbs, shrubs, regeneration, etc.), and concentrations of down and standing dead trees increase the risk of localized intense wildfires. As these fuel hazards develop across the landscape, the risk of fires that are both intense and large increases. Events of this nature could further reduce vegetative diversity by destroying remaining live trees and vegetation, of all involved species, size, and age classes. Intense fires could have serious effects on soil erosion, soil productivity, mycorrhizal development (provides an important symbiotic relationship with coniferous trees), as well as other elements of the ecosystem which affect the growth of trees.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could have serious adverse effects to forest health. Some of the effects would include: reduction of vegetative diversity, decreased soil productivity, increased soil erosion, and reduction of mycorrhizal development.
Cumulative Effects

Cumulative effects of each alternative will be discussed individually in following sections.

Possible Conflicts with Plans and Policies of Other Jurisdictions

No conflicts with plans and policies of other jurisdictions apply to any of the evaluated alternatives in reference to this issue.

Probable Environmental Effects that Cannot be Avoided

In currently infested stands, existing mortality levels plus subsequent spruce mortality as spruce beetle populations continue to expand is an environmental effect of all alternatives that cannot be avoided. Depending on stand conditions, the level of infestation in these stands is such that 50% to 100% mortality levels have occurred. Spruce mortality is expected to continue, unless a natural environmental event (i.e., cold, wet summer, or heavy freeze during critical Spruce beetle life periods) occurs which would cause population levels to collapse and stop the epidemic.

Munson (1994) indicated that an average of 56% mortality of large diameter spruce trees had occurred in stands sampled for the biological evaluation of spruce beetle activity in this area. As high as 92% mortality was recorded in one sample stand. As the spruce beetle epidemic continues, these levels of mortality will not be uncommon in stands consisting of a high percentage of susceptible spruce.

Relationship Between Short Term Use and Long Term Productivity

Soil and water are considered to be the primary factors of productivity and a stands associated ability to produce trees or timber outputs. Regardless of short-term uses or non-uses proposed under individual alternatives, long term productivity of soils and associated potential to grow trees within individual stands will be maintained through implementation of mitigation measures described in Chapter 2.

Irreversible and Irretrievable Commitments of Resources

In infested stands, mortality of spruce trees which are currently, or will soon be infested with Spruce beetle is an irreversible effect that cannot be avoided under all alternatives. If mass attacked, tree mortality will occur, and under all alternatives a minimum of 100 to 200 years will be required to bring stand structures back to conditions similar to those which existed prior to the Spruce beetle epidemic. This is a period of time which equals one to two full management rotation periods. The forest plan specifies that the desired rotation age (age at regeneration harvest) for spruce-fr is 80 to 140 years.

Under all alternatives salvageable timber values in those areas which are selected for non-harvest, or are removed from harvest as mitigation measures for resource protection at this time will be irretrievably lost.

Consistency with NFMA/Forest Plan Standards

Because this analysis involves vegetative management treatments NFMA compliance items covered under 36 CFR 219.27(b) "Vegetative Manipulation", 36 CFR 219.27(c) "Silvicultural Practices", and 36 CFR 219.27(d) "Even-aged Management" will be summarized below.
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219.27 (b)(7): "Be practical in terms of transportation and harvesting requirements, and total cost of preparation, logging, and administration."

The transportation and harvest methods described are capable of being implemented, based on the Silvicultural information and transportation plan and feasibility report (Refer to the Project file). The economic analysis as outlined in Chapter 4 demonstrates that all costs are within expected revenues.

Silvicultural Practices

219.27 (c)(1): "No timber harvesting shall occur on lands classified as not suited for timber production pursuant to 219.14 except for salvage sales. These lands shall continue to be treated for reforestation purposes if necessary to achieve the multiple-use objectives of the plan."

This has been discussed under the "Forest Land Suitability" section. Based on discussions in this section, all harvest activities proposed are in full compliance with this management requirement.

219.27 (c)(2): "The selected sale schedule provides the allowable sale quantity for the first planning period. Within the planning period, the volume of timber to be sold in any one year may exceed the annual allowable sale quantity so long as the total amount does not exceed the allowable sale quantity. Nothing in this paragraph prohibits salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger of insect or disease attack and where such harvests are consistent with silvicultural and environmental standards. Such timber may either substitute for timber that would otherwise be sold under the plan or, if not feasible, be sold over and above the planned volume."

Portions of the volume to be sold under the Proposed Action or other Action Alternatives may contribute to the allowable sale quantity (ASQ) for the first planning period for the Forest Plan. Sale of any volume proposed under the Proposed Action or Action Alternatives would not result in exceeding the ASQ for the planning period because salvage or sanitation harvesting may either substitute for timber that would otherwise be sold under the plan or, if not feasible, be sold over and above the planned volume.

Volumes sold off of lands classified as unsuited for timber harvest would not contribute to the ASQ. Refer to "Forest Land Suitability" for acres classified as unsuitable.

219.27 (c)(3): "When trees are cut to achieve timber production objectives, the cuttings shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands within 5 years after the final harvest. Research and experience at the final harvest shall be the basis for determining whether the harvest and regeneration practices planned can be expected to result in adequate restocking."

NFMA requires that timber be harvested from National Forest Systems lands only where there is assurance that such lands can be adequately restocked within 5 years of final harvest (16 U.S.C. 1604).

Under the Proposed Action, and other Action Alternatives, dead, dying and bark beetle infested trees are being cut to reduce bark beetle populations and disrupt population cycles. Only in the areas where bark beetle populations have killed substantial numbers of trees would an unstocked opening be created, and regeneration activity be necessary. Regeneration in these areas is not a result of silvicultural treatments aimed at achieving timber production objectives, but are a result of site rehabilitation on areas impacted by a natural disaster (bark beetle infestation). Therefore, the NFMA 5 year requirement does not apply to regeneration activities proposed under the Proposed Action, or any Action Alternative.

Under some alternatives, selected green trees would be removed to reduce future losses to the existing bark beetle populations that are in and near the project area. Removal of these trees would not result in an unstocked stand condition that would require regeneration activity.

Monitoring would be used to assess the success of regeneration efforts following project completion. Desired results and forest plan standards would be specifically stated in the detailed silvicultural prescriptions written for each area. The details of the monitoring plan are in Appendix A.3.

Although the Manti-La Sal National Forest has had limited experience planting in these forest types, experience from forests of similar elevation and habitat types indicates stands in the project area requiring regeneration activity following implementation of the Proposed Action, or other Action Alternatives, can be successfully regenerated in accordance with the National Forest Management Act (NFMA 1976) requirements.

219.27 (c)(4): "Cultural treatments such as thinning, weeding and other partial cutting may be included in the forest plan where they are intended to increase the rate of growth of remaining trees, favor commercially valuable tree species, favor species age classes which are most valuable for wildlife, or achieve other multiple-use objectives."

Sanitation treatments prescribed in Alternative 3 and 4 are intended to meet desired stocking levels to promote tree growth and vigor, and to achieve desired species mix to reduce Spruce beetle risk. This is outlined in Chapters 2 and 4 (Section 4.9).

219.27 (c)(5): "Harvest levels based on intensified management practices shall be decreased no later than the end of each planning period if such practices cannot be completed substantially as planned."

This applies to Forest Plan level decisions, not to project level decisions.

219.27(c)(6): "Timber harvest cuts designed to regenerate an even-aged stand of timber shall be carried out in a manner consistent with the protection of soil, watershed, fish...resources, and the regeneration of the timber resource."

No treatments designed to regenerate even-aged stands are proposed under the Proposed Action or other Action Alternatives. However, as discussed in Chapters 3 and 4, the SWCP's are designed to protect soil, water, and instream resources. Pertinent SWCP's are retention of adequate ground cover, harvest restrictions in critical soil and watershed areas, wet condition restrictions, designated ski trails, and ripping of ski trails.

219.27 (c)(7): "Timber harvest and other silvicultural treatments shall be used to prevent potential damaging population increases of forest pest organisms. Silvicultural treatments shall not be applied where such treatments would make stands susceptible to pest-caused damage levels inconsistent with management objectives."

A Purpose and Need for this action is driven by the need to reduce the potential damaging population increases of bark beetles in the project area. As described in Chapter 4, section 4.9,
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Action Alternatives would move toward achieving this objective. The proposed silvicultural treatments would improve the existing situation.

Even-Aged Management

OPTIMIZATION OF CLEARCUTTING: The National Forest Management Act states that clearcutting is to be used on National Forest System lands only where it is determined to be the optimum method.

The Manti-La Sal National Forest has interpreted this requirement to mean that clearcutting would be used only where it is consistent with the Forest Plan standards and guidelines, and where it would accomplish Forest Plan objectives that cannot be accomplished through other harvest methods.

Salvage and/or sanitation are the only proposed treatments under the Proposed Action, or other action alternatives. Clearcutting is not a proposed treatment. Some areas have been or are projected to be heavily impacted by Spruce beetles. Insect infested trees and a portion of the dead trees would be removed in these areas. This may result in some areas being "understocked" (not fully meeting desired trees per acre or desired species composition goals) due to bark beetle activity. Live, non-infested trees would not be removed from these areas. Damage to live trees that have survived the bark beetle infestation would be minimized by strict adherence to contract requirements for protection of residual green trees.

Silviculture treatments proposed in Alternatives 3 and 4 are also designed to reduce spruce beetle risk in uninfested stands. Live trees would be harvested through sanitation treatments to thin live trees and reduce stand density. No clearcuts or large human-created evenage openings are planned.

APPROPRIATENESS OF EVEN-AGED MANAGEMENT: The National Forest Management Act (NFMA) places special requirements on the use of even-aged silviculture systems on National Forest Systems lands. This is contained in NFMA (16 USC 1604 (g)(3), (F) and (I) which states that "cuts designed to regenerate an even-aged stand of timber would be used as a cutting method only where such cutting is determined to be appropriate, to meet the objectives and requirements of relevant land management plans.

Long term management objectives have not been established for the project area. The Forest Plan (p. III-27) allows use of evenaged (shelterwood) or unevenaged (group or single tree selection) methods in spruce-fir. In some areas, spruce beetles have, or are projected to kill a large proportion of the overstory, creating a more even-aged condition. However, an option would still exist in the future for managing these stands for uneven-aged conditions; it would just take longer for them to achieve an uneven-aged distribution. All stands would have an option in the future to be managed as even or uneven-aged, depending on desired conditions at that time.

219.27 (d)(1): "Openings shall be located to achieve the desired combination of multiple-use objectives. Regional Guides shall provide guidance on dispersion of openings. As a minimum, openings may set forth variations to this minimum based on site-specific requirements for achieving multiple-use objectives. Regional guides shall provide guidance for determining variations to this minimum in the Forest Plan."
stands at this time. No Action may result in mortality levels of 50 to 100 percent of the sawtimber size spruce in those stands currently uninfested by epidemic spruce beetle populations (4,465 acres).

Analysis of Forest Vegetation Simulator (FVS) projections for Alternative 1 result in the largest decline in Periodic Annual Increment (PAI) and Mean Annual Increment (MAI) of the evaluated alternatives. Figures 4.4, 4.5, and 4.6 compare PAI and MAI graphically for each alternative. The low MAI curves for this alternative are indicative of the high mortality sustained by all stands and the slow recovery from reduced tree stocking levels. Theoretically, uneven-aged managed stands should maintain Periodic Annual Increment levels equal to Culmination of Mean Annual Increment (CMAI) (Smith, 1986). Average CMAI level for the treatment stands is 74 cubic feet/acre/year. See Table 4.8 for average potential PAI and MAI conditions following mortality and harvest for infested stands, uninfested stands, and treatment unit averages.

This alternative provides for no proactive reforestation activities within the sale area. 100 to 200 years could be required for many areas to return to pre-epidemic stocking levels. All areas would be left to regenerate naturally. Few dominant or codominant spruce 15 inch diameter or larger (Alexander, 1987) would be left in many areas to provide a viable seed source for natural regeneration of spruce. Although spruce and subalpine fir can begin producing cones at heights of 4 to 5 feet, sapling, pole, and small sawtimber size trees are generally poor seed producers. Increases in herbaceous material in effected stands following the epidemic would also limit natural regeneration and seedling growth (Schmid and Hinds, 1974).

Schmid and Frye Risk: This alternative provides no changes in stand risk levels that may maintain a live sawtimber size spruce component within the study area. Changes in risk or hazard ratings displayed in Table 4.9 for Alternative 1 are a direct result of projected spruce mortality in all stand areas, and associated reductions in spruce composition, average diameter, and basal area.

Implementation of Alternative 1 could result in continued mortality of sawtimber size spruce trees within the Manti Division of the Manti-La Sal National Forest. It is anticipated that the Spruce beetle population will continue to spread to the north, unless beetle populations collapse naturally due to environmental conditions.

Vegetative Diversity: The spruce beetle epidemic, although within the natural range of variability for spruce-fir forest types on the Manti-La Sal National Forest, is creating a condition less varied, and more open in structure than conditions existing prior to the outbreak.

Alternative 1 provides no management activities which maintain or enhance vegetative diversity within stands currently uninfested by Spruce beetle. Direct and indirect effects of this alternative on vegetative diversity in all stand areas are the same as those described in effects common to all alternatives.

Inventory data indicates that the dominant forest (cover) type of uninfested stands prior to the epidemic and up to the time of inventory was 100 percent (4,465 acres) spruce-fir. Current Forest Vegetation Simulator (FVS) projections indicate that mortality in these stands, under Alternative 1, may result in a shift towards nine percent (412 acres) spruce-fir, 0 percent (0 acres) spruce, and 91 percent (4,053 acres) Subalpine fir. The dominant forest type for the total study area treatment stands at time of inventory was 99 percent (10,124 acres) spruce-fir, one percent (87 acres) spruce, and 0 percent (0 acres) Subalpine fir. Current and projected mortality for the total treatment stands under Alternative 1 may result in a shift towards seven percent (756 acres) spruce-fir, one percent (20 acres) spruce, and 92 percent (9,435 acres) Subalpine fir (Table 4.10).
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At the time of inventory, 100 percent (4,465 acres) of the uninfested treatment stand structures were classified as multi-storied or uneven-aged. FVS projections indicate that following the passing of the current epidemic under Alternative 1, the stand structure of currently uninfested treatment stands may be 58 percent (2,574 acres) open, 0 percent (0 acres) single-storied, and 42 percent (1,891 acres) multi-storied. At the time of inventory, stand structures for treatment stands in the total study area were 9.5 percent (988 acres) open, 1.5 percent (164 acres) single-storied, and 89 percent (9,059 acres) multi-storied. Following implementation of Alternative 1 and passing of the current epidemic, 61 percent (6.285 acres) may be open, four percent (384 acres) single-storied, and 35 percent (3.542 acres) multi-storied (Table 4.11).

Effects of fire hazard as related to vegetative diversity for Alternative 1 are the same as described in Effects Common To All Alternatives, Direct and Indirect Effects above.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

Cumulative Effects

This alternative, would result in the cumulative harvest of only the Timber Canyon and Twelvemile Sinks Timber Sales that are currently under timber sale contract. 535 total acres of spruce salvage harvest within the study area would be attributed to the current spruce beetle epidemic. Total recorded harvest since 1979 within this area would total 642 acres.

Unless environmental conditions cause spruce beetle populations to collapse naturally, spruce beetles could continue to spread north infesting areas of suitable host type.

Probable Environmental Effects that Cannot be Avoided

Depending on individual stand conditions, and unless spruce beetle populations collapse naturally due to environmental conditions, mortality levels typical of currently infested stands can be expected in uninfested stands as the epidemic spreads northward. Current rate of spread is approximately 1/2 mile per year (Musson - personal communication). If this rate of spread continues, 50 to 100 percent mortality of large diameter spruce trees could occur in currently uninfested, as well as infested stands. Total affected area of proposed treatment units is 10,211 acres.

Consistency with NFMA/Forest Plan Standards

A Forest Plan goal promotes the use of integrated pest management programs (IPM) to prevent and control insect disease infestations (PP, III-5) across all areas of the forest. Forest-Wide direction directs management activities to prevent or suppress epidemic insect and disease populations that feed on forest and/or range land with an IPM approach consistent with resource management objectives (PP, III-43). Alternative 1 is not fully consistent with the Forest Plan goal and forest-wide direction because no management activities would be directed towards the control of suppression of the existing spruce beetle epidemic expansion into adjacent susceptible stands.

Utilization of timber resources is emphasized within TBR prescription areas, and is permitted within RNG prescription areas. Alternative 1 is not fully consistent with these goals because no action would result in non-utilization of timber resources in TSR or RNG areas, including no attempt to provide a faster recovery toward a desired timber condition.

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In addition to effects described for infested stands in Effects Common To All Alternatives, FVS projections indicate that the following treatment units may be classified as large openings as a result of projected spruce beetle mortality: E4 - 67 acres, F1 - 982 acres, F2 - 451 acres, G1 - 669 acres, G1A - 47 acres, G2 - 97 acres, and G3 - 281 acres. None of the currently uninfested treatment units were classified as open at the time of inventory. These openings are a direct result of the impacts created by the spruce beetle. No timber harvest is proposed under this alternative.

ALTERNATIVE 2

Direct and Indirect Effects

Stand Development: Because this alternative allows salvage of dead and infested spruce trees only, a decision to implement Alternative 2 may result in mortality of 50 to 100 percent of the sawtimber size spruce in 4,465 acres of live, uninfested stands, as well as mortality described in direct and indirect effects.

Mortality levels under this alternative will be similar to those in Alternative 1. The higher level (compared to Alternative 1) of periodic annual increment (PAI) and mean annual increment (MAI) analyzed from Forest Vegetation Simulator (FVS) projections and displayed in Table 4.8 and Figures 4.4, 4.5, and 4.6 is a function of mortality captured through salvage harvest and reforestation efforts, not reduced tree mortality.

Alternative 2 results in the second largest decline in PAI of the evaluated alternatives. Figures 4.4, 4.5, and 4.6 show that MAI under Alternative 2 is very similar to Alternative 4. Both alternatives show a reduced MAI due to mortality, and recovery is at a reduced level compared to Alternative 3 due to reduced reforestation efforts. MAI levels are well below the projected potential average Cullmen Mean Annual Increment (CMAI) level of 74 ft³/acre/year.

2,459 acres would be reforested by natural or artificial (planting) methods following salvage operations under this alternative. Nonharvest areas would be left to regenerate naturally under conditions similar to those described in Alternative 1. The higher level of 74 ft³/acre/year for 2,459 acres of reforestation efforts. MAI levels are well below the projected potential average Cullmen Mean Annual Increment (CMAI) level of 74 ft³/acre/year.

Schmid and Frye Risk: This alternative is the same as Alternative 1 and provides no changes in stand risk levels that would provide the opportunity to protect or maintain a live sawtimber size spruce component within the study area. Changes in risk or hazard ratings displayed in Table 4.9 for Alternative 2 are a direct result of spruce mortality in all stand areas, and associated reductions in spruce composition, average diameter, and basal area.

Vegetative Diversity: Alternative 2 provides no management activities which maintain or enhance vegetative diversity within stands currently uninfested by spruce beetle at this time. Direct and indirect effects of this alternative on vegetative diversity in all stand areas are similar to those described in Alternative 1. Cumulative Effects. The only differences would be those associated with site recovery through reforestation activities. 2,459 acres of reforestation activities would promote a return towards current vegetative structure and forest type conditions over a long-term period.

The post-epidemic genetic pool would be supplemented through planting of Engelmann spruce trees. This provides some opportunity to select parent trees with desirable traits (diameter growth, height growth, and crown development) from within and around the study area. This would help to reduce inbreeding and selection of less successful trees which survive the epidemic due to their small
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of projected spruce beetle induced mortality: E4 - 67 acres, F1 - 982 acres, F2 - 451 acres, G1 - 669 acres, G1A - 47 acres, G2 - 97 acres, and G3 - 261 acres. None of the currently uninfested treatment units were classified as open at the time of inventory. These projections are expected to be a worst case scenario, since many of the stands will be interspersed with areas of mature subalpine fir and aspen, and areas of seedling, sapling, and pole size trees. This will maintain a forested structure in some areas, and limit the size of continuous openings resulting from spruce mortality and salvage harvest in this alternative.

These openings are the same as those described in Alternative 1, and are a direct result of the impacts created by the spruce beetle. Salvage operations proposed in treatment units F1, F2, G1, G1A, and G3 under this alternative would not cause any increase in opening size as a result of any live tree harvest.

ALTERNATIVE 3

Direct and Indirect Effects

Stand Development: A decision to implement Alternative 3 provides the best scenario to maintain sawtimber size spruce within the 4,465 acres of live, uninfested stands. This alternative is the most likely to retain stands in an essentially stocked condition and minimize impacts associated with losses in stand growth that result from spruce mortality in other alternatives.

Analysis of Forest Vegetation Simulator (FVS) projections show that Alternative 3 provides the highest stand growth and production levels of the evaluated alternatives. Periodic Annual Increment (PAI) and Mean Annual Increment (MAI) levels are the highest, and are displayed in Table 4.8 and Figures 4.4, 4.5, and 4.6. These stand growth and production levels are a function of mortality captured through salvage harvest in infested stands, intensive reforestation efforts, and maintenance of a live spruce component in currently uninfested stands. Although below the projected potential average, Culmina-tion Mean Annual Increment (CMAI) level of 74 ft³/acre/year, this alternative maintains current growth levels in uninfested stand areas (Figure 4.5).

Reforestation activities would be implemented in all of the proposed treatment units, so that this alternative provides the most intensive effort of the evaluated alternatives to bring the entire forest area back into tree production. 3,299 acres would be reforested by natural or artificial (planting) methods following salvage operation. Treatment units could return to current production levels in approximately 60 years under this alternative. This provides a return to current production levels approximately 100 years (one rotation period) sooner than would occur under Alternative 1.

Schmid and Frye Risk: This alternative provides for silvicultural treatments consistent with integrated pest management strategies that provide an opportunity to retain a large spruce overstory within the study area. Change in risk ratings displayed in Table 4.9 for Alternative 3 in currently uninfested stands are a result of reducing numbers of trees through harvest of live trees to reduce total stand basal area, average diameter of sawtimber size spruce trees, and the proportion of live spruce to other tree species.

Of the alternatives (3 and 4) which allow sanitation harvest of live, uninfested trees to address Spruce beetle risk, Alternative 3 provides the most intensive effort to manage Spruce beetle activity, reduce losses, and protect the spruce component.

Vegetative Diversity: Alternative 3 provides the most intensive management activities that may maintain or enhance vegetative diversity within stands currently uninfested by Spruce beetle. Although

size or young age. Engelmann spruce abundance would be improved over the conditions which would follow implementation of Alternative 1 if that alternative was selected, but would be less than Alternatives 3 and 4 respectively.

Inventory data indicates that the dominant forest (cover) type of uninfested stands prior to the epidemic and up to the time of inventory was 100 percent (4,465 acres) spruce-fir. Current and FVS projected mortality in these stands, under Alternative 2 is the same as mortality projected for Alternative 1. Salvage harvest of dead trees will not effect forest type under this alternative. The dominant forest type for the total study area treatment units at time of inventory was 99 percent (10,124 acres) spruce-fir, one percent (87 acres) spruce, and 0 percent (0 acres) Subalpine fir. Current and projected mortality for the total treatment units under Alternative 2 is the same as Table 4.10.

Changes in stand structure as a result of the current spruce beetle epidemic and salvage harvest proposed under Alternative 2 are the same as those described for uninfested stands in Alternative 1 (Direct and Indirect Effects). Alternative 2 limits harvest to dead and dying spruce in all areas. Principal structural changes will occur as the result of the loss of green trees and canopy caused by spruce beetle induced mortality, not timber harvest (Table 4.11).

Although the risk of localized wildfires is increased in untreated areas under this alternative, overall hazards are reduced through salvage harvest and slash disposal activities. The probability of wildfires causing further reductions in vegetative diversity or harming other site factors which effect the growth of trees is greatly reduced compared to Alternative 1.

Effects of fire hazard, as related to vegetative diversity, in areas of high spruce beetle mortality for Alternative 2 which are not salvage harvested are similar to those described in Effects Common To All Alternatives, Direct and Indirect Effects above.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

Cumulative Effects

Same as Alternative 1 (Cumulative Effects), except that this alternative, in conjunction with the Timber Canyon and Twelvemile Salvage Timber Sales that are currently under timber sale contract, harvests a total of 6,177 acres of spruce within the study area. Total recorded harvest since 1979 within this area would total 6,284 acres.

Consistency with NFMA/Forest Plan Standards

Alternative 2 is partially consistent with Forest Plan goals and forest-wide direction because Alternative 2 leads to salvage (an Integrated Pest Management tool) or utilization of timber resources across 5,640 acres and the infestation would run its natural course with control or suppression management strategies limited to spraying in dispersed and developed recreation sites to protect high value spruce trees in those areas. Alternative 2 also leads to non-utilization of timber resources across 4,572 acres which are excluded from harvest due to helicopter logging requirements, and includes no attempt to provide a faster recovery toward a desired timber condition in these non-harvest areas.

In addition to effects described for infested stands in Effects Common To All Alternatives, FVS projections indicate that the following treatment units may be classified as large openings as a result

South Manti Timber Salvage Sales EA, Page 4 - 50

South Manti Salvage Sales EA, Page 4 - 50

South Manti Timber Salvage Sales EA, Page 4 - 51

South Manti Salvage Sales EA, Page 4 - 51

South Manti Salvage Sales EA, Page 4 - 50

South Manti Salvage Sales EA, Page 4 - 51

South Manti Salvage Sales EA, Page 4 - 50

South Manti Salvage Sales EA, Page 4 - 51
numbers of individual sawtimber size spruce trees would be reduced by harvest, if effective, a proportion of the existing large diameter spruce population may be maintained in these stands. This would allow a higher proportion of the existing genetic pool to be maintained, with some improvement through selection of existing trees to enhance desirable characteristics of diameter growth, height growth, and crown development during sanitation thinning operations. This would provide an opportunity for the offspring of trees adapted for local conditions to be maintained on the site.

Should sanitation treatments fail, and the epidemic overwhelms these stands as well, effects on genetic diversity would be similar to those described for Alternatives 1 and 2.

Data indicates that the dominant forest (cover) type of uninfested stands at the time of inventory was 100 percent (4,465 acres) spruce-fir, and 23 percent (0 acres) spruce, and 23 percent (1,043 acres) Subalpine fir.

The dominant forest type for the total study area treatment units at time of inventory was 99 percent (10,124 acres) spruce-fir, one percent (87 acres) spruce, and 0 percent (0 acres) Subalpine fir. FVS projections indicate that harvest and mortality for the total treatment units in Alternative 3 may result in a shift towards 77 percent (3,422 acres) spruce-fir, 0 percent (0 acres) spruce, and 23 percent (1,043 acres) Subalpine fir.

At the time of inventory, 100 percent (4,465 acres) of the uninfested treatment stand structures were classified as multi-storied or uneven-aged. FVS projections indicate that following the passing of the current epidemic under Alternative 3, 100 percent (4,465 acres) of the uninfested treatment stand area may remain multi-storied in structure.

At the time of inventory, stand structures for treatment stands in the total study area were 9.5 percent (988 acres) open, 1.5 percent (164 acres) single-storied, and 89 percent (8,059 acres) multi-storied. Following implementation of Alternative 3 and passing of the current epidemic, 66 percent (3,711 acres) may be open, four percent (384 acres) single-storied, and 60 percent (6,116 acres) multi-storied (Table 4.11).

If sanitation treatments in uninfested stands fail to protect sawtimber size spruce in these stands, the combined harvest and subsequent spruce mortality would cause structural and forest type changes similar to those described in Alternative 1 (Direct and Indirect Effects) for uninfested stands and total treatment stands within the study area.

Alternative 3 provides the lowest risk of a large, intense wildfires occurrence following harvest and associated slash disposal activities of the evaluated alternatives. After these activities are completed, the probability of wildfires causing further changes in vegetative diversity or other site factors which effect the growth of trees is reduced in all treatment units.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

Cumulative Effects

If sanitation salvage prescriptions implemented in uninfested stand areas are successful, implementation of Alternative 3 could result in a short-term reduction in spread of insect populations into adjacent untreated stands. This may result in maintenance of a large overstory spruce component in these areas. If unsuccessful, cumulative effects in relation to spruce mortality would be similar to Alternative 1.

This alternative, in conjunction with the Timber Canyon and Twelvemile Salvage Timber Sale that are currently under timber sale contract, harvests a total of 10,746 acres of spruce within the study area. Total recorded harvest since 1979 within this area would be 10,853 acres.

Probable Environmental Effects that Cannot be Avoided

Same as described in effects common to all alternatives for infested stands. If sanitation salvage strategies fail under this alternative, mortality in treated stands may be similar to Alternative 1.

Irreversible and Irretrievable Commitments of Resources

Spruce mortality in infested stand areas may be irreversible and irretrievable commitment of resources. Salvageable timber values in those areas which are selected for non-harvest, or are removed from harvest as mitigation measures for resource protection at this time may be irrevocably lost under this alternative.

Consistency with NFMA/Forest Plan Standards

Alternative 3 is fully consistent with Forest Plan goals and direction because Alternative 3 applies integrated pest management strategies across 10,212 acres including an attempt to provide a faster recovery toward a desired forest health condition (endemic levels of beetles). Alternative 3 utilizes timber resources harvested to meet both goals.

FVS projections indicate that if sanitation thinning treatments are effective a forested condition would be maintained in treatment units currently uninfested by spruce beetle. In these areas, no large openings would exceed NFMA, regional, and forest guidelines for application of even-aged management. If sanitation treatments are unsuccessful, openings resulting from spruce beetle induced mortality would be similar to effects described for Alternatives 1 and 2.

ALTERNATIVE 4

Direct and Indirect Effects

Stand Development: As in Alternative 3, a decision to implement Alternative 4 may result in maintaining sawtimber size spruce within 2,651 of the 4,465 acres of green, uninfested stands. This alternative may maintain stands in an essentially stocked condition and assist in maintaining current production levels. Conditions in inventoried roadless stand areas not treated in this alternative would be similar to Alternative 1.

Analysis of Forest Vegetation Simulator (FVS) projections for Alternative 4 results in the third lowest decline in Periodic Annual Increment (PAI) of the evaluated alternatives. Table 4.8 and Figures 4.4, 4.5, and 4.6 show that Mean Annual Increment (MAI) under Alternative 4 is very similar to Alternative 2. Both alternatives show a reduced MAI due to mortality, and recovery is at a reduced level compared to Alternative 3 due to reduced reforestation efforts. MAI levels are well below the projected potential average Culmination Mean Annual Increment (CMAI) level of 74 ft³/acre/year. Treatment units would return to current production levels in 60 years under this alternative. This provides a return to current production levels approximately 100 years (one rotation period) earlier compared to Alternative 1.
CHAPTER 4

2,347 acres would be reforested by natural or artificial (planting) methods following salvage operations. Because of differences in harvest areas between this alternative and Alternative 2, Alternative 4 provides a reduced reforestation effort. Nonharvest areas would be left to regenerate naturally under conditions similar to those described in Alternative 1, Direct and Indirect Effects (Stand Development).

Schmid and Frye Risk: As in Alternative 3, this alternative utilizes silviculture strategies consistent with integrated pest management alternatives which may provide an opportunity to retain a large spruce overstory within the study area. Change in risk ratings (Table 4.9) for Alternative 4 in currently uninforest stands is due to reducing numbers of trees through harvest of live trees to reduce total stand basal area, average diameter of sawtimber size spruce trees, and proportion of live spruce to other tree species.

Of the alternatives (3 and 4) which allow sanitation harvest of live, uninforest trees to address spruce beetle risk and attempt to meet resource objectives, Alternative 4 provides the least intensive effort to manage spruce beetle activity, and protect the spruce component.

Inventoried roadless areas excluded from sanitation treatments under this alternative can be expected to incur spruce beetle mortality similar to Alternatives 1 and 2. In addition, these moderate to high risk untreated areas could produce large populations of spruce beetle that may reduce the effectiveness treatments.

Vegetative Diversity: Alternative 4 provides the second most intensive management activities that may maintain or enhance vegetative diversity within stands currently uninforest by Spruce beetle. Although numbers of individual sawtimber size spruce trees would be reduced by harvest, if effective, a significant proportion of the existing large diameter spruce population could be maintained in these stands. This would allow a higher proportion of the existing genetic pool to be maintained, with some improvement through selection of existing trees to enhance desirable characteristics of diameter growth, height growth, and crown development during sanitation thinning operations. This would provide an opportunity for the offspring of trees adapted for local conditions to be maintained on the site, rather than depend on planting of seedling stock which has been grown from seed collected from trees in other areas.

Inventoried roadless area stands left untreated would be subject to the same conditions described in Alternative 1. These moderate to high risk untreated stands could produce large populations of spruce beetle that may reduce the effectiveness of sanitation treatments, and could result in mortality levels and effects on genetic diversity similar to Alternatives 1 & 2.

Data indicates that the dominant forest (cover) type of uninforest stands at the time of inventory was 100 percent (4,465 acres) spruce-fir. FVS projections indicate that sanitation harvest treatments and mortality in nonharvest areas in Alternative 4 may result in a shift towards 70 percent (3,147 acres) spruce-fir, 0 percent (0 acres) spruce, and 30 percent (1,318 acres) Subalpine fir.

The dominant forest type for the total study area treatment units at time of inventory was 99 percent (10,124 acres) spruce-fir, one percent (87 acres) spruce, and 0 percent (0 acres) Subalpine fir. FVS projections indicate that harvest and projected mortality for the total treatment units under Alternative 4 may result in a shift towards 54 percent (3,191 acres) spruce-fir, less than one percent (0 acres) spruce, and 46 percent (6,700 acres) Subalpine fir (Table 4.10).

At the time of inventory, 100 percent (4,465 acres) of the uninforest treatment stand structures were classified as multi-storied or uneven-aged. FVS projections indicate that following implementation of Southern Idaho Salvage Sales EA, Page 4 - 54

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Alternative 4 and passing of the current epidemic, 12 percent (518 acres) may be open, 0 percent (0 acres) single-storied, and 88 percent (3,947 acres) multi-storied.

At the time of inventory, stand structures for treatment stands in the total study area were 9.5 percent (988 acres) open, 1.5 percent (164 acres) single-storied, and 89 percent (6,059 acres) multi-storied. FVS projections indicate that following implementation of Alternative 4 and passing of the current epidemic, 41 percent (4,229 acres) may be open, four percent (384 acres) single-storied, and 55 percent (5,598 acres) multi-storied (Table 4.11).

If sanitation treatments in uninforest stands failed to protect sawtimber size spruce, the combined harvest and subsequent spruce mortality could cause structural and forest type changes similar to those described in Alternative 1 (Alternative 1, Direct and Indirect Effects) for uninforest stands and total treatment stands within the study area.

Alternative 4 provides the second lowest risk of a large, intense wildfire occurrence following harvest and associated slash disposal activities of the evaluated alternatives. Overall hazard and the probability of wildfir caus ing further reductions in vegetative diversity or other site factors which effect the growth of trees is reduced in all stand areas treated under this alternative. Non-harvest areas would have the same risk as those areas under Alternative 1.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

Cumulative Effects

Although sanitation treatments are reduced from Alternative 3, if sanitation salvage prescriptions implemented in uninforest stand areas are successful, implementation of Alternative 4 may result in a short-term reduction in spread of insect populations into adjacent untreated stands. This may result in maintenance of the large overstory spruce component in these areas. If unsuccessful, cumulative effects in relation to spruce mortality would be similar to Alternative 1.

This alternative, in conjunction with the Timber Canyon and Twelvemile Salvage Timber Sales that are currently under timber sale contract, harvests a total of 7,549 acres of spruce within the study area. Total recorded harvest since 1979 within this area would total 7,655 acres.

Probable Environmental Effects that Cannot be Avoided

Same as described in effects common to all alternatives for infested, and for uninforest stands excluded from harvest due to inventoried roadless classification. If sanitation salvage strategies fail under this alternative, mortality in treated stands may be similar to untreated stands.

Irreversible and Irretrievable Commitments of Resources

Salvageable timber values in those areas which are selected for non-harvest, or are removed from harvest as mitigation measures for resource protection at this time will be irretrievably lost under this alternative. Site effects common to all alternatives for resource commitments related to spruce mortality in infested stand areas.

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Consistency with NFMA/Forest Plan Standards

A Forest Plan goal promotes the use of integrated pest management programs to prevent and control insect and disease infestations (FP, III-5) across all areas of the Forest. Timber resources within TBR and RNG prescription areas emphasize, and allow for, timber utilization. Alternative 4 is consistent with these goals across 7,015 acres because Alternative 4 applies integrated pest management strategies across 7,015 acres including an attempt to provide a faster recovery toward a desired forest health condition (endemic levels of beetles). Alternative 4 utilizes timber resources harvested to meet both goals.

Alternative 4 is not fully consistent with these goals across 3,197 acres excluded to protect inventoried roadless area characteristics because Alternative 4 allows the infestation to run its natural course and leads to non-utilization of timber resources in areas which are excluded from harvest, including no attempt to provide a faster recovery toward a desired timber condition.

FVS projections indicate that if sanitation thinning treatments are effective a forested condition may be maintained in areas currently uninfested by spruce beetle that are treated under this alternative. In these areas, no openings would exceed NFMA, regional, and forest guidelines for application of even-aged management. Nonharvest areas could be subject to the same conditions described for Alternatives 1 and 2. If sanitation treatments are unsuccessful, large openings resulting from spruce beetle induced mortality would be similar to effects described for Alternatives 1 and 2.
# CHAPTER 4

## TABLE 4.8
STAND PRODUCTION
(Average Current and Post Epidemic or Harvest Condition)

<table>
<thead>
<tr>
<th></th>
<th>CURRENT</th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
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<td>MAI</td>
<td>CMAI</td>
<td>PAI</td>
<td>MAI</td>
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<td>TOTAL AREA Ft³</td>
<td>36</td>
<td>21</td>
<td>74</td>
<td>-144</td>
<td>6</td>
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</table>
### CHAPTER 4

**TABLE 4.9**

**SPRUCE BEETLE RISK RATING**

**AVERAGE CHANGED CONDITION**

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<th>INFESTED STANDS</th>
<th>UNINFESTED STANDS</th>
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<td>Acres Moderate To High</td>
<td>0</td>
<td>0</td>
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<td>Acres Moderate</td>
<td>5,746</td>
<td>4,465</td>
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<tr>
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<td>Acres Low Risk</td>
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</tr>
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<td>Acres Moderate To High</td>
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<tr>
<td>Acres Moderate</td>
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<td>0</td>
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<tr>
<td>Acres Low To Moderate</td>
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<td>4,465</td>
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<td>Acres Low Risk</td>
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<td>0</td>
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<td><strong>ALTERNATIVE 2</strong></td>
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<td>CHANGED CONDITIONS</td>
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<tr>
<td>Acres High Risk</td>
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<td>0</td>
</tr>
<tr>
<td>Acres Moderate To High</td>
<td>0</td>
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<td>Acres Moderate</td>
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<tr>
<td>Acres Low To Moderate</td>
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<td>Acres Low Risk</td>
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<td>Acres High Risk</td>
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<td>Acres Low Risk</td>
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<td>CHANGED CONDITIONS</td>
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</tr>
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<td>Acres Low Risk</td>
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</table>

* ACRES 10,211
## CHAPTER 4

### TABLE 4.10
FOREST TYPE
(AVERAGE STAND CONDITION)

<table>
<thead>
<tr>
<th></th>
<th>CURRENT</th>
<th>ALTERNATIVE 1 &amp; 2</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
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<td>344</td>
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<tr>
<td>SP</td>
<td>67</td>
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<tr>
<td>AF</td>
<td>0</td>
<td>5,382</td>
<td>5,382</td>
<td>5,382</td>
</tr>
<tr>
<td>UNINFESTED ACRES</td>
<td>4,465</td>
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<td>3,422</td>
<td>3,147</td>
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<tr>
<td>SP</td>
<td>0</td>
<td>4,053</td>
<td>1,043</td>
<td>1,318</td>
</tr>
<tr>
<td>AF</td>
<td>0</td>
<td>4,053</td>
<td>1,043</td>
<td>1,318</td>
</tr>
<tr>
<td>TOTAL ACRES</td>
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<td>3,491</td>
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<tr>
<td>SF</td>
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<td>20</td>
<td>20</td>
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<tr>
<td>SP</td>
<td>0</td>
<td>9,435</td>
<td>6,425</td>
<td>6,700</td>
</tr>
</tbody>
</table>

SF = Spruce-Fir Forest Type  
SP = Engelmann Spruce Forest Type  
AF = Subalpine Fir Forest Type

### TABLE 4.11
STAND STRUCTURE
(AVERAGE STAND CONDITION)

<table>
<thead>
<tr>
<th></th>
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<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
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<tr>
<td>INFESTED ACRES</td>
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<td>1,651</td>
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<td>O</td>
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<td>384</td>
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<td>6,285</td>
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</tr>
</tbody>
</table>

O = Open Stand Condition - Non-Forested or Few Scattered Trees.  
MS = Multi-Storied Structure - Uneven-Aged Condition.
CHAPTER 4

4.10 RANGELAND VEGETATION AND NOXIOUS WEEDS

Introduction

Alternatives were analyzed to determine the effect that they would have on rangeland vegetation health and productivity and noxious weed spread, invasion, or establishment. Information used for the analysis was obtained from long-term records kept at the Ferron Work Center and information contained in the Manti-La Sal Noxious Weed Environmental Assessment (see EA for additional management requirements).

EFFECTS COMMON TO ALL ALTERNATIVES

Direct and Indirect Effects

Rangeland Vegetation: Vegetative trends, and production would improve in areas closed to livestock grazing both due to decreased grazing, lack of competition with forbs, and increased sunlight.

Noxious Weeds: Disturbance caused by the construction of roads, skid trails, landing and loading areas and associated harvest of trees will disturb soils which is conducive to the spread of noxious weeds. Possible establishment of isolated plants along roads, skid trails, landing and loading areas and throughout the sale area could result in established populations. Established populations of noxious weeds would be detrimental to the local environment, wildlife and local economies due to the loss of forage (AUM's), hunters afield, and the cost to treat the weeds. Alternatives 3 and 4 would increase the likely hood of noxious weed sites becoming established in log deck ing areas and operation pads.

Existing populations would continue to be treated in accordance with existing decisions and agreements. Should new populations of noxious weeds be introduced within sale areas the weeds would be treated.

Cumulative Effects

Noxious weeds are increasing generally throughout the forest and these alternatives could increase the speed and acres of this increase. Recreationists and livestock are also suspected to be introducing and spreading noxious weeds in the area. If mitigation measures work the cumulative effects will be nullified.

Possible Conflicts with Plans and Policies of Other Jurisdictions

Currently there are cooperating documents with Sanpete County for weed control. These documents indicate that noxious weeds will be treated both on public and private lands. If mitigation measures fail to control noxious weeds, possible conflicts with counties could arise, especially if a new weed species becomes established.

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Probable Environmental Effects that Cannot be Avoided

None.

Relationship between Short Term Use and Long Term Productivity

N/A

Irreversible and Irretrievable Commitments of Resources

No effects are anticipated to cause irreversible commitments of resources. If mitigation efforts fail, some irretrievable commitments may include loss of vegetation for livestock and wildlife if noxious weeds become established. Also some diversity in vegetative composition of the plant community could be lost.

Consistency with Forest Plan Standards

Yes.

4.11 THREATENED, ENDANGERED, and SENSITIVE PLANT SPECIES

Introduction

Astragalus monti (Heliotrope milkvetch) is the only Federally listed, threatened plant species on the forest. Known habitat and population centers do occur within the project area, however this plant and its critical habitat is located outside of the proposed timber cutting units and would not be impacted by any of the sale activities.

Erigeron carringtonae (ERCA), Silene petersonii (SIPE) and Senecio musiniensis (SEMUS) are sensitive plant species and all occur within the proposed sale area. ERCA and SEMUS populations and habitat areas are not found within any of the proposed timber cutting units. SIPE and SEMUS do not occur within any of the timber cutting units but may be impacted by the proposed gravel pit and barrow sites located at Camel Rock.

Alternatives were analyzed to determine the effect that they would have on these plant species. Information used for the analysis was obtained from long-term trend studies on the Astragalus monti and information contained in the Utah Threatened, Endangered, and Sensitive Field Guide.

EFFECTS COMMON TO ALL ALTERNATIVES

Direct and Indirect Effects

There may be an impact to SIPE and SEMUS due to the construction of the gravel pit and barrow site at Camel Rock. Possible elimination of current populations (approximately 50 plants) of SIPE due to disturbance of about 0.25 acres in and around the gravel pit and barrow sites. There are numerous populations of these species in the vicinity and it is unlikely that this will cause the species to become more scarce.
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Cumulative Effects

Appendix A.1 indicates the potential use of this already established aggregate source to support other reasonably foreseeable future activities. Therefore, the SIPE and SEMUS populations would have potentially been impacted in the future.

Possible Conflicts with Plans and Policies of Other Jurisdictions

None.

Probable Environmental Effects that Cannot be Avoided

Direct, indirect, and cumulative impacts can not be avoided unless the rock source is closed and carefully reclaimed.

Relationship between Short Term Use and Long Term Productivity

Negligible effect on SIPE and SEMUS overall populations on the southern end of the wasatch plateau. There are about 2,000 acres of known, occupied habitat currently on the Forest. The area potentially impacted would be less than 0.25 acres. Several populations of the plant occur in the close vicinity and will not be impacted.

Irreversible and Irretrievable Commitments of Resources

Potential irreversible loss of 0.25 acres of habitat and 50 plants. Although the total number of individual plants has not been inventoried, the impact to the overall population is expected to be minimal based on the fact that less than one percent of the habitat may be impacted.

Consistency with Forest Plan Standards

Is consistent with Forest Plan.

4.12 FUELS/FIRE

Introduction

The overall effect fuel accumulation would have on the potential for stand replacement, by fire, was analyzed by assessing the present down and dead fuel loading of each treatment unit within the project area. This analysis was accomplished by comparing actual stand appearance to the photoguide for Appraising Downed Woody Fuels in Montana Forests: Lodgepole Pine, and Engelmann Spruce-Subalpine Fir Cover Types, By William C. Fisher.

By using the criteria set forth in the photoguide, fire potential was assigned to each unit (a rating of Extreme being the greatest risk to fire loss to Low being the least risk to fire loss). The actual fuel loading may be higher or lower in some cases, the fire potential may vary from that of the photo due to differences in elevation, slope and aspect.

It was also assumed that by increasing dead and down fuel loads, the potential for stand replacement by fire would also increase, and that by decreasing dead and down fuel loads, or changing the arrangement of the fuels to meet the guidelines as set forth in the Forest Plan, would decrease the potential for stand replacement by fire.

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EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

Fire Susceptibility and Stand Structure: A multi-layered stand structure would be maintained over a greater number of acres in areas where green spruce trees were removed to reduce the bark beetle infestation. Where large pockets of spruce have been killed, a more 1-2 layered (younger) stand would result.

Spruce regeneration, whether by natural, or artificial methods, would be encouraged on a majority of the treated acres, this species is slightly more fire resistant than Subalpine fir, which in turn is slightly more fire resistant than aspen. Fir and aspen are still important in the species mix and would be maintained where they presently occur. Aspen, though the most susceptible to fire damage, typically sprouts back and recovers quickly after a fire.

Fuel Moisture: It is expected that fuel moisture levels, within the project area, would decline due to opening of the canopy through salvage operations. However, this should only be measurable in the areas with the heavier infestations of bark beetle. Temperature gradients and wind would increase the process of drying the fuels. Risk of potential wildfire starts and spread rates due to drier fuels would be increased in these more heavily infested areas.

Dead and Down Fuels: Dead and down fuels within the project area would increase with the implementation of all alternatives. However, with each of the action alternatives, natural and activity created fuels would be treated using the criteria as set forth in the Forest Plan, page III-43. Actions would include removal of harvestable dead trees, fuelwood sales in specified areas, fuel reduction activities such as pile and burn, prescribed jackpot burns, log and scatter, and/or fuel break construction around and/or through treated units. Thereby reducing the potential of a high intensity stand replacing fire.

Cumulative Effects

The high risk of large scale fire loss of the forested component within the South Manti project area would contribute to the increasing risk to loss of this component in other areas. A fire starting in the project area could easily carry over into adjacent areas, or vice-versa.

Reducing the buildup of activity created fuels by implementing slash disposal mitigations, and breaking up the continuous fuels within the designated treatment acres would reduce the overall wildfire risk for spread from or into the project area. This would contribute to a reduction in the risk of losing acres of spruce-fir type from wildfire, in and around the project area.

Past timber sales within, and around the project area have all required slash treatment. Though actual surveys have not been taken to document fuel loads on these sales, it is estimated that a majority of acres within all sales have fuel conditions that meet the suppression guidelines in the Forest Plan.

Current and future timber management activities in the South Manti project area, have similar slash disposal requirements and fuel continuity breakup as required under all action alternatives. By implementing these mitigation measures, wildfire risk levels would be maintained within desired management guidelines within these project areas. (Appendix A.1, Table B).

It is also expected that current grazing practices will continue into the future. These practices will continue to reduce the fine flashy grasses and forbes, which as stated in chapter three, contribute
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natural fuel breaks. Down material is mainly greater than 3 inches in diameter. Schmid and Frye (1977) reported average fall rates in areas similar to this project to be between 0.7 and 1.5 percent per year with about 84 percent of the trees still standing after about 25 years. It is expected as bark beetle-killed trees fall or blow down, large and fine fuels would rapidly accumulate. The average fuel loading of about 30 tons per acre found presently on the ground could increase to 70+ tons per acre. The lack of fuel breaks, or other treatment methods to reduce the continuity of fuels would result in a high risk of large scale fire loss to National Forest and private lands.

Cumulative Effects

Over time, implementation of Alternative 1 would result in the greatest risk, compared to the action alternatives, of stand replacement fire. This would result primarily from continued fuels buildup as trees (killed by bark beetle) subsequently fall or are blown down. Without fuels treatment, the probability of a stand replacement fire will be very high.

Short Term Use and Long term Productivity

Although the short term fire risk to the project area may not differ greatly from the action alternatives, the opportunity for fuels reduction work will rely on diminishing National Funds, which could mean that the project area, in the long term, faces the greatest chance that it would be lost to a major fire.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible and irretreivable commitments of resources.

Consistency with NFMA/Forest Plan Standards

Implementation of Alternative 1 is not consistent with the guidelines set forth in the Forest Plan. As stated previously, there are acres within the project area that already exceed the capabilities of the Forests protection forces.

ALTERNATIVE 2

Direct and Indirect Effects

Fire Susceptibility and Stand Structure: By salvaging the already dead component on slopes less than 40 percent, approximately 5,640 acres of openings will be created within the project area. Dead and Down Fuel Loads: The acres in the project area that are on slopes greater than 40 percent will continue to have similar effects to Alternative 1. The increase in fuel loading coupled with the risk of fire from the treated units carrying into the untreated units will continue.

Cumulative Effects

There will continue to be a risk of unmanageable fire loss within and around the project area (Slopes over 40 percent will be at the greatest risk).

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to keeping ground fire spread from and into the project area at a low potential. These grazing allotments will also contribute to any suppression effort within the project area, by allowing the suppression resources to build and maintain a quick fire break.

Short Term Use and Long Term Productivity

In the short term (1-3 years) an increase in dead and down fuels, mixed with the fuel moisture characteristics mentioned previously, will contribute to an increase in fire risk, and rate of spread potential. However, reducing the buildup of activity created fuels, by implementing slash disposal requirements described previously, and breaking up continuous fuels within designated treatment areas would reduce the overall wildfire risk to manageable levels. This practice would contribute to the long term (>25 years) reduction in risk of stand replacement due to wildfire.

Irreversible and Irretrievable Commitments of Resources

As the project relates to fuels, there would be no irreversible and irretreivable commitments of resources.

Consistency with NFMA/Forest Plan Standards

All action alternatives contribute to meeting the direction set forth in the Forest Land and Resource Management Plan Standards and Guidelines page III-43.

ALTERNATIVE 1

Direct and Indirect Effects

Fire Susceptibility and Stand Structure: The potential for large scale fire loss to National Forest and adjacent private lands would continue to increase over time. This would result directly from continued increases in down fuel loading as trees, killed by Spruce beetle, fall or blow down. As mentioned in chapter three, spruce-fir, and aspen have very low tolerance to fire damage; even a light-to-moderate fire would result in measurable mortality losses, and high levels of damage to the residual stand.

Younger trees of these species are more susceptible than the older trees. Areas being regenerated following a Spruce beetle epidemic would be set back 20 or more years if fire burned the area (a large percentage of the regeneration and many of the remaining seed trees would be killed).

Stand structure within the project area varies from 1-2 storied stand to multi-layered stands. Typically 1-2 canopy layers exist within the spruce stands that have been heavily infested by bark beetles. In the multi-layered stands, the understory is primarily Subalpine fir which tends to have low, densely packed crowns (very susceptible to crown fire). In these multi-layered stands, even low intensity ground fires would climb into the crowns of Subalpine fir, providing a fuel ladder for the fire to move into the middle and upper canopy layers. A crown fire in the project area, would likely be a stand replacement fire within multi-layered stands, and would heavily damage 1-2 layered stands.

Fuel Moisture: It is anticipated that the amount of time required to open the stand to the drying effects mentioned previously, will be longer in duration than the action alternatives.

Dead and Down Fuel Loads: Dead and down fuel loads within the project area, in some cases, already exceed the levels necessary to maintain fireline intensities at or below a rate which would allow direct suppression efforts to be successful. Fuels are continuous in many areas, without human made or
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Short Term Use and Long Term Productivity

Untreated acres on slopes over 40 percent will have similar effects to Alternative 1.

Consistency with NFMA/Forest Plan Standards

Consistent with Forest Plan on ground-based treatment acres but does not reduce fuel conditions on slopes greater than 40 percent.

ALTERNATIVE 3 AND ALTERNATIVE 4

Direct and Indirect Effects

The only measurable differences between the Proposed Action and Alternative 3 and 4 are: 1. With the addition of helicopter logging, acres over 40 percent slope will also be treated. 2. The addition of a sanitation cut along with the salvage. The only measurable difference between Alternative 3 and 4 is the exclusion of the roadless areas from treatment in Alternative 4.

Harvest acres would include a combination of ground-based and helicopter yarding systems on 10,212 acres in Alternative 3 and with the exclusion of the roadless areas, 7,015 acres in Alternative 4.

Fuel Moisture: Canopy reductions would be greatest under Alternative 3 and Alternative 4 due to the greater number of acres treated by both sanitation and salvage treatments. In the short term risk of potential wild fire starts and spread rates due to the dryer fuels would therefore be slightly higher than the Proposed Action; however, in the long term, the chance of a high intensity stand replacement fire would be lessened due to the removal of heavy and fine fuels over the entire project area.

Consistency with NFMA/Forest Plan Standards

Implementation of Alternative 3 more fully addresses the direction set forth in the Forest Plan Standards and Guidelines page III-43, as it relates to the entire project area.

4.13 WILDLIFE HABITAT

Introduction

Timber harvest activities impact wildlife species both adversely and favorably by altering their habitat. Impacts to habitat usually comes from two main areas. These are impacts to protective cover and impacts to sources of food. Protective cover can be in the form of vegetative cover or geographic features and food sources can be vegetation or other species of wildlife. The importance of these will vary from species to species. As a result, one of the best ways to evaluate impacts to wildlife is to analyze impacts to vegetation.

The overall effect to wildlife habitat was analyzed by assessing the impacts to the Management Indicator Species that are identified in the Forest Land and Resource Management Plan. These species represent a variety of habitat types; and impacts to them can be extrapolated to other species. Additionally, the impacts to Endangered, Threatened, and Sensitive species will be discussed in the following section.
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Consistency with NFMA/Forest Plan Standards

All of the alternatives would be consistent with NFMA and the Forest Land and Resource Management Plan.

ALTERNATIVE 1

Direct and Indirect Effects

Existing road density for the project area across 24,624 acres are 2.3 miles per square mile. Using the road density/habitat-use relationships discussed previously, currently about 57 percent of the available habitat (across 24,624 acres) is not used by elk for forage or cover. Beetle induced spruce mortality has increased visibility and reduced cover security by about one third compared to pre-infestation vegetative conditions. Loss of security due to spruce mortality combined with existing hunter access to the area would increase elk vulnerability and possibly lead to increased hunter success. Increases in mortality from natural predators are not anticipated.

The existing situation of cover being reduced and forage increased because of the insect killed trees would remain until natural reforestation takes place. Adverse, indirect effects could occur if the stands of conifers took longer to regenerate naturally, than they would after commercial harvest and reforestation efforts.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

Cumulative Effects

None.

Possible Conflicts with Plans and Policies of Other Jurisdictions

There would be no conflicts with the plans and policies of other jurisdictions under this alternative.

Probable Environmental Effects That Cannot Be Avoided

Because this alternative literally means that 'No Action' would be taken, there would be no environmental effects that cannot be avoided.

Relationship Between Short Term Use and Long Term Productivity

This does not apply to the No Action alternative.

Irreversible and Irretrievable Commitments of Resources

This does not apply to the No Action alternative.

Consistency with NFMA/Forest Plan Standards

The No Action alternative is consistent with NFMA and Forest Plan Standards when dealing with wildlife habitat.
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ALTERNATIVE 2

Direct and Indirect Effects

This alternative would adversely impact elk and Mule deer habitat directly in the short term by displacing them from 5,792 acres by the disturbance of logging activities. Such displacement would not all take place at the same time, rather it would occur as the logging activities occur. The impact of this displacement is increased vulnerability rather than limiting available forage. A long term, indirect effect would be decreased vulnerability to hunting caused by reduced access. The average road density would decrease from 2.3 to 2.0 miles of road per square mile. Using the road density/habitat use relationships discussed previously, approximately 50 percent of the available habitat across 24,624 acres would not be used by elk for security cover or foraging. Timber harvest would dramatically increase visibility and reduce cover security by about two thirds compared to pre-infestation vegetative conditions. Loss of security cover due to timber harvest and spruce mortality would increase elk vulnerability and possibly lead to increased hunter success. Increases in mortality from natural predators are not anticipated.

See the section above on Effects Common To All Action Alternatives for a discussion on the effects to Blue Grouse and their habitat.

This alternative would have very little or no effect on Golden Eagles.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects

This alternative would have the greatest adverse impact on elk and Mule deer habitat. The main difference between this alternative and the other action alternatives is the large acreage of habitat that will be disturbed and the associated displacement of animals. These effects would be direct in the short term (generally while actual logging is taking place), by displacing animals from 10,212 acres as a result of logging activities. Such displacement would not all take place at the same time, rather it would occur as the logging activities occur. The impact of this displacement is increased vulnerability rather than limiting available forage. Similar to Alternative Two, a long term, indirect effect would be decreased vulnerability to hunting caused by reduced access.

Alternative 3 road densities for the project area across 24,624 acres would be 2.0 miles per square mile. Using the road density/habitat-use relationships discussed previously, about 53 percent of the available habitat (across 24,624 acres) would not be used by elk for security cover or foraging. Timber harvest would dramatically increase visibility and reduce cover security by about two thirds compared to pre-infestation vegetative conditions. Loss of security cover due to timber harvest and spruce mortality would increase elk vulnerability and possibly lead to increased hunter success. Increases in mortality from natural predators are not anticipated.

See the section above on Effects Common To All Action Alternatives for a discussion on the effects to Blue Grouse and their habitat.

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ALTERNATIVE 4

Direct and Indirect Effects

This alternative would adversely impact elk and Mule deer habitat directly in the short term by displacing them from 7,015 acres by the disturbance of logging activities (generally while actual logging is taking place). Such displacement would not all take place at the same time, rather it would occur as the logging activities occur. The impact of this displacement is increased vulnerability rather than limiting available forage. A long term, indirect effect would be decreased vulnerability to hunting caused by reduced access. Of all alternatives, Alternative 4 has the lowest average road density overall. Therefore, the impacts would be the lowest for this alternative.

Alternative 4 road densities for the project area across 24,624 acres would be 1.9 miles per square mile. Using the road density/habitat-use relationships discussed previously, about 51 percent of the available habitat (across 24,624 acres) would not be used by elk for security cover or foraging. Timber harvest would dramatically increase visibility and reduce cover security by about two thirds compared to pre-infestation vegetative conditions. Loss of security cover due to timber harvest and spruce mortality would increase elk vulnerability and possibly lead to increased hunter success. Increases in mortality from natural predators are not anticipated.

See the section above on Effects Common To All Action Alternatives for a discussion on the effects to Blue Grouse and their habitat.

This alternative would have very little or no effect on Golden Eagles.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

4.14 THREATENED, ENDANGERED, AND SENSITIVE WILDLIFE SPECIES

Introduction

Timber harvest activities impact wildlife species, both adversely and favorably, by impacting their habitat. Impacts to habitat usually comes from two main types. These are impacts to protective cover and impacts to sources of food. Protective cover can be in the form of vegetative cover or geographic features and food sources can be vegetative or other species of wildlife. The importance of these impacts will vary from species to species. As a result one of the best ways to evaluate impacts to wildlife is to analyze impacts to vegetation.

There are no Threatened species that have habitat in the analysis area. Bald Eagles are the only Endangered species known to occur in the area. The analysis area contains habitat for the following Sensitive species: Spotted Owl, Townsend’s Big-eared Bat, Flammulated Owl, Northern Goshawk, and Three-toed Woodpecker. These are the species that will be discussed in this section. For these species possible adverse impacts are mitigated to a high degree. However, even with mitigations the potential for adverse impacts still exists only to a lesser degree.
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EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

None of the action alternatives should have a noticeable adverse effect on Bald Eagles. The foraging activities of the Bald Eagles nesting near Castle Dale do not occur on the Forest (UDWR, 1995) let alone in the analysis area. Therefore, the only possible impact would be a disturbance factor to migrating Bald Eagles foraging in the late fall and early winter. For Alternatives Three and Four, where helicopters would be used, there is an increased potential for disturbance above that of Alternative Two. However, because only limited harvest activities would be allowed adjacent to the lakes and reservoirs, and leave trees would be designated, such disturbance would be limited.

Very little or no impacts should occur to the two sensitive species of bats for any of the action alternatives. Spotted and Townsend’s Big-eared Bats forage mostly along forest edges and over water. Mainly because bats forage at night and not in stands of timber, timber harvest activities should not impact bat foraging. Both of these species are known to use limestone cliffs for roosting. Timber harvesting activities that impact limestone cliffs, such as quarry sites for road gravel, could impact these species. The only quarry site adjacent to cliffs is the Camel Rock quarry. This site is the same for each alternative so there would be similar impacts for all action alternatives. One of the mitigation measures common to all action alternatives calls for inventorying limestone cliffs for bats where impacts could occur. By avoiding any sites where bats are found any impacts should be negligible.

It is unlikely that timber harvest activities would jeopardize the Flammulated Owl population that may be found in the area. They prefer foraging in areas with open canopies and have been known to avoid cut-over areas. Therefore, the more acres cut the greater the potential for adverse impacts (the more foraging area impacted), Impacts to Flammulated Owl nesting habitat could occur in spruce stands containing Douglas-fir located along ridge-tops and upper slopes. The only stand of Douglas-fir is located near Julius Flat Reservoir in the southern portion of the analysis area. None of the alternatives allow the harvest of Douglas-fir however, harvesting large diameter snags of any species in these areas could impact nesting habitat. One of the mitigation measures common to all action alternatives calls for managing for the retention of all large snags containing cavities and retain small pockets of dense vegetation along ridge tops. This mitigation would reduce any possible adverse impacts to Flammulated Owl nesting habitat.

As a result of the mitigation measures it is unlikely that timber harvesting activities would jeopardize the Goshawk population in the analysis area. All action alternatives call for harvesting timber in suitable Goshawk habitat. However, in areas where nesting is known to occur there is a mitigation common to all action alternatives that calls for providing for the protection and management of at least six 30-acre foraging areas. Because Goshawks may nest in new areas on any given year, an additional mitigation calls for surveys for new nesting territories in areas of suitable habitat the year prior to each sale. These mitigations should greatly reduce the impacts to nesting goshawks (Reynolds, 1993). A second impact to goshawks resulting from timber harvesting is the indirect impact to prey species. Timber harvesting would increase populations of some prey species (especially small mammals) and decrease populations of others (such as woodpeckers). Therefore, it is likely that impacts to prey species would not make much difference in the overall availability of prey.

Because Three-toed Woodpeckers forage mainly on dead trees, all action alternatives would impact their amount of available forage. This would result in a reduction of the Three-toed Woodpecker population. These reductions would be slightly offset by the mitigation common to all action alternatives that calls for retaining 90 snags for every 100 acres harvest.

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Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fire fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could have serious adverse effects to threatened, endangered and sensitive wildlife species. Some of the effects would include: Bald Eagle foraging area as mentioned in the section previous, adverse effects to Flammulated Owl habitat, as well as Goshawk, and especially Three-toed Woodpecker habitat (dead snags are required for forage).

Cumulative Effects

There are no known effects of a cumulative nature within the project area that would have a noticeable effect on populations of listed or sensitive species.

Possible Conflicts with Plans and Policies of Other Jurisdictions

There are no conflicts with the plans and policies of other jurisdictions concerning impacts to Endangered, Threatened, or Sensitive animal species.

Probable Environmental Effects That Cannot Be Avoided

While there may be negligible effects to populations of the species of concern that can not be avoided with the action alternative, the main effect would be upon populations of Three-toed Woodpeckers as discussed above.

Relationship Between Short Term Use and Long Term Productivity

All of the effects discussed above would be short term effects. In the long term these effects would be negligible.

Irreversible and Irretrievable Commitments of Resources

There would be no irrevocable commitment of resources of concern to Endangered, Threatened, or Sensitive Species. An irreversible commitment of resource would be the annual production of each species (primarily Three-toed Woodpeckers) that would be lost due to the direct and indirect effects as discussed above.

Consistency with NFMA/Forest Plan Standards

All alternatives are consistent with NFMA and Forest Plan Standards.

ALTERNATIVE 1

Direct and Indirect Effects

The No Action alternative would cause no changes in the population trends of Endangered, Threatened, or Sensitive species. The Three-toed Woodpeckers population would continue to grow as the beetle outbreak expanded. However, within two or three years after the outbreak subsides, the populations would decline because of the lack of food.

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Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

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Cumulative Effects
This does not apply to the No Action alternative.

Possible Conflicts with Plans and Policies of Other Jurisdictions
None for this alternative.

Probable Environmental Effects That Cannot Be Avoided
None for this alternative.

Relationship Between Short Term Use and Long Term Productivity
This does not apply to the No Action alternative.

Irreversible and Irretrievable Commitments of Resources
None for this alternative.

Consistency with NFMA/Forest Plan Standards
Yes, this alternative is consistent with NFMA/Forest Plan Standards.

ALTERNATIVE 2

Direct and Indirect Effects
The direct and indirect effects to Bald Eagles and sensitive bat species are discussed in the Effects Common to All Action Alternatives (above).

Because ground-based logging is not allowed on ridge tops or steeper slopes, this alternative should have no or very limited effects on Flammulated Owls.

Of the action alternatives this alternative has the potential for an intermediate adverse impact upon Goshawks. This is because this alternative would allow harvest activities on 1,124 acres of suitable Goshawk habitat.

Of all the action alternatives this alternative would allow timber harvest activities on the least amount of acres (5,792) and the least amount of timber would be removed. Therefore, it would have the least impact upon populations of Three-toed Woodpeckers.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects
The direct and indirect effects to Bald Eagles and sensitive bat species are discussed in the Effects Common to All Action Alternatives (above).

Because this alternative would allow logging on 4,587 acres of ridge tops and steep slopes, and the highest acreage would be harvested, it would have the greatest adverse impact upon Flammulated Owls of all the action alternatives.

Of the action alternatives this alternative has the potential for the greatest impact upon Goshawks. This is because this alternative would allow harvest activities on 1,504 acres of suitable Goshawk habitat.

Of all the action alternatives this alternative would allow timber harvest activities on the highest amount of acres (10,379). Therefore, it would have the greatest impact upon populations of Three-toed Woodpeckers.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

ALTERNATIVE 4

Direct and Indirect Effects
The direct and indirect effects to Bald Eagles and sensitive bat species are discussed in the Effects Common to All Action Alternatives (above).

Because this alternative would allow logging on 1,386 acres of ridge tops and steep slopes, it would have an intermediate adverse impact upon Flammulated Owls when compared to the other action alternatives.

Of the action alternatives this alternative has the potential for the least impact upon Goshawks. This is because this alternative would allow harvest activities on only 816 acres of suitable Goshawk habitat.

Of all the action alternatives this alternative would allow timber harvest activities on an intermediate number of acres (7,178). Therefore, it would have an intermediate impact upon populations of Three-toed Woodpeckers.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

4.15 TRANSPORTATION

Introduction
National Forest users of all types require roads to access the resources. Transportation planning efforts consider the type and quantity of vehicles which need a road, how often, and for what duration.
In conjunction with the Forest Plan and other management decisions, a system plan is developed to accommodate users in travel need and safety. Road management is a combination of construction, maintenance, restrictions, and closures, depending upon resource needs. Roads are closed and reclaimed when they no longer serve the purposes for which they were developed.

A transportation analysis was performed on the South Manti project area. Rangers and specialists met to look at resources, traveler needs, and existing system and non-system roads. Some roads were noted to be causing resource damage, others were noted as causing a higher density than needed (i.e. where three roads access the same area, one road could access the area adequately). The rangers decided that many of the non-system roads were not needed and should be reclaimed as funding becomes available. Roads that could be used for harvest and removal of timber would be improved as necessary. Some areas needed new roads constructed to facilitate the removal of timber. The new roads are for short and long-term timber access.

The desire to harvest trees from the project area and the location of the sale units were the initiating drive for road reconstruction and location. Aerial photography, topographic maps, and field reconnaissance were used for preliminary analysis. Where photo analysis or field reconnaissance reported a road (as little as two wheel tracks), this alignment was mapped as possible access to timber.

A geographic information system program was used to analyze the effects of constructing and reconstructing roads in the project area. Resource concerns like wetlands, riparian areas, and slump areas influenced road location primarily by avoidance. The design standard of eight percent maximum grade influenced road location greatly. Areas of retention or partial retention VQO did not influence off road location.

**EFFECTS COMMON TO ALL ACTION ALTERNATIVES**

**Direct and Indirect Effects**

**Transportation System:** There will be roads constructed and reconstructed to access timber; land needed for construction will be taken out of production. A portion of constructed and reconstructed roads will be reclaimed and put back to resource production. Unwanted additions to local roads may continue. Some roads will be improved by placing aggregate surfacing. Aggregate could be acquired off the forest, however there are three existing aggregate sources in the project area that could be reopened and developed, and potential sites exist which could also be developed. If existing aggregate sites are used, NEPA analyses will be reviewed and updated as needed. If new aggregate sources are developed, NEPA analyses will be conducted on those sites.

**Visitor Safety:** Forest visitors will encounter more vehicles on roads in the project area and on the Ferron-Mayfield road. With higher traffic volumes, there is an increased probability of accidents. Warning signs will be placed to caution travelers of logging traffic and activities; traffic control (flaggers) will be used as necessary for safe operations. The alternatives have sale durations ranging from 6 to 9 years. Table 4.13 shows by alternative and by year the predicted traffic and expected travel delay on the Ferron-Mayfield road, #50022.

Increased vehicles on system roads will displace and temporarily suspend dust particles affecting forest visitors and drivers associated with harvest activities. This could be a problem for visibility and vehicle control on washboarding, however, dust abatement applications will keep dust down, and act as a particle binder to reduce washboarding.

**Access:** Timber purchasers will have an adequate transportation system to facilitate log removal from the forest. Over time, forest users will see a decrease in roads from current condition in part due to the reclamation of some roads used for timber activities and, to a greater extent, the reclamation of roads not needed for future resource management. Some roads will remain open to administrative use only and maintained at maintenance level 1 (Table 4.12).

Description of maintenance level 1: Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate." (FSH 7709.58,10 p.4)

Some reconstructed roads will give travelers improved access through aggregate placement, road widening, improved sight distance, and improved turns. Improved access could likely increase the number of visitors to the forest. Two trails are impacted by action alternatives due to reconstruction from trail widths to road widths, but will be returned to trail widths.

**Travel Delay:** During log hauling operations, travelers will have at least four minutes added on to their travel time for every hour they drive on system roads in the project area. This is due to needing to pull into turnouts to allow vehicles to pass on single lane roads and to follow loaded, slow moving trucks. During construction or reconstruction of roads, delay may be two hours on average, but only for the duration of the construction. Construction delays can be expected on system roads #50022, #50044, and #500150.

**Cumulative Effects**

- **Transportation System:** There are no additional effects to the system in terms of constructing new roads.
- **Visitor Safety:** Accident potential is slightly increased by the addition of traffic from other projects or proposed projects. The high estimate is 25 vehicles per day from the combination of the Twoewmile Timber Sale, two exploration wells for oil and gas, and possibly two quarries opened for other projects. Otherwise, the effects are the same as in "Direct and Indirect Effects" due to mitigation.

**Access:** There is potential for some road construction to occur over the next ten years due to oil and gas exploration and quarry development. These areas have not been identified, but if developed in or near the project area, they would add to the road density.

**Travel Delay:** There is no significant increase due to other projects (eight seconds increase). The impact to big game hunters will be minimized because of mitigation to halt timber haul operations during the first five days of the deer and elk hunts.

**Probable Environmental Effects that Cannot be Avoided**

- **Transportation System:** The effects of construction and reconstruction of roads to erosion, wildlife, visual, roadless character, and the number of people using an area are discussed in their respective sections in this chapter.
CHAPTER 4

Visitor Safety: The effects are the same as in "Direct and Indirect Effects" above.

Relationship Between Short Term Use and Long Term Productivity

Short term: for these evaluation criteria is up to ten years, long term is beyond ten years. There is no distinction for safety however, because safety is a priority that does not change with time.

Transportation System: In the short term, traffic flow will be interrupted by limited passing facilities, slowed by the road condition and volume of traffic, or temporarily halted for construction activities. This holds true for the long term as well, however the effects are reduced due to a reduction in vehicles traveling the roads.

Travel Delay: See "Direct and Indirect Effects" above.

Irreversible and Irretrievable Commitments of Resources

Transportation System: The amount needed for road construction and aggregate sources takes that land out of production and is an irreversible commitment. Removal of the rock is an irreversible commitment.

Travel Delay: The time spent by travelers because of delay or extended travel time is irretrievable.

Consistency with NFMA/Forest Plan Standards

Anticipated effects are consistent with NFMA and forest plan standards.

ALTERNATIVE 1

Direct and Indirect Effects

Transportation System: There is no effect because there is no road construction. Existing roads will continue to receive maintenance and improvements. Existing road density in the area is 2.3 miles per square mile. Unwanted additions to some roads will continue.

Visitor Safety: Forest visitors will encounter 50 to 170 vehicles per day (maximum); every encounter has the potential to be an accident. Dispersed recreation, rural recreation, hunting recreation, fuelwood activities, range activities, and timber activities continue to contribute to seasonal traffic volumes in and around the project area.

Access: Approximately 87 miles of road remain with some unwanted additions to some roads.

ALTERNATIVE 2

Direct and Indirect Effects

Transportation: There will be 22.9 miles of road constructed and 24.0 miles of road reconstructed (0.47 miles of trail #22). 56 acres of land will be needed for construction. New and reconstructed roads will facilitate the removal of logs to mills. 34 miles of project relate: and non-project related roads will be reclaimed. Road density decreases from 2.3 to 2.0 miles of road per square mile.

CHAPTER 4

Visitor Safety: Higher traffic volumes increase the probability of accidents. Forest visitors will encounter 66 to 191 additional vehicles per day on the Ferron-Mayfield road. Quantities vary by year and which sales are active, (Table 4.13, Traffic on Forest Arterial #50022).

Access: Over time, forest users will see an 11 mile decrease in roads from current condition in part due to the reclamation of some roads used for timber activities (about 2 miles) and, to a greater extent, the reclamation of roads not needed for future resource management (about 19 miles), (Table 4.12).

Approximately 76 miles of road remain with some unwanted additions to some roads.

Travel Delay: During log hauling operations, travelers will have between 4 and 12 minutes added to their travel time for every hour they drive on system roads, (Table 4.13, Traffic on Forest Arterial #50022).

Relationship Between Short Term Use and Long Term Productivity

Transportation System: The effects to the transportation system would be short term initially (six years), but could turn into long term if additional salvage harvest is needed. This means that visitor safety and travel delay are affected. The long term effect is a decreased density from 2.3 to 2.0 miles per square mile.

Visitor Safety: Visitors will need to pass between 12 and 31 vehicles every hour of travel for the six years of the operation; every encounter is a chance for an accident.

Travel Delay: Due to the increased number of vehicles, time spent to use turnouts while vehicles pass ranges from 4 to 12 minutes. This is an increase of 7 to 20 percent in travelling to the Twelvemile Campground.

Irreversible and Irretrievable Commitments of Resources

22.9 miles of newly constructed roads would irretrievably remove 55.3 acres from production.

ALTERNATIVE 3

Direct and Indirect Effects

Transportation: There will be 22.9 miles of road constructed and 28.7 miles or road reconstructed (47 miles of trail #22). 55.3 acres of land will be needed for construction of roads, which is the same as in Alternative 2. New and reconstructed roads will facilitate the removal of logs to mills. 34 miles of project related and non-project related roads will be reclaimed. Road density decreases from 2.3 to 2.0 miles of road per square mile.

Visitor Safety: Higher traffic volumes increase the probability of accidents. Forest visitors will encounter 61 to 192 additional vehicles per day; quantities vary by year and which sales are active, (Table 4.13, Traffic on Forest Arterial #50022).

Access: Over time, forest users will see an 11 mile decrease in roads from current condition in part due to the reclamation of some roads used for timber activities (about 2 miles) and, to a greater extent, the reclamation of roads not needed for future resource management (about 19 miles), (Table 4.12).

Approximately 76 miles of road remain with some unwanted additions to some roads.
CHAPTER 4

Travel Delay: During log hauling operations, travelers will have between 5 and 12 minutes added to there travel time for every hour they drive on system roads, (Table 4.13, Traffic on Forest Arterial #50022).

Relationship Between Short Term Use and Long Term Productivity

Transportation System: The effects to the transportation system would be short term initially (nine years), but could turn into long term if additional salvage harvest is needed. Alternative 3 is three years longer in duration than Alternative 2. Visitor safety and travel delay are effected. The long term effect is a decreased density from 2.3 to 2.0 miles per square mile.

Visitor Safety: Visitors will need to pass between 13 and 37 vehicles every hour of travel for the nine years of the operation; every encounter is a chance for an accident.

Travel Delay: Due to the increased number of vehicles, time spent to use turnouts while vehicles pass ranges from 5 to 12 minutes. This is an increase of 8 to 20 percent in traveling to the Twelvemile Campground.

Irreversible and Irretrievable Commitments of Resources

22.9 miles of newly constructed roads would irretrievably remove 55.3 acres from production. This is the same as in Alternative 2.

ALTERNATIVE 4

Direct and Indirect Effects

Transportation: There will be 17.3 miles of road constructed and 27.0 miles of road reconstructed (0.6 miles of trail #003). 41.6 acres of land will be needed for construction of roads which is 13.7 acres less than Alternatives 2 and 3. New and reconstructed roads will facilitate the removal of logs to mills, 32 miles of project related and non-project related roads will be reclaimed. Road density decreases from 2.3 to 1.9 miles of road per square mile, which is 0.1 miles per square mile less than in Alternatives 2 and 3.

Visitor Safety: Higher traffic volumes increase the probability of accidents. Forest visitors will encounter 90 to 162 additional vehicles per day; quantities vary by year and which sales are active, (Table 4.13, Traffic on Forest Arterial #50022).

Access: Over time, forest users will see a 14 mile decrease in roads from current condition in part due to the reclamation of some roads used for timber activities (about 2 miles) and, to a greater extent, the reclamation of roads not needed for future resource management, (about 19 miles), (Table 4.12). Approximately 72 miles of road remain with some unwanted additions to some roads.

Travel Delay: During log hauling operations, travelers will have between 6 and 11 minutes added to there travel time for every hour they drive on system roads, (Table 4.13, Traffic on Forest Arterial #50022).

Relationship Between Short Term Use and Long Term Productivity

Transportation System: The effects to the transportation system would be short term initially (six years), but could turn into long term if additional salvage harvest is needed. Alternative 4 is three years shorter in duration than Alternative 3 and equal to Alternative 2. Visitor safety and travel delay are effected. The long term effect is an decreased density from 2.0 to 1.9 miles per square mile.

Visitor Safety: Visitors will need to pass between 13 and 33 vehicles every hour of travel for the six years of the operation; every encounter is a chance for an accident.

Travel Delay: Due to the increased number of vehicles, time spent to use turnouts while vehicles pass ranges from 6 to 11 minutes. This is an increase of 10 to 18 percent in traveling to the Twelvemile Campground.

Irreversible and Irretrievable Commitments of Resources

17.3 miles of newly constructed roads would irretrievably remove 41.6 acres from production. This is a decrease of 13.7 acres from Alternatives 2 and 3.

<table>
<thead>
<tr>
<th>TABLE 4.12 FOREST ACCESS</th>
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<tbody>
<tr>
<td><strong>Existing Roads:</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Long term</td>
</tr>
<tr>
<td>System Road</td>
</tr>
<tr>
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<td>System Road</td>
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<tr>
<td>Access</td>
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<tr>
<td>Short term</td>
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<td>Roads constructed</td>
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<td>Roads reclaimed</td>
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<tr>
<td>Additional Non-system roads</td>
</tr>
<tr>
<td>reclaimed</td>
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<tr>
<td>Existing roads after</td>
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<tr>
<td>alternative completion</td>
</tr>
</tbody>
</table>

* accounted for in the 86.7 miles
### CHAPTER 4

**TABLE 4.13**
**TRAFFIC ON FOREST ARTERIAL 50022**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>VPD</th>
<th>CVPD RANGE</th>
<th>CVPHR</th>
<th>DELAY (Min)</th>
<th>YEAR</th>
<th>VPD</th>
<th>CVPD RANGE</th>
<th>CVPHR</th>
<th>DELAY (Min)</th>
<th>YEAR</th>
<th>VPD</th>
<th>CVPD RANGE</th>
<th>CVPHR</th>
<th>DELAY (Min)</th>
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<td></td>
<td></td>
<td>2002</td>
<td>178</td>
<td>228-348</td>
<td>23-35</td>
<td>10.9</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2003</td>
<td>122</td>
<td>172-292</td>
<td>18-30</td>
<td>7.5</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>2004</td>
<td>61</td>
<td>111-231</td>
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<td>3.7</td>
<td></td>
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</tr>
</tbody>
</table>

VPD = Vehicles Per Day
CVPD = Cumulative Vehicles Per Day
(Existing Traffic ~ 50 VPD near Twelvemile Campground Maximum)
(Existing Traffic ~ 170 VPD near Mayfield Maximum)
CVPHR = Cumulative Vehicle Per Hour
CHAPTER 4

4.16 RANGE ALLOTMENTS

Introduction

Alternatives were analyzed to determine the effect that they would have on allotments and improvements. Information used for the analysis was obtained from allotment management records.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

Range Allotments: Reductions and altered management to some allotments could occur due to the loss of suitable range. Suitable range is defined as range accessible to livestock which can be grazed on a sustained yield basis without damage to the resource. There is the need to keep livestock out of the reforestation plantations long enough for the seedling conifer to grow to a height of 4 feet because seedling conifers are susceptible to damage from livestock. In some situations, livestock removal for 15-20 years may occur. Possible means of accomplishing this is through fencing, herding, scheduling, and altered management, or any combination. The effects will be similar with all alternatives but will vary according to the percent of the allotment impacted. Table 4.14 displays the percent decrease in suitable rangelands by allotment and by alternative.

Although some acres may be closed to grazing, the impacts to the allotment may not directly correlate with the percent suitable range impacted. An example of this may be an area that has 10 percent of the suitable range impacted but only 2 percent of the animal unit months (AUM) come from that area due to the fact that some timber areas produce less forage per acre (AUM is the amount of feed necessary to support one animal for one month). Some pastures in the cattle and sheep allotments may have to be closed because controlling sheep at night and the additional expense of fencing and maintenance may not be practicable. Some roads may be closed to livestock grazing for two to three years to provide for revegetation.

The impact to individual permittees may be significant economically when they are required to alter management. Additional costs could make some marginal operations economically unfeasible under current market prices. Some permittees have two or more allotments impacted by the timber sale. Having two allotments may complicate management.

Range Improvements: Short term impacts to range improvements would occur, however any damage to improvements would be repaired or replaced by the timber sale operator. Impacts could include tearing down and removal of fences and damage to cattle guards by heavy equipment.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could affect range conditions. The degree of effect will depend on the time of year, the size and duration of the fire.

Cumulative Effects

Economic revenue generated through grazing may decrease when required reductions are added to other reductions taking place throughout the forest. Some permittees have recently been required to reduce their permitted numbers to bring their allotments in line with carrying capacity. Additional reductions or increased herding costs could make marginal operations economically unfeasible.

Possible Conflicts with Plans and Policies of Other Jurisdictions

Range Allotments: There may be conflicts with local county land plans if community leaders are not kept informed and advised of needed reductions in livestock numbers and those impacts to the local tax payers and economy.

Range Improvements: Maintenance of existing fences falls to the permittees or livestock associations according to the allotment management plan and their individual permits. Cattle guards are maintained by the Forest Service.

Probable Environmental Effects that Cannot be Avoided

Direct and indirect effects cannot be avoided.

Relationship between Short Term Use and Long Term Productivity

Over the short term closures would reduce available forage for livestock. In the long term, when areas are opened back up, vegetative trends and production should be improved above the existing condition.

Irreversible and Irretrievable Commitments of Resources

Range Allotments: No effects are anticipated to cause irreversible commitments of resources. Irretrievable commitments include loss of forage production that previously had been available for livestock use.

Range Improvements: No effects are anticipated to cause irreversible commitments of resources. Irretrievable commitments include short term damage to existing improvements.

Consistency with Forest Plan Standards

Short term goals within Range Management areas (RNG) may not be fully met because silvicultural reforestation practices would preclude use of existing forage in favor of protecting seeding conifers. Long term goals would be met in that range condition and forage production would be improved.

ALTERNATIVE 1

Direct and Indirect Effects

Vegetative production would increase due to decreased competition with conifers and increased sunlight.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.
CHAPTER 4

Probable Environmental Effects that cannot be Avoided

Increased vegetative production in dead stands of timber.

Relationship between Short Term Use and Long Term Productivity

Increased vegetative production in dead stands of timber.

Consistency with Forest Plan Standards

This alternative is consistent with Forest Plan Standards.

TABLE 4.14

<table>
<thead>
<tr>
<th>CATTLE ALLOCATIONS</th>
<th>ALLOTMENT ACRES</th>
<th>SUITABLE ACRES</th>
<th>DECREASE IN SUITABLE ACRES</th>
<th>PERCENT DECREASE IN SUITABLE ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
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<tr>
<td>Twelvemile</td>
<td>30,066</td>
<td>17,376</td>
<td>582</td>
<td>645</td>
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<td></td>
<td>17,057</td>
<td>9,001</td>
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<td></td>
<td>69,648</td>
<td>26,767</td>
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<td>52,876</td>
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<td></td>
<td>170,269</td>
<td>84,449</td>
<td>1,357</td>
<td>1,814</td>
</tr>
<tr>
<td>TOTAL</td>
<td>170,269</td>
<td>84,449</td>
<td>1,357</td>
<td>1,814</td>
</tr>
<tr>
<td>SHEEP ALLOTMENTS</td>
<td>ALLOTMENT ACRES</td>
<td>SUITABLE ACRES</td>
<td>DECREASE IN SUITABLE ACRES</td>
<td>PERCENT DECREASE IN SUITABLE ACRES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Island Lake</td>
<td>4,576</td>
<td>3,622</td>
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<td>Lake Fork</td>
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<td>1,182</td>
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<tr>
<td>Duck Fork</td>
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<td>Paseine</td>
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<td>3,804</td>
<td>379</td>
<td>443</td>
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<tr>
<td>Blue Lake</td>
<td>2,656</td>
<td>2,103</td>
<td>226</td>
<td>291</td>
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<tr>
<td>Shimmie</td>
<td>17,057</td>
<td>* 10,089</td>
<td>212</td>
<td>136</td>
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<tr>
<td>TOTAL</td>
<td>44,491</td>
<td>30,617</td>
<td>1,409</td>
<td>1,620</td>
</tr>
</tbody>
</table>

* 1,088 Acres Suitable For Sheep Allotment Included In Total

4.17 VISUAL LANDSCAPE

Introduction

Disturbance caused by the construction of roads and the associated harvest of trees has an impact on visual quality. This impact is caused by contrasts created between the natural forest landscape and the managed landscape. These contrasts involve changes in form, line, color, and texture of soil and vegetation.

In evaluating the specific effects for each of the different alternatives relative to scenic value, several objective variables come into play. Although information such as road miles built and their location, treatment unit size and relative scale, duration of sale, and total acreage visually affected (involves treatment unit size and relative scale) is required to gauge total change per alternative in relation to meeting established visual quality objectives (VQO).

The relative dominance of management activities, i.e. logging and road building must be identified to determine if Forest Plan VGO standards will be met by the activity. If activities are designed to repeat form, line, color, and texture common to the characteristic landscape to a degree that changes in these characteristics are not evident to the casual forest visitor, a VQO of Retention would be achieved. If these changes are evident, but remain visually subordinate to the characteristic landscape or VQO of Partial Retention would be met. If changes in the characteristics visually dominate the landscape, a VQO of Visual Disruption would be met. Given the varied landscape, but borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area a VQO of Modification would be achieved.

The longest lasting visual disturbance is typically caused by soil movement, particularly from road construction. While harvested treatment units over time will recover to an "unnoticed" visual condition, even low standard roads can remain noticeable for generations.

Disturbance to vegetation begins to heal immediately while soil disturbance takes years to be restored. The duration of this process is directly related to the extent of disturbance. In two or three years, herbaceous vegetation would cover most disturbed sites in the decision area. Within 25 to 30 years, tree cover would grow to the point where the visual impact will be unnoticed. Opportunities to years tree cover will grow to the point where the visual impact will be unnoticed. Opportunities to

The visual effects analysis is based on the inventory created in support of the Forest Plan supplemented with aerial photo and topographic map interpretations, and limited field confirmation.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Direct and Indirect Effects

Short term gain to visual qualities of color and texture would result from dead spruce removal. However, within a context approaching an ecological time frame, this positive effect may be offset by more permanent and visually objectionable elements, i.e., scarred associated with roads, landings and skid trails.

Timber harvesting and associated road building would modify the existing landscape to varying degrees, which would be more or less apparent at different distances.

The visual management system defines three distance zones: Foreground is the distance at which detail such as tree limbs can be identified; usually up to 1/4 mile to 1/2 mile from the observer. Middleground extends from Foreground to 3 to 5 miles from the Foreground; texture is emphasized. Background is everything beyond Middleground; colors and pr -1- rems dominate the visual impres-
CHAPTER 4

The visually apparent results of road building i.e., cut banks, fill slopes, and right-of-way/shoulder clearing would be clearly apparent in the Foreground; some would be visible in the Middleground and may appear as a dominant element of line in the Background view. Sights of timber salvage operations i.e., landings, stumps, and slash would be visible in Foreground and Middleground. Harvested units of high insect infestation density—particularly if silhouetted against a backdrop of sky-forming unnatural openings, would be noticeable at Background distances.

As for recreation related to scenic viewing—although the degree of effects would vary by alternative—the nature of the effects would be similar for all action alternatives. Recreation use patterns associated with visual quality could change in areas adjacent to, or subject to salvage harvest. Disturbed areas and those sites from which they are seen) could become less attractive to visitors who value the area for its scenic character. Subsequently these visitors may choose not to return and go elsewhere.

Although it can be projected with confidence that recreation use patterns related to aesthetics would change, the amount of change is difficult to predict; however some assumptions can be made. For the duration of the salvage harvest (and for a period related to regeneration afterward for sight-seers) some recreation users would be displaced to remaining or adjacent less developed areas. On the one hand, this displacement would add to the cumulative sensation of becoming crowded that users experience as their traditional recreation spots are developed. On the other hand, additional access would make more area available for recreation on closed or open roads: such as short-duration hunting trips, and opportunity for mountain bike or ATV users to enter previously less accessible areas. Once roads are closed their presence remains to some extent and provides increased access for hikers and those with horses, etc. to enter the area.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could have short term adverse effects to visual quality by reducing the amount of green vegetation. The reduction of the dead, brown trees was previously discussed as a positive effect. In the long term, however, color and texture would be increased through aspen regeneration and creation of openings in the form of meadows. The increased chance of mass soil movement, as discussed in the soils section, would be the greatest long term negative effect to visual quality.

Cumulative Effects

The proposed action alternatives would add to the visual effects of unnaturally appearing line, texture, form, etc. already caused by roading and timber harvesting in the area.

Past and present actions include the Timber Canyon (330 acres) and Twelvemile (205 acres) timber sales. The Timber Canyon sale is approximately 50 percent finished and completion is expected by 1997. The Twelvemile sale begins in 1995 and will be completed in 1997.

Possible Conflicts with Plans and Policies of Other Jurisdictions

None

Probable Environmental Effects That Cannot Be Avoided

Roads will be required to some extent in order to economically salvage timber, and the residual visual effect of associated scarping could be long term. Although not avoided, other visual effects resulting from the harvest activity itself will be relatively short lived and consequently of less significance.

Relationship Between Short Term Use and Long Term Productivity

Again, there will be benefits to texture and color in the short term by removing visually objectionable dead and dying spruce. However, this short term gain may be offset in the longer term by more permanent visual impacts associated with soil scarring. Additionally, interrupting natural cyclic processes may serve to reduce vegetative diversity (as described later concerning aspen) thereby causing a reduction in visual variety, etc.

Irreversible and Irretrievable Commitments of Resources

Salvage harvesting itself—particularly with helicopter—would not cause irreversible visual impacts because vegetation is regenerated over time. Additionally, until full regrowth, any reduction of visual quality resulting from timber harvest itself would be offset by improvement to color and texture associated with the removal of the dead and dying spruce component.

Although the roads may eventually undergo reclamation efforts, a potential irretrievable loss exists regarding any associated road cuts, etc. which may not be reclaimed to the extent that they are not recognized as being unnatural.

Additionally, the opportunity to recreate in an undeveloped setting in portions of the planning area affected by the salvage harvest and associated road building would be irretrievably lost for a period. This change would be irreversible within our lifetimes; only a period of many decades would allow revegetation and natural succession to restore the area to a naturally appearing condition. (of course—from many visitor’s perspective—this return to a “naturally appearing” condition would take years even if no action occurred, due to the negative visual effects of beetle infestation)

Consistency with NFMA/Forest Plan Standards

The E-2 and E-3 treatment units occur in an area designated by the Forest Plan as Retention. Because the visual impact associated with road NE-2 will be evident to the casual observer, the action alternatives will be inconsistent with NFMA/Forest Plan Standards regarding this area of Retention located south of the Ferron Reservoir Complex.

Impacted areas managed under Modification will easily meet this VQO after prescribed mitigation measures are applied following salvage sale activity.

As far as can presently be determined using aerial photos and maps, Partial Retention will be met upon completion of planned mitigation (including revegetation) following salvage sale activity; except possibly at the two locations listed for the action Alternatives 2, 3 and 4 where potential road scarring may remain dominant.
CHAPTER 4

ALTERNATIVE 1

Direct and Indirect Effects

Present viewsheds (and associated levels of VQO's) would not be altered by human induced activities. Consequently, views of infested areas (as perceived by the average forest visitor) would not gain the relatively short term improvement in color and texture resulting from removal of dead spruce or be subject to potentially long term impacts associated with salvage operations. Scenery would be subject to cyclical, natural disturbance processes such as fire, wind, drought, and natural succession. In approximately 100 years the dead and dying spruce component would be naturally regenerated and/or replaced by other species. Views would return to their pre-infestation condition or perhaps show improvement to the condition which existed immediately prior to infestation.

The landscape's diversity is not static, gradual change to visual character may be naturally accelerated by the effects of the beetle infestation and subsequent natural consequences, i.e. naturally limited fire (typical to the physiography found in the decision area) which generates aspen. If left to these natural processes the resulting vegetative condition may be more diverse and provide for richer variety in color and texture. Even during the interim, some visitors (especially those conscious of the natural process which occurred) may prefer to view dead spruce in the short term as opposed to unnatural linear vegetative corridors created by harvest unit boundaries and road cuts.

Figure 4.7 displays the existing visual condition across a typical acre in treatment units E,F,G. Figure 4.8 displays the anticipated visual condition across a typical acre in treatment units E,F,G following implementation of Alternative 1, No Action and the existing visual condition across a typical acre in treatment units A,B,C,D.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

Irreversible and Irretrievable Commitments of Resources

This alternative of no action would cause no irreversible or irretrievable effects to visual quality in the long term. There would however be an irretrievable loss of opportunity to recreate here and at this time, in an expanded roaded setting resulting from salvage operations.

Consistency with NFMA/Forest Plan Standards

This alternative is consistent with NFMA/Forest Plan standards.

ALTERNATIVE 2

Direct and Indirect Effects

About 0.72 miles of road will be built within an area designated as Retention. Due to being evident to the casual observer—particularly in open meadow areas near summer homes and overlooks from heavily used system roads—road NE-2 will not meet retention VQO in this visually sensitive area.

A total of 5,218 acres of timber units and approximately 17.5 miles of road would be built within areas designated as Partial Retention. An estimated five miles of road would undergo major reconstruction. In this alternative only the infested, dead and dying Engelmann spruce would be harvested using ground-based logging techniques on slopes less than 40 percent and natural and artificial regeneration activities would be employed. Although roads associated with salvage operations would be revegetated following completion, road/soil scarring could remain as a dominant visual element for fifty years.

In general, disturbance associated with roads could dominate wherever it is visible, particularly in long views where an unnatural line may be apparent. Line is the most dominant of any visual element in the landscape, and from some locations the effects of road building could result in a relatively permanent linear scar in background views which may appear dominant to the casual observer. Consequently, Background Partial Retention might not be met for an indefinite period of time (fifty years) in a few cases.

Road shoulder clearing, exposed soil due to skidding, stumps, and slash resulting from logging activity which is visible from major travel corridors would dominate sensitive Foreground views. In other words, the VQO of Foreground Partial Retention would not be met while the presence of these objectionable visual elements dominates the texture of vegetation mixed with the color of the aspen, etc. However, when prescribed mitigation (including revegetation) is properly implemented, Foreground Partial Retention will be met.

Middleground Partial Retention would not be achieved if harvest areas greatly differ in form and scale from the natural openings found in the surrounding landscape. Again however, it is expected that due to the nature of the infestation pattern, harvested edges will reasonably follow natural contours and generally reflect natural form and line of historic openings created by fire and beetle mortality.

As was expressed before, there are some positive visual effects of salvage, which will be apparent immediately, i.e. improvement to color and texture from dead and dying timber removal. With the possible exception of some roads; most potentially dominant negative effects are far from permanent and would likely become non-apparent as slash was removed or burned, revegetation occurred, etc.

Figure 4.9 displays the anticipated visual condition across a typical acre in all treatment units following salvage harvest of dead and dying trees in Alternative 2. It should be emphasized that the Forest Service will target mitigation to maximize benefits to the forest visitor. Accordingly, most mitigation efforts will be focused at the visually sensitive areas which are highly visible and frequently seen.

In summary, Retention will not be met in views associated with the area south of the Ferron Reservoir Complex (E-2) due to visual evidence of proposed road (NE-2).

Partial Retention would be eventually met after salvage operations and subsequent mitigation (including revegetation) is complete except possibly at one location: Views from Skyline Drive of both new and reconstructed roads located in or near the cluster of C units near Herrington Reservoir and Blue Lake. The landscape architect and engineer will determine if specific road alignments in this area meet or do not meet VQO. If they do not, they will be modified or dropped, including the harvest units associated with the road(s).

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.
CHAPTER 4

ALTERNATIVE 3

Direct and Indirect Effects

In addition to the 5,218 acres of ground-based harvested treatment units and approximately 17.5 miles of road built within areas designated as Partial Retention and .72 miles of road built in an area of Retention in Alternative 2; this alternative would add 4,025 acres of helicopter harvested treatment units on 40 percent or greater slopes for a total of 9,243 harvested acres in area managed as Partial Retention and 14 helicopter harvested acres in Retention. No additional miles of road would be added or reconstructed. Helicopter pads and associated log decking areas would be added, but the net visual effect would be negligible in due to size and location. In addition to infested, dead and dying spruce; green (non-infested) trees would be harvested. Re-entry to salvage will occur. Trap sites will be located in non-Visually sensitive locations. Mitigation measures would be fully prescribed as in Alternative 2.

Because no additional roads will be built or reconstructed than what is planned for Alternative 2, visual impacts related to meeting Retention, Partial Retention, and Modification will be as in Alternative 2. Any gain to visual quality from removing dead and dying trees in the selective and non-impacting manner associated with helicopter harvest methods would be offset by the harvest of green, non-infested timber. Consequently, VQO’s will be met as in Alternative 2, when mitigation is similarly complete.

Figure 4.9 displays the anticipated visual condition across a typical acre in treatment units A, B, C, D following salvage harvest of dead and dying trees in Alternative 3. Figure 4.10 displays the anticipated visual condition across a typical acre in treatment units E, F, G following sanitation harvest thinning of green trees and salvage harvest of dead and dying trees in Alternative 3.

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

ALTERNATIVE 4

Direct and Indirect Effects

VQO’s will be met as in Alternatives 2 and 3, with the exception of inventoried roadless areas being excluded from salvage. Consequently in areas of Partial Retention, as compared to Alternative 3: There will be 1,688 less acres of ground-based harvested timber units, 1,322 less acres of helicopter harvested timber units, and approximately five less new and reconstructed road miles. The total harvested acres of treatment unit for this Alternative will be 6,233 acres and the total miles of road to be built will be approximately 12.5. Consequently Partial Retention will be met as in Alternative 3 contingent upon comparable mitigation efforts, with no direct impacts to the aesthetics associated with the roadless areas.

Figure 4.8 displays the anticipated visual condition within roadless areas following implementation of Alternative 4. Figure 4.9 displays the anticipated visual condition across a typical acre in treatment units A, B, C, D following salvage harvest of dead and dying trees in Alternative 4. Figure 4.10 displays the anticipated visual condition across a typical acre in treatment units E, F, G following sanitation harvest thinning of green trees and salvage harvest of dead and dying trees in Alternative 4.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.
EXISTING VISUAL CONDITION

Across a typical acre in treatment Units E,F,G
ANTICIPATED VISUAL CONDITION

Following implementation
Alternative 1 (No Action)
Alternative 4 within roadless areas
ANTICIPATED VISUAL CONDITION

Following salvage on a typical acre of dead and dying trees
Alternative 2, all Treatments Units
Alternatives 3 & 4, Treatment Units A,B,C,D
ANTICIPATED VISUAL CONDITION

Following sanitation harvest thinning of green trees and salvage of dead and dying trees
Alternatives 3 & 4, Treatment Units E,F,G
CHAPTER 4

4.18 ROADLESS CHARACTER

Introduction

Effect on roadless character involves many environmental components. As defined in Chapter 3; the six roadless characteristics of Natural Integrity, Apparent Naturalness, Solitude, Remoteness, Manageability, and Special Features will be discussed in relation to potential impact from actions outlined in the different Alternatives.

EFFECTS COMMON TO ACTION ALTERNATIVES 2 and 3

Direct and Indirect Effects

Directly, timber salvage and associated road building would change the physical and biological aspects of the land, consequently effecting Natural Integrity, Apparent Naturalness, sense of Solitude, etc. The modified setting would heighten the sensation of being in a developed area. The character of the landscape would change because the sights, sounds, and other reminders of humans would be present. Some impacts to roadless characteristics would be short-lived: introduced weeds, skinned trees, flagging, and tree paint. Some would be long-lived: road cuts, fills, stumps, slash, skidtrails, unnatural openings, and atypical vegetative patterns.

Visitors seeking a relatively primitive recreation experience would choose not to visit the area; visitors seeking a more modified setting would increase. If extensive salvage and associated roading occurred in an inventoried roadless area, the Forest Service could consider that portion of the area developed and may consequently drop it as a part of the roadless area. If the impact was sufficient enough to affect any of the six roadless characteristics to the extent that a large enough unaffected area (usually of at least 5,000 acres) would not remain--the Forest Service could consequently drop it entirely as an inventoried roadless area.

Additionally, activities associated with salvage operations would also have indirect effects in the adjacent undeveloped vicinity. The sights and sounds of roads, logging, and motorized access would be noticed some distance outside the harvested treatment unit and possibly within the boundary of a roadless area.

Cumulative Effects

Past and present actions include the Timber Canyon (330 acres) and Twelvemile (205 acres) timber sales. The Timber Canyon sale is located within the Twelvemile Roadless area and consequently has direct effect (this sale is 3.1 percent of the Twelvemile Roadless Area). The Timber Canyon sale is approximately 50 percent finished and completion is expected by 1997.

The Twelvemile sale (begins in 1995 and will be completed in 1997) is located well west of the Heliotrope Roadless area and accordingly will have no direct effect. Indirect effect will be negligible because it will not be readily seen from Heliotrope or any other roadless area.

Additionally, existing development associated with historic mining or logging operations and two-track roads located in or near the roadless areas contribute to further reducing roadless character.
CHAPTER 4

Possible Conflicts with Plans and Policies of Other Jurisdictions

None

Probable Environmental Effects That Cannot Be Avoided

The direct and indirect effects that cannot be avoided are described above.

Relationship Between Short-Term Use and Long-Term Productivity

Although in ecological time the development associated with the action alternatives would eventually be unnoticeable (at minimum blend the existing condition); inventoried roadless acreage developed by this action could be dropped, in part or wholly, as an inventoried roadless area for the foreseeable future.

Irreversible and Irretrievable Commitments

Within our human context or time-frame, roadless character is essentially a non-renewable resource. Any development of a roadless area is an irretrievable and irreversible commitment of the resource to a developed condition for the long-term because the natural processes of recovery and succession move so slowly compared to a human life span. In a broader time-frame the developed condition would be reversible after about 100 years.

Consistency with NFMA/Forest Plan Standards

All of the alternatives are consistent with NFMA/Forest Plan Standards.

Table 4.15 and Figures 4.7 - 4.9 Illustrates potentially developed roadless area for each alternative

<table>
<thead>
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<th>TABLE 4.15</th>
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<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
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<td>0.18%</td>
</tr>
</tbody>
</table>

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FIGURE 4.11

Roadless Areas
Alternative 2

PROJECT BOUNDARY
TREATMENT UNITS
ROADLESS AREAS

Black Mtn
Big Bear Canyon
Heliotrope
Muddy Crk - Nelson Mtn
White Mtn

1 0 1 2 3 Miles

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FIGURE 4.12

Roadless Areas
Alternative 3

PROJECT BOUNDARY
TREATMENT UNITS
ROADLESS AREAS

Black Mtn
Big Bear Canyon
Heliotrope
Muddy Crk - Nelson Mtn
White Mtn

1 0 1 2 3 Miles

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CHAPTER 4

ALTERNATIVES 1 and 4
Direct and Indirect Effects

In Alternative 1 (No Action) there would be no additional development in any of the roadless areas, nor would there be any additional development in any lands adjacent to any roadless areas. Therefore, there would be no direct or indirect effects on roadless character.

Existing activities would continue and there would be no irreversible or irretrievable commitment of resources. The present levels of Natural Integrity, Apparent Naturalness, Remoteness, Solitude, Special Features, and Manageability would remain, affected mainly by natural processes.

Alternative 4 would have the same effects as Alternative 1 except roadless areas could be affected indirectly by salvage related development in adjacent non-roadless areas. The sights and sounds of roads, logging, and motorized access could be noticed some distance outside the treatment unit and within the boundary of any nearby roadless area.

ALTERNATIVE 2
Direct and Indirect Effects

Roadless areas would be impacted by development to a varied extent as shown in Table 4.15 and discussed below. Accordingly, areas containing or visually adjacent to roads and harvested treatment units would be proportionately modified in Natural Integrity and Apparent Naturalness, and opportunities for Solitude and a related sense of Remoteness would be eliminated along the roads and in and around the timber units.

Manageability and Special Features would be effected in more specific ways for each area.

Big Bear Canyon

In this alternative, this roadless area is located far enough away from any potential development to preclude any visual or audible effect whatsoever to its roadless characteristics (existing road density is 0.54 miles/square mile). Even in background views, development related to soil disturbance in ground-based logged F-2 will not be readily viewed from any portion of this roadless area (except for perhaps high points such as from Cove Mountain) because salvage related disturbance occurs at a lower elevation on relatively flat topography and is therefore naturally screened.

Black Mountain

One timber unit of 380 acres (G-1) and 0.9 miles of road will be placed in the eastern margin of this roadless area. Directly affecting approximately 5.8 percent of the Black Mountain Roadless Area and increasing the existing road density from 1.0 to 1.09 miles/square mile. The amount of acreage directly affected by development would reduce the areas total to 6,200 acres. The Special Features associated with Black Mountain and the scenic aspen basins would remain the same.

There would be some indirect effect to Apparent Naturalness and a sense of Remoteness while viewing areas of salvage operation on adjacent lands to the immediate east (G-1, G-3). Although the view would be limited by the divide at Skyline Drive, visitors within the roadless area could readily see across to, and be reminded of development nearby.
CHAPTER 4

Heliotrope
Four treatment units (A-11, E-1, E-2, E-3) and 2.1 miles of road are planned in a large northwestern portion of this roadless area, directly effecting approximately 575 acres or 11 percent of its total roadless area and increasing the existing road density from 0.58 to 0.83 miles/square mile. Due to the small size of this entire roadless area (5,196 acres) this impact could result in dropping the entire area’s roadless designation because its undeveloped acreage would fall well below the 5,000 acre minimum to at most 4,621 acres. This amount does not include acres subject to indirect or cumulative effects as seen from above Emery Reservoir and heard from traffic using road 50022 on its northern margin.

Manageability of this Heliotrope unit is already low due to the impacts associated with previous off-road use and the cumulative effects of additional access opportunities would reduce Manageability even more. Special Features are non-existent.

Indirect visual effects to roadless characteristics in this area from other adjacent lands programmed for ground-based harvest operations would not be apparent except from the western margin above Emery Reservoir because of topographic screening. Due to the proximity of road #50022 on the northern border, which would be a major haul/traffic route, audible effects would be present near the entire northern margin during hours of operation.

As mentioned in chapter 4, Heliotrope was not completely carried through the RARE II process, given primarily to ease of vehicular accessibility and livestock use.

Muddy Creek-Nelson Mountain
One timber unit of 103 acres (C-2) and 0.9 miles of road will be placed in the extreme northwest corner of this roadless area, directly impacting approximately 0.18 percent of its total roadless area and increasing existing road density from 0.26 to 0.27 miles/square mile. Because this area is large in size (54,235 acres) this impact would be negligible. Manageability would be impacted during harvest operations by improved access. The new road will be constructed along an existing ATV trail approved in the travel plan. Following harvest the road will be reclaimed and returned to ATV access status. Special Features would not be measurably affected.

Twelvemile
Two treatment units totaling 36 acres (B-3, B-4) and 0.7 miles of new road will be placed in the small southeast portion of this roadless area, directly effecting approximately 0.18 percent of this roadless area and increasing existing road density from 0.75 to 0.79 miles/square mile. Manageability would be impacted following harvest operations by improving access to Island Lake with the new road. New road will be constructed, impact along an existing skid trail used in the past to harvest timber. About 0.47 miles of new road (NB-3) will be left in place following harvest activities and added to the travel plan as approved access. The current access (FDR 136) requires a 4X4 vehicle.

Following harvest, existing road number 136 will be obliterated and closed to public access decreasing road density from 0.79 to 0.76 miles/square mile. Potential impact from the small salvage harvest itself would not effect the Special Feature of the large landslide. Manageability as a whole would be negligibly effected.

White Mountain
Two treatment units totaling 595 acres (D-4, D-5) and 1.9 miles of road will be placed in the northeast appendage of this roadless area, directly effecting approximately 2.1 percent of it and increasing existing road density from 0.20 to 0.24 miles/square mile. The White Mountain Roadless Area is relatively large (27,700 acres), which given the treatment units relatively small combined size and consolidated location, would allow for future Manageability of the remaining unit. However, these treatment units and associated roads would be located within the viewed of an outstanding lookout point which is a Special Feature of this roadless area located near the Three Lakes area thereby effecting Apparent Naturalness, sense of Remoteness and opportunity for Solitude.

ALTERNATIVE 3

Direct and Indirect Effects
As shown in Table 4.15, no roads will be built in addition to that planned for Alternative 2.

Helicopter logging itself would not have the impact of ground-based logging to roadless characteristics except for a negligible amount of acreage (at most 1 acre per) for helipads (of which 15 of the 22 total are located outside roadless area boundaries). Noise of helicopter logging could effect solitude.

However, the increased effect to Apparent Naturalness resulting from timber harvest on more readily viewed slopes of over 40 percent combined with the harvest of green trees (particularly if skylined) would offset any advantage of harvesting from the air. In consequence, total acres of timber unit, whether ground-based or helicopter logged, will be considered as a having a proportionately direct effect to roadless characteristics as that described in Alternative 2.

Manageability and Special Features will be more specifically addressed.

Big Bear Canyon
A very small portion of this roadless area will be helicopter logged (F-3) (directly effecting approximately 36 acres or 0.13 percent of the Big Bear Canyon Roadless area. As stated for Alternative 2, there will be no new roads or ground-based logging anywhere near this area. Consequently, the net direct effect of salvage operations to the roadless characteristics of this area will be negligible.

Apparent Naturalness could be reduced indirectly from the effects of helicopter logging on adjacent, steep and consequently more obliquely apparent, viewsheds as seen from within the roadless area itself. From the eastern-most appendage in the area of Cove Mountain, the steeper slopes of timber unit F-3 will be seen almost entirely and those of F-1 will be viewed in part.

Fortunately, the high ridge above Duck Fork Reservoir which lies in between these timber units and the southern portion of the roadless area will prevent longer views of these harvest areas. Higher elevation helicopter logged areas (G-3) even further away should not have any apparent effect to Naturalness or sense of Remoteness due to variation in texture becoming obscured at this distance and this harvest method’s preclusion of linear soil/vegetative scars typically associated with roaded and ground-based logging.

As in Alternative 2, development related to soil disturbance in ground-based logged F-2 will not be readily viewed from any portion of this roadless area because it occurs at a lower elevation than ridges
in-between, on relatively flat topography and is therefore naturally screened. The negative effect associated with long views of non-characteristic development on steep helicopter logged slopes would last only until the units were revegetated.

In consequence, visitors using the roadless area would perceive only moderate changes in Apparent Naturalness, etc. from visible reminders of development nearby.

Black Mountain

In addition to the one ground-based logged treatment unit (G-1) and 0.9 miles of road placed in the eastern margin of this roadless area in Alternative 2, a narrow strip (97 acres) of helicopter logged treatment unit (G-2) is planned along the western edge of the ground-based unit. Thirteen additional acres will be helicopter logged in G-1. Taken together with the 380 ground-based logged acres, this harvest activity directly affects approximately 490 acres or 7.4 percent of the Black Mountain Roadless Area.

This additional amount of acreage directly affected by development would reduce the roadless area's total to 6,090 acres (not including indirect effects). This amount brings this area closer than in Alternative 2 to the 5,000 acre minimum, thus further increasing the potential for conflicts related to Manageability in the future.

The Special Feature associated with Black Mountain would be affected for the period until full revegetation, due to its face being helicopter logged (of course the improvement in color and texture resulting from dead and dying spruce removal from this steep face would need to be factored in). The other Special Feature related to the scenic aspen basins would remain the same.

There would be an increased indirect effect from that of Alternative 2 to Apparent Naturalness and sense of Remoteness due to views from this area of salvage operations on adjacent lands to the immediate east. Although the view would also be limited by the divide at Skyline Drive; additional developed area would be evident on the slopes of the helicopter harvested unit (G-3).

Heliotrope

919 helicopter harvested acres (A-11, E-1, E-2, E-3, E-4) would be added to the 575 acres of ground-based harvested units and the 2.1 miles of road planned in Alternative 2. In total, approximately 1,493 acres or 28.7 percent of roadless area would be affected. As mentioned in discussion for Alternative 2; the entire roadless area is 5,196 acres in size and would fall below the normally required amount needed for inventoried roadless area consideration if only ground-based logged units were harvested. Additional Helicopter logging planned in this alternative would further reduce this amount of eligible acreage from 4,621 to 3,703 acres.

As described previously, manageability of this unit is already low due to impacts associated with off-road use and Special Features are not-existent.

Although one would sense indirect visual and audible effects to Apparent Naturalness and Remote- whirle in this area, very little helicopter harvested steep slopes may be apparent due to topography. The exception would be treatment units A-1 and A-3 as seen from the far western margin of the roadless area above Emery Reservoir.

Again as previously mentioned, this roadless area was not completely carried through the RARE II process.
CHAPTER 4

The harvesting of timber, construction of new and reconstruction of existing facilities may be of three kinds:

- Isolation
- Preservation
- Destruction or alteration of all or part of the property

An adverse effect is defined as one that changes the characteristics that make a prehistoric or historic resource significant. Inventory of project areas and documentation of survey findings will assist in understanding the Forest prehistory and history. Cultural resource inventories would also identify significant paleontological localities.

An adverse effect is defined as one that changes the characteristics that make a prehistoric or historic resource as defined by regulation (36 CFR 800.9) may be of three kinds:

- No effect
- No adverse effect
- Adverse effect

An adverse effect is defined as one that changes the characteristics that make a prehistoric or historic property eligible for listing in the National Register of Historic Places; these characteristics are defined in 36 CFR 60.4 and Section 101 of the NHPA. In addition, an adverse effect can be one in which an activity produces conditions which would lead to:

- 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 after its setting (36 CFR 800.9).

A "No Adverse Effect" would be an action whereby the research value of a cultural resource can be preserved by completing appropriate research; or as in the case of a historic building, proposed alterations are done in such a way so as to preserve the historical architectural values (36 CFR 800.9).

Avoidance of significant sites is the preferred management option. Since most prehistoric sites in the area will be small in overall area size and should be located in areas of relatively level or gently sloping terrain, avoidance should be feasible in most cases. In some cases, such as at very large sites, cumulative effects could pose a very low risk of impact to cultural resources.

Prehistoric Cultural Resources: It is anticipated that activities associated with the action alternatives has a low potential for impacting prehistoric cultural resources by following inventory, evaluation and protection measures as specified in the Forest-SHPO agreement. Furthermore, in areas where site density is highest (i.e. level terrain), small project modifications such as road realignments and exclusion of small can probably be accommodated in most cases. In areas where such modifications may be more difficult (i.e. road relocation), modeled site density is anticipated to be low, thus posing a very low risk of impact to cultural resources.

Paleontological Resources: No known paleontological resources would be affected. Paleontological resources will be documented during the course of cultural resource inventories, evaluated and protected as appropriate.

Prior to ground disturbing activities all areas would be inventoried, all sites would be evaluated and significant sites avoided. Where sites cannot be avoided, mitigation plans would be required and implemented before impacting activities can proceed in these areas. Therefore, no significant impacts are anticipated under Alternatives 2 or 4.

Although high intensity (stand replacement) wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas will result in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels, and increasing concentrations of down and standing dead trees increase the probability of more frequent, high intensity wild fires. Intense (stand replacement) fires could compound the adverse effects to cultural resources. The most significant adverse effect would be to any historic or prehistoric sites located in the burn area. They could be lost forever.

Cumulative Effects

Livestock grazing in the late 1800s has had a significant influence on soil erosion and possibly archaeological site preservation. Changes in natural vegetation, soil and land stability has resulted in a loss of topsoil and most likely buried archaeological remains contained in these soils. Intensive management of vegetation resources has resulted in increasing vegetation and stabilizing land surfaces. In turn, this has probably stabilized archaeological sites. With appropriate identification and monitoring, ground disturbing activities and/or conducting data recovery through more extensive excavation. This work would be conducted in consultation with the State Historic Preservation Office.
CHAPTER 4

protection measures as stipulated in the Forest-SHPO agreement, sites prone to soil erosion impacts from proposed actions (all action alternatives and reasonably foreseeable actions associated with the no action alternative) potential adverse effects can be avoided.

Exposure of archaeological sites to the public with increased access to the area could encourage artifact collection or other activities that could alter sites or traditional cultural properties. Over time, this could result in a loss of information on cultural resources. The closing of temporary roads under all action alternatives should discourage unauthorized collection.

Possible Conflicts with Plans and Policies of Other Jurisdictions

No conflicts with plans and policies of other jurisdictions are anticipated under any of the alternatives.

Probable Environmental Effects that Cannot be Avoided

No effects to significant cultural resources are anticipated which cannot be avoided or mitigated through implementation of an approved data recovery/mitigation plan under the action alternatives and through implementation of standard NHPA consultation-compliance procedures for reasonably foreseeable actions (under the No Action alternative) which would be treated as separate undertakings.

Relationship Between Short-Term Use and Long-Term Productivity

It is possible that some cultural resources which cannot be avoided by timber harvest and/or activities associated with action alternatives or reasonably foreseeable actions identified under the no action alternative would have to be subjected to scientific excavation. While this would ultimately result in removal of the resource and decrease opportunities to apply new research techniques and methods of the future, the work would be conducted in accordance with professional standards thereby resulting in appropriate recovery and documentation. Identification, evaluation and excavation of resources could provide opportunities to interpret certain sites for public appreciation and enjoyment. Overall, the effects to the database of cultural resources for the general Wasatch Plateau Region would be minimal.

Irreversible and Irretrievable Commitments of Resources

As noted above, a few archaeological/historical sites which cannot be avoided by ground-disturbing activities could be subjected to data recovery measures. Since cultural resources are non-renewable, these effects would be irreversible. While the recovered data could be used in public displays, the removed portion of the site would be irretrievably lost.

Consistency with NFMA/Forest Plan Standards

The analysis of existing data on cultural resource site types within and adjacent to the project area, the development of a cultural resource sensitivity model, the implementation of professional cultural resource surveys, evaluations and protection measures as specified in the programmatic agreement with the Utah State Historic Preservation Office is consistent with the National Forest Management Act and management direction for cultural resources found in the Manti-La Sal National Forest Land and Resource Management Plan.

CHAPTER 4

ALTERNATIVE 1

Direct and Indirect Effects

Under the No Action Alternative no timber harvest or road construction activities would occur. Reasonably foreseeable future actions such as oil and gas exploration activities, limestone quarry developments, small timber sales and road improvement activities would be treated as separate undertakings and inventoried for cultural resources as appropriate. Other current actions related to the Timber Canyon and Twelvemile Timber Sales have been already been analyzed, assessed and determined to have no effect on cultural resources. Inventory of the South Manti area would not occur on the scale which they would occur for the action alternatives. Thus, it is anticipated that the vast majority of existing, but undocumented cultural resources will remain undocumented.

Dead Engelmann Spruce will continue to fall over time. With no treatment to break up or reduce fuel loading, the entire project area and beyond will be at risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment.

ALTERNATIVES 2 AND 4

Direct and Indirect Effects

Prehistoric Cultural Resources: Proposed timber harvest would encompass all prehistoric site sensitivity zones. Based on the sensitivity model and estimates of site density, it is estimated that between three and six prehistoric sites will be located within areas classified as high sensitivity; 1 to 2 sites will be located within areas classified as moderate sensitivity; and 1 to 3 sites will be located within areas classified as low sensitivity (Table 4.16). Thus, a total of approximately 5-11 sites are anticipated within areas under consideration in Alternatives 2 and 4. However, these numbers could vary depending on local factors. In addition, one known prehistoric site (ML-2757) determined eligible for the National Register of Historic Places is located along an existing road and will be protected from adverse impacts associated with road reconstruction/maintenance.

5,640 acres of the total project area will receive treatment (removal of dead trees and fuels reduction) that will create a mosaic of openings and fuel breaks throughout the analysis area, thereby reducing the potential of a high intensity stand replacement fire.

7,015 acres throughout the analysis area will receive treatment thereby reducing the potential for stand replacement fire.

ALTERNATIVE 3

Direct and Indirect Effects

Prehistoric Cultural Resources: Based on the sensitivity model and estimates of site density, it is estimated that between four and seven prehistoric sites will be located within the areas classified as high sensitivity; 2 to 3 sites will be located within areas classified as moderate sensitivity; and 3 to 5 sites will be located within areas classified as low sensitivity (Table 4.16). Thus, a total of approximately 9-15 sites are anticipated within treatment areas or road construction/reconstruction areas under consideration in Alternative 3. One prehistoric site (ML-2757) determined eligible for the National Register of Historic Places is located along an existing road, but will be protected from adverse impacts associated with road reconstruction/maintenance actions.
CHAPTER 4

10,212 acres or virtually all of the analysis area (affected by mortality from spruce beetle), will receive treatment thereby reducing the potential of a stand replacement fire.

<table>
<thead>
<tr>
<th>ACTION ALTERNATIVE NO.</th>
<th>SENSITIVITY ZONE</th>
<th>HIGH</th>
<th>MODERATE</th>
<th>LOW</th>
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<tbody>
<tr>
<td>ALTERNATIVE 2</td>
<td>Estimated Number of Prehistoric Sites Expected</td>
<td>1032</td>
<td>2416</td>
<td>2327</td>
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<td></td>
<td>Acres in Sensitivity Zone</td>
<td>3-6</td>
<td>1-2</td>
<td>1-2</td>
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<td>ALTERNATIVE 3</td>
<td>Estimated Number of Prehistoric Sites Expected</td>
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<td>5834</td>
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<td></td>
<td>Acres in Sensitivity Zone</td>
<td>4-7</td>
<td>3-3</td>
<td>3-5</td>
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<tr>
<td>ALTERNATIVE 4</td>
<td>Estimated Number of Prehistoric Sites Expected</td>
<td>1060</td>
<td>2180</td>
<td>3913</td>
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<tr>
<td></td>
<td>Acres in Sensitivity Zone</td>
<td>3-6</td>
<td>1-2</td>
<td>2-3</td>
</tr>
</tbody>
</table>

4.20 ECONOMICS

introduction

Timber harvest activities impact local and regional communities by increasing the number of jobs and incomes. A percentage (25 percent) of timber receipts is returned to counties in lieu of taxes for local schools and roads. Remaining receipts are returned to the Federal treasury.

In this analysis the values used for employment and income multipliers are 10.8 jobs per million board feet (MMBF) and 555,000 dollars per MMBF per year respectively. This information is based on the Manti-La Sal National Forest 1994 Fiscal Year Timber Sale Program Information Reporting System (TSPIRS) report instructions.

The Transaction Evidence Appraisal (TEA) program was used to develop the stumpage values for species and products evaluated for harvest. The base period cost file used rates and costs through the fourth quarter of calendar year 1994. The rates and costs were adjusted to February 1995. Individual sale appraisals are in the project file. Proposed timber sales, which have negative present net values, would not be offered for less than the 10 dollars per MBBF minimum rate. Skyline (cable) logging systems were not considered in the economic analysis of the action alternatives.

The demand for wood fiber to produce house log products is in an increasing trend. Inquires about the availability of dead spruce are increasing. Dead Engelmann spruce is a preferred species for house logs and could supply the raw material for the house log demand. Generally economic data is spares for helicopter harvest in this area. These qualitative indications suggest that marketability of such an offering is reasonable.

CHAPTER 4

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Cumulative effects

The Timber Canyon and Twelvemile Timber Sales are located within the project area. These sales are scheduled to complete harvest of 5,074 MMBF of insect-infested, recently dead, and older dead Engelmann spruce sawtimber within the next two years. This wood fiber is providing raw material for local and regional wood product manufacturing facilities. An estimated 54 jobs and 2.8 million dollars in income is generated from this harvest. Sanpete County would receive approximately 193,000 dollars as payments in lieu of taxes.

Two sales located outside the project area, but on the Manti Division of the Manti-La Sal National Forest are likewise contributing to the local economy. The Bear Ridge and Four Mile II Timber Sales will have 1,947 MMBF harvested in the next two years. About 21 jobs and $1.1 million in income may be generated by this harvest. Sanpete County and Juab County could each receive 1,100 dollars for payments in lieu of taxes. Utah County would receive about 4,500 dollars for payment in lieu of taxes.

Spooner Creek Il Timber Sale was offered and awarded in 1995, Blaze-A-Glor, will be offered in 1996. Economic returns from these sales may be realized in late 1996. Both sales are located in Emery County.

Possible Conflicts with Plans and Policies of Other Jurisdictions

The action alternatives do not conflict with local, state, or federal agencies or government plans or policies.

Probable Environmental Effects That Cannot Be Avoided

The action alternatives do not have any unavoidable environmental (economic) effects.

Relationship Between Short Term Use and Long Term Productivity

The impact of increased job numbers and associated incomes is short term. The time varies from six years for Alternatives 2 and 4 up to nine years for Alternative 3. This potential 6 to 9 year period of use does not adversely impact long term productivity. The action alternatives maintain and enhance long term productivity.

Irreversible and Irretrievable Commitments of Resources

The action alternatives do not cause irreversible or irretrievable commitments of economic resources.

Consistency with NFMA/Forest Plan Standards

All action alternatives are consistent with NFMA and Forest Plan standards. They provide a source of wood fiber for commercial timber harvest.
CHAPTER 4

ALTERNATIVE 1

Direct and Indirect Effects

Conducting an environmental analysis to consider the No Action alternative is a cost to the agency. Commencing with the Forest Supervisor’s project initiation letter of June 16, 1994, analysis costs were $69,116 dollars in Fiscal Year 1994 and $69,027 in Fiscal Year 1995. These costs have a Present Net Value of negative 140,000 dollars with implementation of Alternative 1. No increase in timber commodity base jobs or income would be generated by the selection of this alternative.

Throughout the project area about 52.5 MMBF of dead and recently dead Engelmann spruce would be left to fall to the ground and deteriorate. Loss of this amount of wood fiber represents about 567 jobs and 29.1 million dollars that could have benefited the local economies. As the epidemic continues the amount of dead will increase as will the increased loss of jobs and income.

Cumulative effects

There will be no additional cumulative effects other than those described above.

Possible Conflicts With Plans And Policies Of Other Jurisdictions

The No Action Alternative does not conflict with local, state, or federal agencies or government plans or policies.

Probable Environmental Effects That Cannot Be Avoided

Payments to counties for local schools and roads would not be made to Sanpete or Sevier Counties. Timber receipts would be unavailable to make these payments.

Relationship Between Short Term Use and Long Term Productivity

This alternative provides non-use of the project area. Long term productivity is maintained but not enhanced.

Irreversible and Irretrievable Commitments of Resources

This alternative is not irreversible. Potential increases of jobs and income along with payments to counties for in lieu of taxes (25 percent fund) are foregone and are irretrievable.

Consistency with NFMA/Forest Plan Standards

Even though the No Action Alternative does not provide a source of wood fiber for the wood products industry, it is consistent with NFMA and Forest Plan Standards. It does not preclude other areas of the National Forest from providing a source of raw material for industry.

ALTERNATIVE 2

Direct and Indirect Effects

This alternative would harvest about 52.5 MMBF of insect infested, recently dead, and older dead Engelmann spruce sawtimber over the next six year period. This volume would equate to an estima-
ALTERNATIVE 3
Direct and Indirect Effects

This alternative would harvest about 94.5 MMBF of live, insect infested, recently dead, and older dead Engelmann spruce sawtimber over a 9-year period. An estimated 1,020 jobs related to this harvest could be generated. Employment related income could amount to 52.4 million dollars, (Table 4.17). The increased jobs and income could benefit both local and regional economies.

Twenty-five percent of the federal timber receipts from the project area located within Sanpete and Sevier Counties would be available for local schools and county roads. Current appraisal information indicates the timber proposed in this alternative could generate 1.55 million dollars in revenues. Sanpete County could receive approximately 330,000 dollars. Sevier County could receive approximately 60,000 dollars.

With the offer and award of timber considered in this alternative the Present Net Value would be about negative 2,960,000 dollars, (Table 4.18). The economic analysis of this alternative is in the project file.

Alternative 3, overall, has a negative present net value. Successful implementation of spruce harvest within treatment units E,F, and G is required to successfully implement the integrated pest management strategies of Alternative 3 (Figure 2.2). Positive present net value for these treatment unit sales (Table 2.2) is not always required to provide a reasonable opportunity for the timber sales to be bid and awarded. The Rescission Act (P.L. 104-19) allows below cost sales to be offered at minimum rates of 10 dollars per MBF.

As grouped in Table 2.2 timber in treatment units E,F,D,B would have a negative present net value and timber in treatment units G,A,C would have a positive present net value. The high operating costs of helicopter logging and the ratio of acres logged using helicopter methods vs acres logged using ground-based methods were critical factors contributing to the outcome of whether treatment units would have a positive or negative present net value. The assumed appraisal values for recently dead ($7.66 dollars) and green spruce (219 dollars) also affected the present net value results.

Further economic sensitivity analysis suggests a reorganization of the treatment unit groups displayed in Table 2.2 could result in sales with positive present net value for treatment units E and F (G is currently positive). This could be achieved by reducing the amount of acres with dead and dying trees logged by helicopter methods, by group, relative to the amount of acres logged with ground-based methods. This would eliminate some helicopter supported salvage harvest of dead and dying trees, especially in treatment units A,B,C,D.

Should treatment units E, F, and G not sell then the primary objective of Alternative 3; application of silviculture treatments to reduce spruce susceptibility to beetle attack addressing forest health, diversity, and productivity would not be realized nor practical. In this situation implementing the remaining salvage portion of Alternative 3 would be essentially economically similar to implementing Alternative 2.

Timber sales with negative value would be offered at the minimum rate of 10 dollars per MBF. It is possible timber purchasers would bid on and be awarded sales for minimum rates. For example, the Dixie National Forest recently awarded an Engelmann spruce salvage sale with the helicopter harvest units bid at the 10-dollar minimum rate. With no bids the potential revenues would be reduced by 0.58 million dollars. Twenty-five percent of this value would be unavailable to Sanpete and Sevier Counties.
Cumulative Effects

Energy consumed by the project adds to the existing level of energy consumed in the area by other forest resource activities (recreation, special use permits, concurrent timber sales). These other resource activities consume approximately 5,356 Million British Thermal Units (MMBTU) per year.

Possible Conflicts with Plans and Policies of Other Jurisdictions

None

Probable Environmental Effects that Cannot be Avoided

All action alternatives consume additional fuels proportional to the number of timber-related vehicles (engines) operating during the life of the project.

Relationship Between Short Term Use and Long Term Productivity

Fuels will be used in the short term to harvest timber, haul timber to mills, and administer contracts. In the long term, salvage operations may continue as well as thinning or other silviculture treatments, at which time additional fuel will be consumed.

Irreversible and Irretrievable Commitments of Resources

The use of fossil fuels are both irreversible and irretrievable.

Consistency with NFMA/Forest Plan Standards

Anticipated effects are consistent with NFMA and forest plan standards.

ALTERNATIVE 1

Direct and Indirect Effects

None

Cumulative Effects

There is an existing level of energy consumed in the area by other forest resource activities (recreation, special use permits, concurrent timber sales).

ALTERNATIVE 2

Direct and Indirect Effects

1,050 MMBTU consumed. Energy output is calculated as 1,382 MMBTU.

ALTERNATIVE 3

Direct and Indirect Effects

1,889 MMBTU consumed. Energy output is calculated as 2,482 MMBTU.

ALTERNATIVE 4

Direct and Indirect Effects

1,391 MMBTU consumed. Energy output is calculated as 1,623 MMBTU.
CHAPTER 5

Public Involvement Summary, List of Preparers, and List of Agencies, Organizations, and Individuals to Whom Copies of the EA/BE has been sent.

5.0 INTRODUCTION

This Chapter includes a summary of public involvement, a list of the preparers of the EA, and list of agencies, organizations, and individuals to whom copies of the EA/BE has been sent.

5.1 SUMMARY OF PUBLIC INVOLVEMENT

The following discussion presents an analysis of the public response during the scoping process. The project file contains scoping analysis and issue approval documentation.

A process of public participation began September 17, 1992 with a public meeting at Twelvemile Flat Campground to view the area affected by the spruce beetle epidemic and discuss possible opportunities to salvage timber and improve forest health. A second meeting was held October 15, 1992 to provide an additional opportunity for public participation.

The project initiation letter for the South Manti Timber Salvage analysis was signed by the Forest Supervisor June 21, 1993, and scoping initiated July 2, 1993. Scoping packages were mailed to 82 people, organizations, and agencies on the project mailing list (Project File). At that time (July 1993) the Forest Service intended to develop an environmental assessment and request an exemption from administrative appeal under 36 CFR 217.4 (a) (11). During the analysis process (November 1993), appeal regulations were revised making the proposed action appealable under (36 CFR 215). A news article requesting public input was also printed in the December 9, 1993, issue of the Sun Advocate.

In late 1993, the ID Team recognized the proposed action may have a significant effect on the human environment and informed the Forest Supervisor. At issue was the potential for significant effects to the undeveloped characteristics of inventoried roadless areas. The Forest Supervisor determined there may be a significant effect and directed the IDT Leader to prepare an environmental impact statement. A notice of intent to prepare an environmental impact statement was published in the Federal Register on February 28, 1994. A letter was sent March 4, 1994, informing those on the mailing list of the decision to develop an EIS. A second notice was published April 14, 1995 extending the anticipated date for release of a Final EIS, from September 1994 to September 1995.

On July 27, 1995 the President signed the Rescission Act (Public Law 104-19) which contained provisions related to emergency salvage of timber on lands administered by the U.S.D.A. Forest Service. The salvage provisions of the Act are intended to expedite salvage timber sales in order to achieve, to the maximum extent feasible, a salvage sale volume above the programmed level to reduce the backlogged volume of salvage timber within a framework of maintaining forest health and ecosystem management. The authorities provided by P.L. 104-19 are in effect until December 31, 1996.

On September 12, 1995 the Forest Supervisor determined the provisions of Public Law 104-19 applied to the South Manti Timber Salvage Sales project and directed the IDT to produce a combined environmental assessment and biological evaluation (EA/BE) to disclose the environmental impacts of the proposed action.

Response to Scoping Document

Table 5.1 lists all the persons, organizations, or agencies who responded to the Forest Supervisor with comments or issues regarding the proposed action. Twenty two responses were received concerning the project.
The following discussion presents the issues and concerns received throughout the public participation process. Comments are grouped by common viewpoints, organizations, and/or by resource issues. The scoping response number appears first followed by a narrative summary. Quotes were used whenever possible.

**Public Meeting**

3 A public meeting was held in October 1992 at the Twelvemile Campground to discuss the beetle epidemic, forest health, public and agency concerns and various scenarios that might be used to address the current situation. The following persons attended the meeting.

Vernon Oldroyd
Karl Oldroyd
Gary McFarlane
Rick Biddinger
Ross Boyack
Russel Jensen

Issues raised at the meeting were documented by Tom Shore, Sanpete District Ranger. They were:

South Manti Timber Salvage Sales EA, Page 5 - 2
CHAPTER 5

- How do the proposed sales relate to the Forest Plan and ASQ? Is this a new policy that will effect how the Forest operates in the future?
- Is the issue to save the summer home area, the overall health of the forest, or the timber operators?
- How will Threatened, Endangered, and Sensitive species and nongame wildlife concerns be handled?
- Concern over visual quality.
- Will NEPA requirements be met or is this new salvage policy an attempt to circumvent NEPA?
- Will existing roads be improved?

Commercial Industry

7 Yellowstone Log Homes is very interested in the proposed salvage sales.

Satterwhite Log Homes expressed interest in this proposal and wanted to be kept informed.

9 Doug Jones Sawmill is interested in participating in the salvage operations. They stated the sooner the better because the longer that it (spruce) remains unharvested the growth, volume, and value would be greatly affected.

10,11 Utah Forest Products supports the project and is interested in the salvage sales because they just built a new saw mill and this project is within their working circle. They urged the Forest to expedite something real soon because every year value and byproduct value is reduced. They indicated there were too many dead trees and forest health was important. Allowing the epidemic to run its course will likely cause this area to take decades to recover to a natural forested condition. They indicated there was a real demand for fiber. They wished to be kept on the bidders list and informed.

13 Kaibab Forest Products requested the Forest Service to proceed as quickly as possible to reduce the number of infested trees and also provide the necessary basal area reduction of "unit stands to a level compatible with successful protection of the residual stand. Please proceed with the action to control as much beetle buildup as possible and to salvage that timber already dead while it is in a condition where it has greater value.

2 Jack M. Anderson is interested in helping log the timber.

15 Boise Cascade expressed interest in the project and wanted to set up a meeting with Forest officials.

21 Mountain Home Logging is interested in the dead spruce for house logs. Steep slope logging methods should consider cable systems; i.e. Christy cable logging systems.

22 Spruce-Wood Products, LLC, is interested in the dead spruce for house log material. Very old dead spruce is okay unless the weather checks are deep and/or there is spiral grain.

Local Government

19 Sanpete County Commission is in support of the timber salvage proposal.

6.16 The Emery County Board of Commissioners supports the timber salvage sale. "It makes good economic, visual, and scientific sense to cut out the beetle infested trees from the forest." They urged the Forest Service to proceed quickly.

8 Source: eastern Utah Association of Local Governments is in support of forest management that would eliminate timber damaged, potentially damaged, or killed, by insect infestation. They believe the proposal will restore forest health and roadless areas should not be excluded from this management practice. Consideration should be given to both commercial and private users of wood products. Harvesting this resource in a sound manner will create jobs and business opportunities for the local people.

Utah Wilderness Association

4.5 The Utah Wilderness Association (UWA) expressed concern over the relationship between the Timber Canyon and Twelvemile Flat sales (ongoing at the time) and this larger proposed sale.

UWA expressed concern of the apparent change in Forest policy. After the Timber Canyon Sale UWA understood no additional sales were planned in the area. Now it seems the Forest Service is going back on that spirit of environmental concern and cooperation by proposing more timber sales for the southern end of the Wasatch Plateau near Timber Canyon.

"Rather than making up reasons to do a timber sale, which eventually prove to be unjustified, the Forest Service should simply tell the truth, if this timber sale is desired to meet ASQ or there is pressure to sell more timber, that should be clearly stated." How do the proposed sales relate to the Forest Plan and ASQ (from response 3)?

Old dead and dying forests are critical for many wildlife species including the three-toed woodpecker and other sensitive species. Forest management considers old, dead, and dying decadent forest habitats unhealthy and undesirable. UWA believes this attitude needs to be changed if the agency is truly concerned about biological and social diversity. Diversity provides nutrients for soils, food for microorganisms, and hiding cover for a variety of wildlife species by saying this will go elsewhere.

UWA stated... "drought, beetles, and fire have been part of these intermountain forests for the past 10,000 years. Short of totally destroying the forests by cutting all the trees we can't stop the bugs. New Forestry, the agency's own plan for ecological management, should recognize the natural processes are part of the system and integrate management to fit the natural cycles."

There should be no rush to go ahead... a policy that harvests old trees on a sustainable basis over a long period is far more environmentally and economically sensitive. "A rush to harvest based on salvage is not a windfall, so to speak, but affects sustainability in the future."
CHAPTER 5

The Forest assertion over the beetle in terms of recreation/aesthetics would be better directed at addressing specific concerns in campgrounds and summer home areas. If not, then the excuse of using the beetle to instigate timber sales ostensibly to improve recreation/aesthetics rings hollow. Visual qualities of the area would be harmed and slopes would take on different appearances after harvesting. We find it sadly humorous the Forest Service would use this sale to "rationalize" visual quality objectives.

State and Federal Agencies

14 The Utah Governor's Office of Planning and Budget, Resource Development Committee had no comments at this time.

12,18 The Utah Division of Wildlife Resources is concerned that timber salvage activities may impact cavity nesting species and old growth forest inhabitants. Species that can be negatively impacted are USFS sensitive species including northern three-toed woodpecker, northern goshawk, the flammulated owl, and other cavity nesting birds.

Other concerns include increased access through new or improved roads and trails; water quality degradation due to increased sedimentation; reclamation of roads, trails, and landings; buffer zones around nests and habitat corridors; spatial and temporal considerations of cuts; buffer zones around riparian areas; monitoring of sensitive species populations; and cumulative impacts.

20 The US Fish and Wildlife Service identified two issues. Nesting bald eagles occur in or adjacent to the proposed salvage sale area. Mexican spotted owls, a threatened species, may also occur, although no observations have been reported.

The following issues were approved by the Forest Supervisor based on IDT analysis of the public scoping responses. Some issues were determined to be outside the scope of the proposed action and/or already decided by law or Forest Plan decision (Project File). Table 5.2 compares the issues to be analyzed with the scoping response. The intent is to also show responsiveness of the selected issues to public issues and concerns raised during scoping.

1. What will be the effects of harvesting green, live spruce, in addition to the dead and dying spruce, to reduce the overall risk of spruce beetle attack and subsequent mortality on currently unaffected timber stands?
2. What will be the effects of timber harvest and road construction on the roadless character?
3. What will be the visual effects on the landscape resulting from timber harvest and road construction?
4. What will be the effects of timber harvest and construction of roads on Threatened, Endangered, or Sensitive wildlife and plant species?
5. What will be the effects of timber harvest and construction of roads on wildlife habitat?
6. What will be the effects of timber harvest and construction of roads on cultural resources?
7. What will be the effects of timber harvest and construction of roads on fuels and the potential risk of unmanageable fire?

8. What will be the effects of timber harvest and construction of roads on water quality, quantity, riparian/wetland vegetation and fisheries, and downstream beneficial uses of the water resources?
9. What will be the effects of timber harvest and construction of roads on visitor safety, access, and Forest user travel delays?
10. What will be the effects of timber harvest and construction of roads on economics?
11. What will be the effects of timber harvest and construction of roads on air quality?
12. What will be the effects of timber harvest and construction of roads on the spread of noxious weeds?
13. What will be the effects of timber harvest and construction of roads on soil productivity and land stability?
14. What will be the effects of timber harvest and construction of roads on range allotments?
15. What will be the effects of timber harvest and construction of roads on energy use?
### CHAPTER 5

#### TABLE 5.2
**ISSUE RESPONSIVENESS TO SCOPING DOCUMENTATION RECEIVED**

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<tr>
<th>ISSUE</th>
<th>SCOPING DOCUMENTATION NUMBER</th>
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<tr>
<td>1. Timber Health, Diversity, and Productivity</td>
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<td>2. Roadless Character</td>
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<td>3. Visual Character</td>
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<td>4. Threatened, Endangered, and Sensitive Animal and Plant Species</td>
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<td>5. Deer, Elk, and Neotropical Birds</td>
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<td>6. Cultural Resources</td>
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<td>7. Fuel Loading and Fire Risk</td>
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<td>8. Water Quality and Quantity, Riparian and Fish Habitat</td>
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<td>9. Visitor Safety, Access, and Travel Delays</td>
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<td>10. Economics</td>
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<td>11. Air Quality</td>
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<td>12. Noxious Weeds</td>
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<td>13. Soil Productivity and Land Stability</td>
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<td>14. Range Allotments and Improvements</td>
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<td>15. Energy</td>
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### 5.2 LIST OF PREPARERS

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<thead>
<tr>
<th>Name</th>
<th>Area of Expertise</th>
<th>Education</th>
<th>Experience (Years)</th>
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<tr>
<td><strong>Core IDT</strong></td>
<td></td>
<td></td>
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<tr>
<td>Martha DeFreest</td>
<td>Transportation Planner</td>
<td>B.S. Civil Engineering</td>
<td>6</td>
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<tr>
<td>Kevin Draper</td>
<td>Visuals, Roadless, Recreation</td>
<td>B.S. Wildlife and Range M.L.A. Landscape Architect</td>
<td>5</td>
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<tr>
<td>Jill Dufour</td>
<td>Aquatic Habitat</td>
<td>B.S. Fisheries Science M.S. Fisheries and Wildlife</td>
<td>10</td>
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<tr>
<td>David Hatfield</td>
<td>ID Team Leader</td>
<td>B.A. Natural Science M.S. Geology</td>
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<tr>
<td>Glen Jackson</td>
<td>Forester Contract Administration</td>
<td>B.S. Forest Management</td>
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<tr>
<td>Pete Kilbourne</td>
<td>GIS Coordinator</td>
<td>B.A. Geology</td>
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<td><strong>Extended IDT</strong></td>
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<tr>
<td>Judy Beacco</td>
<td>Editing/Publishing</td>
<td>B.S. Forest Management</td>
<td>5</td>
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<tr>
<td>Diane Cote</td>
<td>Silviculture</td>
<td>B.S. Forestry Certified Silviculturist</td>
<td>19</td>
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<tr>
<td>Bill Dye</td>
<td>Forester</td>
<td>B.S. Forest Recreation</td>
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<td>John Healy</td>
<td>Rangeland Vegetation</td>
<td>B.S. Forest Watershed</td>
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<tr>
<td>Dennis Kelly</td>
<td>Water Quantity, Water Quality, Riparian/Wetlands</td>
<td>B.S. Forest Engineering M.S. Forest Hydrology</td>
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<tr>
<td>Dan Larsen</td>
<td>Soils</td>
<td>B.S. Natural Resource M.S. Soil Science</td>
<td>27</td>
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<tr>
<td>Stan McDonald</td>
<td>Cultural Resources</td>
<td>B.S., M.A. Anthropology</td>
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</table>
### CHAPTER 5

#### 5.3 LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS TO WHOM THE EA/BE HAS BEEN SENT

<table>
<thead>
<tr>
<th>AGENCIES</th>
<th>ORGANIZATIONS</th>
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<tr>
<td>Utah State Office of Planning/Budget</td>
<td>Cottonwood Creek Livestock Assn</td>
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<tr>
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#### Forest Management Team

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<tr>
<th>Name</th>
<th>Position</th>
<th>Education</th>
<th>Experience (Years)</th>
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<tr>
<td>Janette Archibeque</td>
<td>Staff Officer</td>
<td>B.S. Biological Science</td>
<td>23</td>
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<tr>
<td>Don Fullmer</td>
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<td>M.S. Wildland Resource Science</td>
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<tr>
<td>Aaron Howe</td>
<td>Staff Officer</td>
<td>B.S. Civil Engineering</td>
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<tr>
<td>Reed Irwin</td>
<td>Forest Planner</td>
<td>B.S., M.A. Geology</td>
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<tr>
<td>Charlie Jankiewicz</td>
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<tr>
<td>Darwin Jensen</td>
<td>Recreation/Lands</td>
<td>B.S. Range Management</td>
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<tr>
<td>Janette Kaiser</td>
<td>Forest Supervisor</td>
<td>B.S. Natural Resource Management and Range Ecology</td>
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<tr>
<td>Tom Shore</td>
<td>District Ranger</td>
<td>B.S. Forest Range Management</td>
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<th>Name</th>
<th>Area of Expertise</th>
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<tbody>
<tr>
<td>Greg Montgomery</td>
<td>Forest Vegetation, Silviculture</td>
<td>B.S. Forestry, Certified Silviculturist</td>
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<tr>
<td>Larry Mickleisen</td>
<td>Rangeland Vegetation</td>
<td>B.S. Range Science, M.S. Plant Science</td>
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<tr>
<td>Don Okerlund</td>
<td>Forester</td>
<td>B.S. Forest and Watershed Management</td>
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<tr>
<td>JayLynn Pell</td>
<td>Editing/Publishing</td>
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<tr>
<td>Rod Player</td>
<td>Wildlife</td>
<td>B.S. Range Science, M.S. Range/Wildlife Relations</td>
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<tr>
<td>Carter Reed</td>
<td>Geology, Land Stability</td>
<td>B.S. Geology</td>
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<tr>
<td>Bob Thompson</td>
<td>Botany, Range</td>
<td>B.S. Botany</td>
<td>41</td>
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<tr>
<td>Jon Tucker</td>
<td>Fire/Fuels</td>
<td>Associate of Science</td>
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CHAPTER 5

Utah Forest Products
Lon Sawmill, Inc.
Grand Canyon Trust
Stone Forest Industries

Kaibab Forest Products
Public Timber Purchasers Group
Small Business Administration
SRS Timber

INDIVIDUALS

Edward S. Syrjala
Nickolas Wylie
Jim Dayton
Craig Muzzy
Lewis Freemen
Smokey Conney
Leon Moores
Jack Anderson
MSShaw
Jim Peacock
Steve Brown
Adrian Gerritsen
Grant and Esther Burbidge
C. Jay or Natalie Larson
Andy Ludon Jensen
Honorable Orin G. Hatch
Honorable Robert Bennett
Garth Baxter
Blake Liddell
Bob Searcy
Jerry and Frances Price
Joel Frandsen
Mr. and Mrs. Biddinger
Randi and Wendy Cowley
Ross Boyack

Jack Tate
Gerald Stanton
H. Riedel George
Jack J. Funk
Bob Searly
Ira Hatch
Lee McElprang
Maughn Guyton
Russel Jensen
Jack Campbell
Ken Sleight
Max Jensen
Owen Severance
Mark V. or Ruth Bunderson
Honorable Bill Orton
James Gregerson
Ada J. and Perry Ellason
Eugene Bartholomew
Lane Elliott
Charles R. Holliday
Wesley and Barbara George
Tom Livingston
William M. Miller
Robert M. Kennedy

CHAPTER 6

Glossary and References
6.0 INTRODUCTION

This chapter includes a glossary of terms and references cited in this draft environmental impact statement.

6.1 GLOSSARY

**abiotic**: Non-living. Climate is an abiotic component of ecosystems.

**adaptive management**: A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

**aerial logging**: Removing logs from a timber harvest area by helicopter. Fewer roads are required, so the impact to an area is minimized.

**affected environment**: The natural environment that exists at the present time in an area being analyzed.

**age class**: An age grouping of trees according to an interval of years, usually 20 years. A single age class would have trees that are within 20 years of the same age, such as 1-20 years or 21-40 years.

**allotment (range allotment)**: The area designated for use by a prescribed number of livestock for a prescribed period of time. Though an entire Ranger District may be divided into allotments, all land will not be grazed, because other uses, such as recreation or tree plantings, may be more important at a given time.

**anadromous fish**: Species of fish that mature in the sea and migrate into streams to spawn.

**aspect**: The direction a slope faces. A hillside facing east has an eastern aspect.

**ASQ (allowable sale quantity)**: The amount of timber that may be sold within a certain time period from an area of suitable land. The suitability of the land and the time period are specified in the Forest Plan.

**aquatic macroinvertebrates**: Invertebrates living within aquatic systems that are large enough to be seen with the naked eye (e.g., most aquatic insects).

**aquifer**: A body of rock that is saturated with water or transmits water. When people drill wells, they tap water contained within an aquifer.

**AUM (animal unit month)**: The quantity of forage required by one mature cow and her calf (or the equivalent, in sheep or horses, for instance) for one month.

**bark beetle**: An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs. Bark beetles are important killers of forest trees.

**basal area**: The area of the cross section of a tree trunk near its base, usually 4 and 1/2 feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

**big game**: Large mammals, such as deer, elk, and antelope that are hunted for sport.

**biological control**: The use of natural means to control unwanted pests. Examples include introduced or naturally occurring predators such as wasps, or hormones that inhibit the reproduction of pests. Biological controls can sometimes be alternatives to mechanical or chemical means.

**biological diversity**: The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

**biomass**: The total weight of all living organisms in a biological community.

**biome**: The complex of living communities maintained by the climate of a region and characterized by a distinctive type of vegetation. Example of biomes in North America include the tundra, desert, prairie, and the western coniferous forests.

**biota**: The plant and animal life of a particular region.

**biotic**: Living. Green plants and soil microorganisms are biotic components of ecosystems.

**BMP (Best Management Practices)**: Practices designed to prevent or reduce water pollution. Also, referred to as Soil and Water Conservation Practices (SWCPs).

**board foot**: A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

**broadcast burn**: A prescribed fire that burns a designated area. These controlled fires can reduce wildfire hazards, improve forage for wildlife and livestock, or encourage successful regeneration of trees.

**browse**: Twigs, leaves, and young shoots of trees and shrubs that animals eat. Browse is often used to refer to the shrubs eaten by big game, such as elk and deer.

**BTU**: British Thermal Unit; the quantity of heat required to raise the temperature of one pound of water 1 degree fahrenheit.

**buffer**: A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Buffer strips along a trail could block views that may be undesirable. Buffers may be set aside next to wildlife habitat to reduce abrupt change to the habitat.
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C

cable logging- Logging that involves the transport of logs from stump to collection points by means of suspended steel cables. Cable logging reduces the need for the construction of logging roads.

canopy- The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied forest.

canopy cover- see cover class.

capture (input)- one of the ways functions are described; resources (organisms, materials, and energy) brought into the system (i.e. photosynthesis, migration into summer range, pollution brought in by wind or water).

cavity- A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.

chemical control- The use of pesticides and herbicides to control pests and undesirable plant species.

clear cut- A harvest in which all or almost all of the trees are removed in one cutting.

climax- The culminating stage in plant succession for a given site. Climax vegetation is stable, self-maintaining, and self-reproducing.

coarse filter management- Land management that addresses the needs of all associated species, communities, environments, and ecological processes in a land area. (See fine filter management.)

collector roads- These roads serve small land areas and are usually connected to a Forest System Road, a county road, or a state highway.

common (Class B) landscape- Areas where features contain variety in form, line, color, and texture or combinations thereof, but which tend to be common throughout the character type and are not outstanding in visual quality.

composition- What an ecosystem is composed of. Composition could include water, minerals, trees, snags, wildlife, soil, microorganisms, and certain plant species.

conifer- A tree that produces cones, such as a pine, spruce, or fir tree.

connectivity (of habitats)- The linkage of similar but separated vegetation stands by patches, corridors, or "stepping stones" of like vegetation. This term can also refer to the degree to which similar habitats are linked.

consumptive use- Use of resources that reduces the supply, such as logging and mining.

tour- An opening in the forest cover created by the cutting of trees.

corridor- Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

cover- Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to escape from predators, rest, or feed.

cover class- Represents a percentage range for a fixed area covered by the crowns of plants. It is measured as a vertical projection of the outermost portion of the foliage. Cover class A = 0-40% canopy cover; cover class B = 40-60% canopy cover; cover class C = >60% canopy cover.

cover forage ratio- The ratio of hiding cover to foraging areas for wildlife species.

cover type (forest cover type)- Stands of a particular vegetation type that are composed of similar species. The aspen cover type contains plants distinct from the pinyon-juniper cover type.

created opening- An opening in the forest cover created by the application of even-aged silvicultural practices.

critical habitat- Areas designated for the survival and recovery of federally listed threatened or endangered species.

crown closure- see cover class.

crown height- The distance from the ground to the base of the crown of a tree.

cultural resource- The remains of sites, structures, or objects used by people in the past; this can be historical or pre-historic.

cumulative effects - Effects on the environment that result from separate, individual actions that, collectively, become significant over time.

cycling- One of the ways functions are described; resources which are transported within the system (i.e. animal migration, nutrient cycling in a forest stand, snow melt becoming part of the surface or groundwater flow).

dbh (diameter at breast height)- The diameter of a tree 4 and 1/2 feet above the ground on the uphill side of the tree.

decision criteria- The rules and standards used to evaluate alternatives to a proposed action on National Forest land. Decision criteria are designed to help a decisionmaker identify a preferred choice from the array of alternatives.

decking area- A site where logs are collected after they are cut and before they are taken to the landing area where they are loaded for transport.

DEIS (Draft Environmental Impact Statement)- The draft version of the Environmental Impact Statement that is released to the public and other agencies for review and comment.

desired future condition- Land or resource conditions that are expected to result if goals and objectives are fully achieved.
CHAPTER 6

developed recreation- Recreation that requires facilities that, in turn, result in concentrated use of the area. For example, skiing requires ski lifts, parking lots, buildings, and roads. Campgrounds require roads, picnic tables, and toilet facilities.

dispersed recreation- Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.

distinctive (Class A) landscape- Areas where features of landform, vegetative patterns, water forms, and rock formations are of unusual or outstanding visual quality.

disturbance- Any event, such as forest fire or insect infestations that alter the structure, composition, or functions of an ecosystem.

E

early forest succession- The biotic (or life) community that develops immediately following the removal or destruction of vegetation in an area. For instance, grasses may be the first plants to grow in an area that was burned.

ecological approach- An approach to natural resource management that considers the relationships among all organisms, including humans, and their environment.

ecology- The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

ecoregion- An area over which the climate is sufficiently uniform to permit development of similar ecosystems on sites that have similar properties. Ecoregions contain many landscapes with different spatial patterns of ecosystems.

ecosystem- An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within ecosystems.

ecosystem management- An ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, physical, and biological needs and values

ecotone- The transition zone between two biotic communities, such as between the Ponderosa pine forest type and the mixed conifer forest, which is found at higher elevations than the pine.

ecotype- A population of a species in a given ecosystem that is adapted to a particular set of environmental conditions.

edge- The margin where two or more vegetation patches meet, such as a meadow opening next to a mature forest stand, or a ponderosa pine stand next to an aspen stand.

edge effect- the increased richness of plants and animals resulting from the mixing of two communities where they join.
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element (of ecosystems) - An identifiable component, process, or condition of an ecosystem.

endangered species - A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

demic plant/organism - A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.

environmental analysis - An analysis of alternative actions and their predictable long and short-term environmental effects. Environmental analyses include physical, biological, social, and economic factors.

environmental assessment - A brief version of an Environmental Impact Statement. (See Environmental Impact Statement.)

Environmental Impact Statement - A statement of environmental effects of a proposed action and alternatives to it. The EIS is released to other agencies and the public for comment and review.

ephemeral streams - Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow.

erosion - The wearing away of the land surface by wind or water.

escape cover - Vegetation of sufficient size and density to hide an animal, or an area used by animals to escape from predators.

even aged management - Timber management actions that result in the creation of stands of trees in which the trees are essentially the same age.

eyrie - a ledge along a cliff used for nesting by peregrine falcons.

fauna - The animal life of an area.

forest development roads (FDR) - Roads that are part of the Forest development transportation system which includes existing and planned roads as well as other special and terminal facilities designated as Forest development transportation facilities; an existing road that is shown on the Forest Travel map and maintained for access.

felling - Cutting down trees.

final cut - The removal of the last seed bearers or shelter trees after regeneration of new trees has been established in a stand being managed under the shelterwood system of silviculture.

fine filter management - Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem. (See coarse filter management.)

flood plain - A lowland adjoining a watercourse. At a minimum, the area is subject to a 1% or greater chance of flooding in a given year.

flora - The plant life of an area.

forage - All browse and non-woody plants that are eaten by wildlife and livestock.

forb - A broadleaf plant that has little or no woody material in it.

foreground - The part of a scene or landscape that is nearest to the viewer.

forest cover type - See cover type.

Forest Vegetation Simulation - A computer model for timber growth and yield. It projects per acre growth and volume yield for commercial timber stands. Formerly known as "Prognosis".

forest health - A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity; soil, air, and water productivity; natural disturbances; and the capacity of the forest to provide a sustaining flow of goods and services for people.

Forest Roads and Trails - Roads and trails under the jurisdiction of the Forest Service.

Forest Supervisor - The official responsible for administering National Forest lands on an administrative unit, usually one or more National Forests. The Forest Supervisor reports to the Regional Forester.

fragmentation - The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat. Habitat can be fragmented naturally or from forest management activities, such as clearcut logging.

frost heave - A land surface that is pushed up by the accumulation of ice in the underlying soil.

fuels - Plants and woody vegetation, both living and dead, that are capable of burning.

fuels management - The treatment of fuels that would otherwise interfere with effective fire management or control. For instance, prescribed fire can reduce the amount of fuels that accumulate on the forest floor before the fuels become so heavy that a natural wildfire in the area would be explosive and impossible to control.

fuels - Wood cut into short lengths for burning.

function - All the processes within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.
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GAME SPECIES- Any species of wildlife or fish that is harvested according to prescribed limits and seasons.

GEOMORPHIC PROCESSES- Processes that change the form of the earth, such as volcanic activity, running water, and glacial action.

GEOMORPHOLOGY- The science that deals with the relief features of the earth's surface.

GIS (geographic information systems)- GIS is both a database designed to handle geographic data as well as a set of computer operations that can be used to analyze the data. In a sense, GIS can be thought of as a higher order map.

GROUND FIRE- A fire that burns along the forest floor and does not affect trees with thick bark or high crowns.

GROUND WATER- The supply of fresh water under the earth's surface in an aquifer or in the soil.

GROUP SELECTION- A method of tree harvest in which trees are removed periodically in small groups. This silvicultural treatment results in small openings that form mosaics of age class groups in the forest.

HABITAT- The area where a plant or animal lives and grows under natural conditions.

HABITAT CAPABILITY- The ability of a land area or plant community to support a given species of wildlife.

HABITAT DIVERSITY- A number of different types of wildlife habitat within a given area.

HABITAT DIVERSITY INDEX- A measure of improvement in habitat diversity.

HABITAT TYPE- A way to classify land area. A habitat type can support certain climax vegetation, both tree and undergrowth species. Habitat typing can indicate the biological potential of a site.

HIDING AREA/COVER- Vegetation capable of hiding 90% of an adult elk or deer from human's view at a distance of 300 feet or less.

HORIZONTAL DIVERSITY- The distribution and abundance of different plant and animal communities or different stages of plant succession across an area of land; the greater the numbers of communities in a given area, the higher the degree of horizontal diversity.

HYDROLOGIC CYCLE- Also called the water cycle, this is the process of water evaporating, condensing, falling to the ground as precipitation, and returning to the ocean as run-off.

HYDROLOGY- The science dealing with the study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

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INDICATOR SPECIES- A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

INDIGENOUS (SPECIES)- Any species of wildlife native to a given land or water area by natural occurrence.

INDIVIDUAL TREE SELECTION- The removal of individual trees from certain size and age classes over an entire stand area. Regeneration is mainly natural, and an uneven aged stand is maintained.

INDUCED EDGE- an edge that results from the meeting of two successional stages or vegetative conditions within a plant community. These can be created by disturbance (i.e. grazing, timber harvest, fire, insect outbreaks).

INHERENT EDGE- an edge that results from the meeting of two plant community types. These often result from abrupt changes in soil type, topographic differences, geomorphic differences, and changes in microclimate.

INSTREAM FLOW- The quantity of water necessary to meet seasonal stream flow requirements to accomplish the purposes of the National Forests, including, but not limited to fisheries, visual quality, and recreational opportunities.

INTEGRATED PEST MANAGEMENT- IPM evaluates alternatives for managing forest pest populations, based on consideration of pest-host relationships.

INTERDISCIPLINARY TEAM- A team of individuals with skills from different disciplines that focuses on the same task or project.

INTERMEDIATE CUT- The removal of trees from a stand sometime between the beginning or formation of the stand and the regeneration cut. Types of intermediate cuts include thinning, release, and improvement cuttings.

INTERMITTENT STREAM- A stream that flows only at certain times of the year when it receives water from streams or from some surface source, such as melting snow.

INTERMOUNTAIN REGION- The portion of the USDA Forest Service, also referred to as Region Four, that includes National Forests in Utah, Nevada, southern Idaho, and southwestern Wyoming.

IRREREVERSIBLE- One of the categories of impacts mentioned in the National Environmental Policy Act to be excluded in statements of environmental impacts. An irreversible effect applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. If the ski area closes, timber production could resume; the loss of timber production during the time that the area was devoted to winter sports is irreversible. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

IRREREVERSIBLE- A category of impacts mentioned in statements of environmental impacts that applies to non-renewable resources, such as minerals and archaeological sites. Irreversible effects can also...
CHAPTER 6

refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.

K

key summer range- The portion of a wildlife species' summer range that is essential for the animal's pre, post, and reproduction cycles. Deer require "fawning areas" where does give birth and hide their fawns for an essential period of time in the spring.

key winter range- That portion of big game's range where the animals find food and cover during severe winter weather.

L

ladder fuels- Vegetation located below the crown level of forest trees which can carry fire from the forest floor to tree crowns. Ladder fuels may be low-growing tree branches, shrubs, or smaller trees.

land class- The topographic relief of a unit of land. Land classes are separated by slope; this coincides with the timber inventory process. The three land classes used in the Forest Plan are defined by the following slope ranges: 0 to 35 percent; 36 to 55 percent; and greater than 55 percent.

landing- Any place where cut timber is assembled for further transport from the timber sale area.

landline- The boundary lines for National Forest land.

landscape- A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts. Landscapes are often used for coarse grain analysis.

land use planning- The process of organizing the use of lands and their resources to best meet people's needs over time, according to the land's capabilities.

late forest succession- The stage of forest succession in which most of the trees are mature or overmature.

life zone- Areas or "belts" of land that have distinct plant and animal characteristics determined by elevation, latitude, and climate. When ascending a high mountain, you will pass through these life zones. Examples of life zones include the Upper Sonoran, where Cedar City is located and gramna grasses, sagebrush, and scattered pinyon juniper predominate, and the Transition zone, where Ponderosa pine is predominant.

litter (forest litter)- The freshly fallen or only slightly decomposed plant material on the forest floor. This layer includes foliage, bark fragments, twigs, flowers, and fruit.

logging residue (slash)- The residue left on the ground after timber cutting. It includes unutilized logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.
mitigation- Actions taken to avoid, minimize, or rectify the impact of a land management practice.
mixed stand- A stand consisting of two or more tree species.
MM- Million
MMBF- Million Board Feet (See board feet.)
modification- A visual quality objective; management activities may visually dominate the original characteristic landscape, but they must borrow from naturally established form, line, color, or texture so that the activity blends with the surrounding area.
monitoring and evaluation- The periodic evaluation of forest management activities to determine how well objectives were met and how management practices should be adjusted. See "adaptive management".
mortality- Trees that were merchantable and have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.
mosaic- Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.
mountain pine beetle- A tiny black insect, ranging from 1/8 to 3/4 inch in size, that bores through a pine tree's bark. It stops the tree's intake and transport of the food and nutrients it must have to stay alive, thus killing the tree.
multiple use management- The management of all the various renewable surface resources of National Forest lands for a variety of purposes such as recreation, range, timber, wildlife and fish habitat, and watershed.

National Park Service- The agency of the US Department of the Interior responsible for the administration of National Parks, Monuments, and Historic Sites. It is distinct from the USDA Forest Service both administratively and by mission.
natural barrier- A natural feature, such as a dense stand of trees or downfall, that will restrict animal travel.
natural disturbance- See disturbance.
natural range of variability- See range of variability
natural resource- A feature of the natural environment that is of value in serving human needs.
NEPA (National Environmental Policy Act) - Congress passed NEPA in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be included in the public and other agencies for review and comment.
CHAPTER 6

old growth- Old forests often containing several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material.

organic soil- Soil at least partly derived from living matter, such as decayed plant material.

ORV- Off-road vehicles, such as motor cycles, 4-wheel drive vehicles, and 4-wheelers.

output- one of the ways functions are described; resources which leave a system (i.e. animals migrating out of an area, mass erosion, removal of commercial timber from an area).

over-mature timber- Trees that have attained full development, particularly in height, and are declining in vigor, health, and soundness.

overstory- The upper canopy layer; the plants below comprise the understory.

parent material- The mineral or organic matter from which the upper layers of soil are formed.

park-like structure- Stands with large scattered trees and open growing conditions, usually maintained by ground fires.

partial retention- A visual quality objective which, in general, means human activities may be evident, but must remain subordinate to the characteristic landscape.

patch- An area of homogeneous vegetation, in structure and composition.

patch cut- A clearcut that creates small openings in a stand of trees, usually between 15 and 40 acres in size. On the Dixie National Forest and elsewhere, patchcuts are used to provide the disturbance needed to regenerate aspen.

percolation- Downward flow or infiltration of water through the pores or spaces of rock or soil.

perennial stream- A stream that flows throughout the year and from source to mouth.

permitted grazing- Grazing on a National Forest range allotment under the terms of a grazing permit.

personal use- The use of a forest product, such as firewood, for home use and not for commercial use.

persons-at-one-time (PAOT)- A recreation capacity measurement term indicating the number of people who can use a facility or area at one time.

planning area- The area of National Forest land covered by a Regional Guide or Forest Plan.

planning period- The 50 year time frame for which goods, services, and effects were projected in the development of the Forest Plan.
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public land- Land for which title and control rests with a government—Federal, state, regional, county, or municipal.

public involvement- The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision making.

quadratic mean diameter (QMD)- indicates the diameter of the cross-section of average area. This number is used for determining basal area and volume.

range- Land on which the principle natural plant cover is composed of native grasses, forbs, and shrubs that are valuable as forage for livestock and big game.

range management- The art and science of planning and directing range use intended to yield the sustained maximum animal production and perpetuation of the natural resources.

range of variability (Also called the historic range of variability or natural range of variation.- The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10 year fire cycle have a narrower range of variation than ecosystems with 200-300 year fire cycle. Past management has placed some ecosystems outside their range of variability. Future management should move such ecosystems back toward their natural, sustainable range of variation.

Ranger District- The administrative sub-unit of a National Forest that is supervised by a District Ranger who reports directly to the Forest Supervisor.

raptor- A bird of prey, such as an eagle or hawk.

RARE II- Roadless Area Review and Evaluation. The national inventory of roadless and undeveloped areas within the National Forests and Grasslands.

recharge- The addition of water to ground water by natural or artificial processes.

recreation visitor days (RVD)- Twelve visitor hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

reforestation- The restocking of an area with forest trees, by either natural or artificial means, such as planting.

regeneration- The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

Regional Forester- The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.

release cutting- Removal of competing vegetation to allow desired tree species to grow.

removal cut- The removal of the last seed bearers or shelter trees after regeneration is established.

residual stand- The trees remaining standing after an event such as selection cutting.

resilience- The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.

responsible official- The Forest Service employee who has been delegated the authority to carry out a specific planning action.

restoration (of ecosystems)- Actions taken to modify an ecosystem to achieve a desired, healthy, and functioning condition.

retention- A visual quality objective; management activities are not visibly evident; activities repeat form, line, color, and texture characteristics found in the landscape.

revitalization- The re-establishment and development of a plant cover by either natural or artificial means, such as re-seeding.

 riparian area- The area along a watercourse or around a lake or pond.

 riparian ecosystem- The ecosystems around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

ROD- Record of Decision. A official document in which a deciding official states the alternative that will be implemented from a prepared EIS.

ROS- Recreation Opportunity Spectrum. The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords.

rotation- The number of years required to establish and grow timber crops to a specified condition of maturity.

roundwood- Timber and fuelwood prepared in the round state, such as house logs and telephone poles.

run-off- The portion of precipitation that flows over the land surface or in open channels.

sacrifice area/site- In range management, a site allowed to be overgrazed to obtain efficient overall use of the management area. In cultural resource management, it may refer to a site intentionally sacrificed to extensive public use in order to preserve the larger cultural area.

salvage harvest- Harvest of trees that are dead, dying, or deteriorating because they are overmature or have been materially damaged by fire, wind, insects, fungi, or other injurious agents, before the wood becomes unmerchantable.

sanitation harvest- The harvest of dead, damaged or susceptible trees done primarily to prevent the spread of pests or disease and to promote forest health.
**CHAPTER 6**

**sapling**: A loose term for a young tree more than a few feet tall and an inch or so in diameter that is typically growing vigorously.

**sawtimber**: Trees that are 9 inches in diameter at breast height or larger that can be made into lumber.

**scale**: In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.

**scoping**: The ongoing process to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process. It may involve public meetings, telephone conversations, or letters.

**second growth**: Forest growth that was forest crop, such as cutting, fire, or insect attack.

**seed tree harvest**: Removal of the mature timber crop from an area in one cut, except for a certain number of seed bears.

**sensitive species**: Plant or animal species which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of Threatened or Endangered Species made by the US Fish and Wildlife Service.

**seral**: The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.

**shelterwood**: A cutting method used in a more or less mature stand, designed to establish a new crop under the protection of the old.

**silvicultural system**: The cultivation of forests; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

**silviculture**: The art and science that promotes the growth of single trees and the forest as a biological unit.

**single tree selection**: See individual tree selection.

**site preparation**: The general term for removing unwanted vegetation, slash, roots, and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

**size class**: One of the three intervals of tree stem diameters used to classify timber in the Forest Plan data base. The size classes are: Seedling/Sapling (less than 5 inches in diameter); Pole Timber (5 to 7 inches in diameter); Sawtimber (greater than 7 inches in diameter)

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**skidding**: Hauling logs by sliding, not on wheels, from stump to a collection point.

**skid trail**: Narrow path on which logging equipment travel when moving logs from the forest to a designated landing location.

**skid days**: Twelve skier hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

**skyline logging**: A logging system used to remove timber from steep slopes. Logs are brought up-slope on a suspended cable, or skyline. Since the weight of the log is completely or partially supported by the cable, there is little disturbance to soil or other vegetation.

**slash**: The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

**slump**: A landslide where the underlying rock masses tilt back as they slide from a cliff or escarpment.

**small game**: Birds and small animals normally hunted or trapped.

**snag**: A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

**soil compaction**: The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

**soil productivity**: The capacity of a soil to produce a specific crop. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.

**sound wood**: Timber that is in solid, whole, good condition. Sound wood is free from damage, decay, or defects.

**special use permit**: A permit issued to an individual or group by the USDA Forest Service for use of National Forest land for a special purpose. Examples might be a Boy Scout Jamboree or a mountain bike race.

**stand**: A group of trees that occupies a specific area and is similar in species, age, and condition.

**stand density index (SDI)**: The index number is the number of trees per acre at an average stand diameter of 10 inches. This index changes for different species, since some trees are more shade tolerant than others (i.e. the maximum trees per acre for Engelmann spruce-subalpine fir stand is 670 and for ponderosa pine is 450).

**standards and guidelines**: Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection.

**stewardship**: Caring for the land and its resources to pass healthy ecosystems to future generations.

**stocking level**: The number of tree in an area as compared to the desirable number of trees for best results, such as maximum wood production.
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storage: one of the ways functions are described; resources which are conserved within the system (i.e. sediments and water retained in wetlands, carbon and other nutrient storage in down woody material).

stringer: A strip of vegetation different from surrounding vegetation, such as a stringer of aspen in a area of spruce.

structure: How the parts of ecosystems are arranged, both horizontally and vertically. These parts include vegetation patches, edge, fragmentation, canopy layers, snags, down wood, steep canyons, rocks in streams, and roads. For example, structure might reveal a pattern, or mosaic, or total randomness of vegetation.

suitability: The appropriateness of certain resource management to an area of land. Suitability can be determined by environmental and economic analysis of management practices.

successional stage: A stage of development of a plant community as it moves from bare ground to climax. The grass-forb stage of succession precedes the woody shrub stage.

succession: The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

surface resources: Renewable resources that are on the surface of the earth, such as timber and forage, in contrast to ground water and minerals which are located beneath the surface.

sustainability: The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

sustainable: The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

sustained yield: The yield that a renewable resource can produce continuously at a given intensity of management.

Soil and Water Conservation Practices (SWCPs): Refer to BMPs.

system road: Roads that are part of the Forest development transportation system. (see forest development roads)

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target: A National Forest's annual goals for accomplishment for natural resource programs. Targets represent the commitment the Forest Service has with Congress to accomplish the work Congress has funded, and are often used as a measure of the agency's performance.

thermal cover: Cover used by animals against weather. For elk, thermal cover can be found in a stand of coniferous trees at least 40 feet tall with a crown closure of at least 70%.

thinning: A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.

thinning: A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.

CHAPTER 6

threatened species: Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

timber classification: The classification of forested lands into land management alternatives according to how the land relates to management of the timber resource there.

tractor logging: A logging method that uses tractors to carry or drag logs from the stump to a collection point.

treatment area: The site-specific location of a resource improvement activity.

tree opening: An opening in the forest created by even-aged silvicultural practices.

TSI (Timber Stand Improvement): Actions to improve growing conditions for trees in a stand, such as thinning, pruning, prescribed fire, or release cutting.

type conversion: The conversion of the dominant vegetation in an area from forested to non-forested or from one species to another.

understory: The trees and woody shrubs growing beneath the overstory in a stand of trees.

understory: The trees and woody shrubs growing beneath the overstory in a stand of trees.

unregulated harvest: Tree harvest that is not part of the allowable sale quantity (ASQ). It can include the removal of culled or dead material or non-commercial species. It also includes volume removed from non-suitable areas for research, to meet objectives other than timber production (such as wildlife habitat improvement), or to improve administrative sites (such as campgrounds).

unsuitable lands: Forest land that is not managed for timber production. Reasons may be matters of policy, ecology, technology, silviculture, or economics.

use, allowable: An estimate of proper range use. Forty to fifty percent of the annual growth is often used as a rule of thumb on ranges in good to excellent condition. It can also mean the amount of forage planned to be used to accelerate range rehabilitation.

variety class: A way to classify landscapes according to their visual features. This system is based on the premise that landscapes with the greatest variety or diversity have the greatest potential for scenic value.

vegetation management: Activities designed primarily to promote the health of forest vegetation for multiple-use purposes.
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vegetation type- A plant community with distinguishable characteristics.

vegetative structural stage- A method of describing the growth stages of a stand of living trees: it is based on tree size (DBH, diameter at breast height) and total canopy cover. The stages are:
- Grass/forb/shrub (VSS 1) = 0-1 inch DBH
- Seedling/sapling (VSS 2) = 1-5 inches DBH
- Young Forest (VSS 3) = 5-12 inches DBH
- Middle-aged Forest (VSS 4) = 12-18 inches DBH
- Mature Forest (VSS 5) = 18-24 inches DBH
- Old Forest (VSS 6) = 24+ inches DBH

vertical diversity- The diversity in a stand that results from the different layers or tiers of vegetation.

viable population- The number of individuals of a species sufficient necessary to ensure the long-term existence of the species in natural, self-sustaining populations, adequately distributed throughout its range.

virgin forest- A natural forest virtually uninfluenced by human activity.

visual quality objective- A set of measurable goals for the management of forest visual resources used to measure the amount of visual contrast with the natural landscape caused by human activities.

visual resource- A part of the landscape important for its scenic quality. It may include a composite of terrain, geologic features, or vegetation.

watershed- The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

water table- The upper surface of groundwater. Below it, the soil is saturated with water.

water yield- The runoff from a watershed, including groundwater outflow.

wetlands- Areas that are permanently wet or are intermittently covered with water.

wilderness (Wilderness Area)- Undeveloped federal land retaining its primeval character, without permanent human habitation or improvements. It is protected and managed to preserve its natural condition. Wilderness Areas are designated by Congress.

wildfire- Any wildland fire that is not a prescribed fire.

wildlife habitat diversity- The distribution and abundance of different plant and animal communities and species within a specific area.

windthrow- Trees uprooted by wind.

wood fiber production- The growing, tending, harvesting, and regeneration of harvestable trees.

woodland products- Harvestable items from pinyon-juniper woodlands. These include fuelwood, posts, pine nuts and Christmas trees.
CHAPTER 6

6.2 REFERENCES

SUMMARY


CHAPTER 1


CHAPTER 2


CHAPTER 3


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Utah Division of Water Quality, May 17, 1995, Tom Toole, Personal Communication.
Appendix

A.0 Introduction

Enclosed are Appendices to the Environmental Assessment (EA) for the South Manti Timber Salvage Sales. A.1 displays the past, present, and reasonably foreseeable future actions, A.2 displays the Best Management Practices to be applied to this project, A.3 displays Monitoring to be accomplished, and A.4 contains the Biological Assessment summary.

A.1 Past, Present, and Reasonably Foreseeable Future Actions

Introduction

CEQ regulations (1508.7) define cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Past, present, and reasonably foreseeable future actions in the South Manti area have been developed in support of the EA. The action, year of occurrence, and an estimate of the impact of the action when added to other past, present, and reasonably foreseeable future actions are presented below.

Table A.1.1 summarizes the past actions within the South Manti cumulative effects analysis area. Table A.1.2 summarizes the present actions within the South Manti cumulative effects analysis area. Table A.1.3 summarizes the reasonably foreseeable future actions within the South Manti cumulative effects analysis area.

**Table A.1.1**

<table>
<thead>
<tr>
<th>PAST ACTIONS</th>
<th>IMPLEMENTATION DATES (Begin and Ending)</th>
<th>RESIDUAL EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MINERALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caminco (North) Limequarry (SEWMA), Sec. 28, T. 19 S., R. 4 E., SUL, Pt. 3 ac., 1,000 ft. of road x 30 ft. width = 1.7 ac; Total Dist. = approx. 4 ac.</td>
<td>1970 - 2005</td>
<td>Vegetation has been removed and erosion has increased along the access roads. It would take approx. 5 years to restore undisturbed vegetation to 60% of original ground cover following reseeding. 4 ac.</td>
</tr>
<tr>
<td>Caminco (South) Limequarry (SEWMA), Sec. 33, T. 19 S., R. 4 E., SUL, Pt. 3 ac., 2,500 ft. of road x 30 ft. width = 1.7 ac; Total Dist. = approx. 5 ac.</td>
<td>1985 - 2005</td>
<td>Same as above: 5 ac.</td>
</tr>
<tr>
<td>Riverside Flat Limequarry (WMA), Sec. 18, T. 19 S., R. 4 E., SUL, Pt. 3 ac., 3,000 ft. of road x 25 ft. width = 1.7 ac; Total Dist. = approx. 4 ac.</td>
<td>1994 - 2005</td>
<td>Same as above: 6 ac.</td>
</tr>
<tr>
<td>High Top (North) Limequarry (SEWMA), Sec. 5, T. 19 S., R. 4 E., SUL, Pt. 3 ac., 2,000 ft. of road x 25 ft. width = 0.4 ac; Total Dist. = approx. 8 ac.</td>
<td>1995 - 2005</td>
<td>Same as above: 8 ac.</td>
</tr>
</tbody>
</table>
### APPENDIX

<table>
<thead>
<tr>
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<th>IMPLEMENTATION DATES (Begin and Ending)</th>
<th>RESIDUAL EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANGE/LAND/WILDLIFE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historic grazing across most of the Manti Division</td>
<td>Late 1800's to mid-1900's</td>
<td>Overgrazing and extensive human caused fires in the late 1800's resulted in habitat deterioration, increased shrub growth, and fire hazard. Changes resulted in increased forest fires, increased erosion, and frequent severe flooding and mudflows during the late 1900's. Large-leaf aspen, some ponderosa pine, and juniper are found in the area. Management since creation of the Manti Forest in 1902 and 1942 has resulted in significant increase in vegetation cover and livestock (Matt La S.A.F., 1993). The decrease in frequency of severe floods and mudflows, especially during the dry summer months, indicates that proposed vegetation conditions have decreased the frequency of wildfires but the potential is probably greater than it was before European settlement.</td>
</tr>
<tr>
<td>Black Mountain Prescribed Burn, 695 ac.</td>
<td>1989</td>
<td>Very spotty burn didn't remove much aspen. Regeneration of aspen is not very good. Sprouting is spotty. Similar to snags.</td>
</tr>
<tr>
<td>Wright/15 Prescribed Burn, 1350 ac., 1746 ROE, 317.20, 21, 28, 29, 33, 34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Flat Prescribed Burn, 1350 ac., about 50% actually burned, 1992 ROE, 292, 27, 24, 25, 26</td>
<td>1992</td>
<td>About 10% of area haven't come back as expected. Aspen sprout over bottom of burn is good, 5-6 ft. Low values standing trees. Waftmeters active in area.</td>
</tr>
<tr>
<td>Duck Fork Prescribed Burn, 460 ac., 511, 12 T160 R4E</td>
<td>1992</td>
<td>Burn only about 50% successful haven't come back as expected. Studies for burn up on file at Manti District Office. Standing fur trees and to mortality. Paths that burnt still visible. Some areas produce good forage</td>
</tr>
<tr>
<td>Six Mile Prescribed Burn, 800 ac., 52 T165 R4E</td>
<td>1993</td>
<td>Area was weakened after a hot burn. Some areas for aspen. Aspen regeneration is spotty. New springs have developed. Fire damage has been reduced. Wood and pine cutters have limited access.</td>
</tr>
<tr>
<td>Beaver Prescribed Burn, 1600 ac., 1205 ROE, 57.8, 16, 17, 18, 19, 20, 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TRANSPORTATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispersed recreation, rural recreation, commercial activities, range activities, and timber activities have contributed to the seasonal traffic volumes in and around the project area.</td>
<td></td>
<td>Road surface displacement/contraction of aggregate, user developed roads.</td>
</tr>
</tbody>
</table>

### APPENDIX

<table>
<thead>
<tr>
<th>PAST ACTIONS</th>
<th>IMPLEMENTATION DATES (Begin and Ending)</th>
<th>RESIDUAL EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RECREATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tremblant Flat Campground has 17 developed campsites that are spread throughout a total of 9 acres.</td>
<td>Built in 1985</td>
<td>In general the site is in good condition because of the mentioned rehab efforts. The Sanpete District Office reported that there are no negative affects from the campground to other resources at all.</td>
</tr>
<tr>
<td>The campground's spur road is a run down on file at Manti District Office.</td>
<td></td>
<td>The campsites are in good condition and all but 2 have universally accessible tables. Overall, the Forest Service facilities are in good shape.</td>
</tr>
<tr>
<td>Brought up to current ADA standards. Accessible tables, grills, and a four unit latrine were installed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The campground's spur road is a run down on file at Manti District Office.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The campground's spur road is a run down on file at Manti District Office.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a small resort to the south of the resort composed of older cabins which are in relatively poor condition. Additionally, there are two-phase subdivisions—one composed of older structures and the other 10 more recently built all 14 are newer homes located on 1/2 acre lots (7) in good condition.</td>
<td></td>
<td>In the case of the Fish and Wildlife Service, the area is good and will continue to be good.</td>
</tr>
<tr>
<td>Disperser recreation area. The Fish and Wildlife Service of relative importance to recreation in the project area are South Fork Reservoir, Emerald Lake, and Blue Lake. The other resources are typically drawn on as marginal and are not stocked by UDFR. According to the Sanpete District Office the area at Twin Mile Flat commonly used for dispersed recreation will be closed beginning the summer of 1996.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>According to the Sanpete District Office there are no negative effects to any other resources resulting from development and/or use at this recreation. Problems with septic system at resort may be affecting water quality of Forest Reservoir.</td>
</tr>
<tr>
<td>South Manti Timber Salvage Sales EA, Page A - 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX

#### TABLE A.1.2
Summary of Present Actions

<table>
<thead>
<tr>
<th>PRESENT ACTIONS</th>
<th>CURRENT EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOIL AND WATERSHED</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>TIMBER</strong></td>
<td>Timber canyon timber sales. Commercial salvage at 2,896 feet of dead Engelmann spruce-sawtimber. About 350 acres. <strong>Section 1 &amp; 8, T29N, R15E.</strong></td>
</tr>
<tr>
<td></td>
<td>Timber harvest would generate about 33,000 board feet and approximately $1,200 million in local communities. Traffic delays of 3 to 10 minutes to allow log truck passage. Minor amounts of road dust. Reduction of fuel loads. Rehabilitation of non-system roads and reduce road density per mile.</td>
</tr>
<tr>
<td><strong>RANGELAND/WILDLIFE</strong></td>
<td>Jumbo prescribed burn. 2,000 ac. S18, T13, R23 NMDW. Thick stand of spruce-fir with scattered aspen will be burned to rejuvenate rangeland and understory vegetation.</td>
</tr>
<tr>
<td></td>
<td>Fall 1996 Burn will be spotty and where it burns not there may be soil loss until regrowth can be established, especially between 2 to 5 years.</td>
</tr>
<tr>
<td><strong>TRANSPORTATION</strong></td>
<td>Dispersed recreation, road recreation, hunting recreation, commercial activities, range activities, and timber activities continue to contribute to seasonal traffic volumes and around the project area.</td>
</tr>
<tr>
<td></td>
<td>The twentimen mile sale has paid for the reconstruction of 545 feet of forested steep roadway and 3.85 miles of reconnection of roadway on the Ferro-Mayfield road. 52,000 board feet. Aggregate has been placed on 11.8 miles of road (1200 feet) in this project area. Add logging trucks and construction equipment to the traffic mix.</td>
</tr>
<tr>
<td></td>
<td>The development of South Shyline Diesel Source (a South Shyline diesel source) improves the throughways on Shyline drive.</td>
</tr>
<tr>
<td></td>
<td>Continuous placement of aggregate out of South Shyline Diesel Source improves the throughways on Shyline drive.</td>
</tr>
<tr>
<td></td>
<td>Monitoring of traffic counters adds to the data collection and analysis for future facility development.</td>
</tr>
</tbody>
</table>

#### APPENDIX

#### TABLE A.1.3
Summary of Reasonably Foreseeable Future Actions (within ten years; 1999-2005)

<table>
<thead>
<tr>
<th>REASONABLY FORESEEABLE</th>
<th>TIMING OF ACTIONS</th>
<th>ANTICIPATED EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MINERALS</strong></td>
<td>Two oil and gas exploration wells with no production wells or fields predicted. 3.04 acres per well, 2 wells for 90 days. 8 acres x 3.04 acres = 24.32 acres. For roads, 1.1 miles x 3.04 acres = 3.376 acres. For roads, 1.1 miles x 3.04 acres = 3.376 acres.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It was anticipated that any of the project roads would be converted to Forest Development Roads.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open 2-mi lineal per mile associated with other project needs: 3 ac. per ft. = 12,000 ft. of new road x 10 mi. = 120,000 ft. = 2,160 ac. Total Soil = nearly 2000 acres.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The production of the project roads would commence during the first field season. Drilling would be conducted during the second field season with physical reclamation completed in the fall.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The project would be opened at some time within the next 10 years and remain for at least 10 years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It would take approximately 5 years for understory vegetation to reach 80% of the postdisturbance ground cover following physical reclamation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation would be removed and some erosion would occur. It would take some time to return to pre-disturbance ground cover following physical reclamation.</td>
<td></td>
</tr>
<tr>
<td><strong>GEOLOGY</strong></td>
<td>Naturally occurring landslides have occurred for thousands of years and will continue to occur.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Isolated rockslides (low magnitude-very high frequency) could occur during periods of average to below average precipitation cycles. Large magnitude/low frequency landslides and fault events similar to the 1983-1984 event could occur during above average precipitation cycles. If the project area was not in the 30-40% of the soil region, landslides would not be expected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It would be high in landslide frequency cycles. The crops would be exposed to hazards. The total loss of that crop could be expected to exceed the 30-40% of the soil region.</td>
<td></td>
</tr>
<tr>
<td><strong>SOIL AND WATERSHED</strong></td>
<td>No soil and waterbath improvement projects are anticipated in the foreseeable future.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improvements to soil conditions are expected as a result of range management actions.</td>
<td></td>
</tr>
<tr>
<td><strong>RANGELAND/WILDLIFE</strong></td>
<td>Prescribed burn. Six miles 2, 2000 ac. S12, T23, R15E.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fall 1996 Burning vegetation conditions, where fire is expected to burn hot (about 75%), will be suppressed if plant cover is less than 15% of the area. Percent loss would be lower. Moisture should hold fuel.</td>
<td></td>
</tr>
<tr>
<td><strong>FIRE</strong></td>
<td>Naturally occurring fires have impacted the South Shyline landscape for thousands of years and are expected to continue. Human-caused fires are also reasonably foreseeable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Isolated low intensity-high frequency fires could occur during periods of average and above average precipitation cycles. High intensity/high frequency fires could occur during below average precipitation cycles as a statistical frequency of 15 to 200 years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Future high intensity, low frequency stand replacement events could result in productivity, increase sedimentation, alter conditions of the treated vegetation communities and aquatic and wildlife habitats, and increase potential for landslides etc.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX

<table>
<thead>
<tr>
<th>REASONABLY FORESEEABLE</th>
<th>TIMING OF ACTIONS</th>
<th>ANTICIPATED EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSPORTATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in traffic and traffic mix.</td>
<td>1995-2005</td>
<td>Increased traffic on area roads, additional surfacing replacement needed, additional maintenance needed.</td>
</tr>
<tr>
<td>Road improvement projects. Aggregate placement, realigning, sight distance improvements, additional turnouts, bridge paving, realigning, additional center line placement/cut/surface replacement.</td>
<td>1995-2005</td>
<td>Continued user access, promotion of resources and investments.</td>
</tr>
</tbody>
</table>

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APPENDIX

<table>
<thead>
<tr>
<th>REASONABLY FORESEEABLE</th>
<th>TIMING OF ACTIONS</th>
<th>ANTICIPATED EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMBER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timber Canyon Timber Sale Reforestation. About 30,000 Engelmann spruce seedlings will be hand planted over 85-90 acres during the spring of 1998. In 1999 another 75,000 seedlings would be hand planted over 210-215 acres. Fencing would be erected to keep livestock out of both plantations for 10-15 years. Sections 7 and A, T20S, R4E.</td>
<td>1999</td>
<td>Suitable timber sites are satisfactorily re-stocked with the Engleman spruce component. Retention removal of the national Forest Management Act (NFMA) would be met. About 250,000 acres of inventory range would be unavailable to the range permittee's livestock for 10-15 years.</td>
</tr>
<tr>
<td>Timber Canyon Timber Sale Slash Disposal. About 250 acres would have logging slash piled by machine. Another 50 acres would be hand piled. Slash piles would be burned in the fall of 1995. Sections 7 and 8, T20S, R4E.</td>
<td>1995</td>
<td>Reduction of fuel loading. Air quality minimally affected by smoke for 1 to 2 days.</td>
</tr>
<tr>
<td>Timber Canyon Timber Sale Slash Disposal. Slash within 200 feet of For-Yet-Muir Road and Timberline Flat Campground would be hand piled by machine. Approximately 20,000 tons of slash per acre. Another 160-165 acres would have 0.5 tons per acre hand piled. Slash piles would be burned in the fall of 1995. Section 7, T19S, R4E.</td>
<td>1997</td>
<td>Reduction of fuel loading. Improves visual foreground appearance adjacent to Timberline Flat Campground and along the For-Yet-Muir Road. Air quality minimally affected by smoke for 1 to 2 days.</td>
</tr>
<tr>
<td>Timberline Timber Sale Reforestation. About 40,000 Engelmann spruce seedlings will be hand planted over 175 acres during the spring of 1999. Fencing would be erected to keep livestock out of the plantation for 10-15 years. Section 29, T19S, R4E.</td>
<td>1999</td>
<td>Suitable timber sites are satisfactorily re-stocked with the Engelmann spruce component. Retention removal of the national Forest Management Act (NFMA) would be met. About 175 acres of inventory range would be unavailable to the range permittee's livestock for 10-15 years.</td>
</tr>
</tbody>
</table>

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APPENDIX

A.2 BEST MANAGEMENT PRACTICES

Introduction

Federal agency compliance with pollution control is addressed through section 313 of the Clean Water Act, Executive Order 12580 (Jan. 23, 1987), National Nonpoint Source Policy (Dec. 12, 1984), USDA Nonpoint Source Water Quality Policy (Dec. 5, 1986) and the Environmental Protection Agency in their guidance "Nonpoint Source Controls and Water Quality Standards" (Aug. 19, 1987). In order to comply with State and local nonpoint pollution controls the Forest Service will apply Best Management Practices (BMP’s) to all possible nonpoint sources, which may result from management activities proposed in this DES. These BMP’s are the Soil and Water Conservation Practices (SWCP) described in the Forest Service Handbook (FSH) 2509.22

Best Management practices (BMP) are the primary mechanism for achievement of water quality standards (Environmental Protection Agency, 1987). This Appendix describes the Forest Service’s BMP process in detail and lists the key Soil and Water Conservation Practices (SWCP) that have been selected to be used in the various alternatives analyzed by the South Manti EA.

BMP’s include, but are not limited to, structural and non-structural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). Usually BMP’s are applied as a system of practices rather than a single practice. BMP’s are selected on the basis of site specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

The Manti-La Sal National Forest Plan (Forest Plan) states that Soil and water conservation practices, as outlined in the Soil and Water Conservation Practices Handbook, (FSH 2509.22, May 1988), will be incorporated into all land use project plans as a principal mechanism for controlling nonpoint pollution sources; meeting soil and water quality goals; and to protect beneficial uses. Activities found to not be in compliance with the soil and water conservation practices or State Standards will be brought into compliance, modified, or stopped. Utah State Water Quality Standards require the use of Reasonable Land, Soil, and Water Conservation Practices (analogous to BMP) as the controlling mechanism for nonpoint pollution. Use of BMP’s is also required in the Memorandum of Understanding (MOU) between the Forest Service and the State of Utah as part of our responsibility as the Designated Water Quality Management Agency on National Forest System (NFS) lands.

BMP IMPLEMENTATION PROCESS

In cooperation with the State, the USDA Forest Service’s primary strategy for the control of nonpoint sources is based on the implementation of preventive practices (BMP) determined necessary for the protection of the identified beneficial uses. The Forest Service Nonpoint Source Management System consists of:

1. BMP Selection and Design. Water quality goals are identified in Forest Plans. These goal or exceed applicable legal requirements, including State water quality regulations, the Clean Water Act, and the National Forest Management Act. Environmental analyses for projects are tied to Forest Plans, using the National Environmental Policy Act (NEPA) process.

   Appropriate BMPs are selected for each project by an interdisciplinary team. In each new location, there is flexibility to design different BMPs depending on local conditions and values, and downstream beneficial uses of water.

   BMP selection and design are dictated by the proposed activity, water quality objectives, soils, topography, geology, vegetation, and climate. Environmental impacts and water protection options are evaluated and alternative mixtures of practices are considered. A final collection of practices are selected that not only protect water quality but meet other resource needs. These final selected practices constitute the BMPs.

2. BMP Application. The BMPs are translated into contract provisions, special use permit requirements, project plan specifications, and so forth. This ensures that the operator or person responsible for applying the BMP is required to do so. Site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and resource specialists (hydrology, fisheries, soil, geology, etc.). This is when final adjustments to fit BMP prescriptions to the site are made.

3. BMP Monitoring. When the resource activity (such as: timber harvest or road construction) begins, timber sale administrators, engineering representatives, resource specialists, and others ensure that the BMP are implemented according to plan. BMP implementation monitoring is done before, during, and after resource activity implementation. This monitoring assures the question: Did we do what we said we were going to do? Once BMP have been implemented, further monitoring is done to evaluate if BMP are effective in meeting management objectives and protecting water beneficial uses. If monitoring indicates that water quality standards are not being met and/or beneficial uses are not being protected, corrective action will be considered.

   A. The BMP is technically sound? Is it really best, or is there a better practice which is technically sound and feasible to implement?

   B. The implementation program or processes: Was the BMP applied entirely as designed? Was it only partially implemented? Were personnel, equipment, funds, or training lacking which resulted in inadequate or incomplete implementation?

   C. The State water quality criteria: Do the parameters and criteria that constitute water quality standards adequately reflect human induced changes to water quality and beneficial uses?

5. Feedback: Feedback of the results of BMP evaluation is both short and long-term in nature. Where corrective action is needed, immediate responses will be undertaken. This action may include: modification of the BMP, modification of the activity, ceasing the activity or possibly modifying the State water quality standard. Cumulative effects over the long-term may also lead to the need for possible corrective actions.

The District Ranger is responsible for ensuring that this BMP feedback loop is implemented on all projects.

FORMAT OF THE BMPs

The practices (BMP’s) described below are tiered to the practices in the Forest Service Handbook 2509.22 (Soil and Water Conservation Handbook). They were developed, with interdisciplinary involvement, as part of the NEPA process and meet Forest and State water quality objectives. Each Soil and Water Conservation Practice (SWCP) is described as follows:

Title: The sequential number of the SWCP.

SWCP Title and Objective: The SWCP title (in capitals) and the manner in which specific BMP’s should protect water quality.

Best Management Practice Description: The specific site uses that will be implemented in order to meet the SWCP objective.

Person(s) Responsible for Implementation: The person(s) responsible for implementing the applicable BMP’s necessary to meet the SWCP objectives.

Effectiveness: Provides a qualitative assessment of expected effectiveness that the applied measure will have on preventing or reducing impacts on water quality. The SWCP effectiveness rating is based on literature research, administrative studies, and professional experience. The SWCP is rated either High, Moderate, or Low based on the following criteria:

a. Literature/Research (must be applicable to area)
b. Administrative studies (local or within similar ecosystem)
c. Experience (judgment of an expert by education and/or experience)
d. Fact (obvious by reason [logical] response)

Contract Clause: Timber Sale Contract provisions referencing protection measures to be implemented and how they are to be applied. Where a specific contract provision is referenced, one only form of the provision is listed. Other equivalent provisions are available to fit other contract formats (example: B6.61 equivalent to B76.61).

ITEMS COMMON TO ALL SOIL AND WATER CONSERVATION PRACTICES

Responsibility for Implementation: The District Ranger and the Forest Engineer are responsible for insuring all applicable SWCP’s are applied and implemented. The Presale Forest and the South Manti ID Team is responsible for insuring that the objectives of the SWCP’s identified in this appendix are incorporated into the Timber Sale Contract by use of the appropriate
APPENDIX

Timber Sale Contract B and/or C provisions. The Project Engineer and the South Manti ID Team are responsible for insuring that the objectives of the SWCP's identified in this appendix are incorporated in the Timber Sale Contract, or Public Works Contract. This is accomplished by incorporating the appropriate Timber Sale B and/or C provisions and by use of Forest Service Specifications for Construction of Roads and Bridges EM 7220-100 L, and by the use of Special Project Specifications, as needed. The Timber Sale Administrator and Engineering Representative/Contracting Officers Representative (ER/CCR) are responsible for insuring that contract provisions are properly administered on the ground.

Monitoring: The Timber Sale Administrator, ER/CCR and Forest Soil Scientist, as needed, will monitor the effectiveness of the applied SWCPs. Should the practice not be effective in meeting State or Forested Plan standards the practice, or project activity, will be redesigned, rescheduled or dropped. Feedback of the results of the site-specific SCPs monitoring to the Forest Soils Scientist will insure that the best practices are incorporated into all projects impacting water quality. This requirement conforms to the objectives of practice 11.02-Soil and Water Resource Monitoring and Evaluation. A Monitoring Plan for the decision area has been developed, will be implemented, and can be found in Appendix A.3.

APPENDIX

Site Specific Best Management Practices (MNF-BMP Form 1)

Description of the soil and water conservation practices from the Forest Service Soil and Water Conservation Handbook (FSH 2509.22) will be applied in Alternatives 2, 3, and 4. The location where the practice will be applied is specified. For a more detailed description of the Best Management Practices (BMP) refer to the Soil and Water Conservation Handbook.

ABBREVIATIONS used in this description:

<table>
<thead>
<tr>
<th>SWCP</th>
<th>SWCP OBJECTIVE</th>
<th>BEST MANAGEMENT PRACTICE DESCRIPTION</th>
<th>PERSONS RESPONSIBLE FOR IMPLEMENTATION</th>
<th>BMP EFFECTIVENESS</th>
<th>CONTRACT V VIOLATIONS</th>
<th>APPLICABLE LAND USE</th>
<th>ABBREVIATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.01</td>
<td>TIMBER SALE PLANNING</td>
<td>To incorporate soil and water resources considerations into Timber Sale Planning</td>
<td>Unit design, mitigation, and effects analysis was done by IDT. TSC will be prepared by Pre-sale Forest. Forest will include management conditions and mitigation from environmental analyses.</td>
<td>IDT, Pre-sale Forester</td>
<td>High</td>
<td>N/A</td>
<td>All units in all alternatives</td>
</tr>
<tr>
<td>14.02</td>
<td>TIMBER HARVEST UNIT DESIGN</td>
<td>To insure that timber harvest unit design will secure favorable conditions of water flow, maintain water quality and soil productivity, and reduce soil erosion and sedimentation.</td>
<td>Cummulative effects analysis and unit design were done by IDT. Management will protect soil values by avoiding sensitive areas, adjusting unit boundaries, issuing specific BMP's to meet specific SWCP's, implementing User Streamside Management Zone Law, applying mitigation, and applying implementation/maintenance monitoring.</td>
<td>IDT</td>
<td>High</td>
<td>N/A</td>
<td>All units in all alternatives</td>
</tr>
<tr>
<td>14.03</td>
<td>USE OF SALE AREA MAPS FOR DESIGNATING SOIL AND WATER PROTECTION NEEDS</td>
<td>To estimate the location of protected areas and available water sources, to insure their recognition, proper consideration, and protection on the ground.</td>
<td>IDT has identified areas of concern such as stream sources, wetlands, and special treatment areas. Should verification, and preparation of maps to be included in TSC will be done by Pre-sale forester. TSC revises areas of concern with purchase before operations.</td>
<td>IDT, Pre-sale forester, TSA</td>
<td>High</td>
<td>B6.3, 51.1</td>
<td>All units with RPM's and STAs</td>
</tr>
<tr>
<td>14.04</td>
<td>LIMITING THE OPERATING PERIOD OF TIMBER SALE ACTIVITIES</td>
<td>To minimize soil erosion and sedimentation and loss in soil productivity.</td>
<td>IDT has identified seasonal restrictions and limitations on sensitive ground. Pre-sale forester will prepare a TSC that includes the duration of the harvest season, restrictions on activities, and special treatment. Operations would be limited to times when the soil is dry to prevent adverse impacts.</td>
<td>IDT, Pre-sale forester, TSA</td>
<td>High</td>
<td>B6.31, B6.8, CB.3</td>
<td>All units in all alternatives</td>
</tr>
<tr>
<td>14.05</td>
<td>PROTECTION OF UNSTABLE AREAS</td>
<td>To protect unstable areas and to avoid triggering mass movements of the soil matrix and resultant erosion and sedimentation.</td>
<td>IDT has identified unstable areas and mitigative measures in NCPA process. Pre-sale forester incorporates mitigation into TSC. Protective measures will be kept current on all areas where new road construction moves unstable and necessary unstable and loss in soil productivity.</td>
<td>IDT, Pre-sale forester</td>
<td>High</td>
<td>B6.31, B6.8, CB.3</td>
<td>All units and roads in all alternatives</td>
</tr>
<tr>
<td>14.06</td>
<td>APPRAISAL AREA DESIGNATION</td>
<td>To minimize the adverse effects on riparian areas with practices that manage lightly lagging and related land disturbance activities.</td>
<td>IDT has identified areas needing riparian areas protection. Pre-sale forester has verified locations and will prepare a contract to conform to the objectives. Making new delineates boundaries and implements riparian area protection in RPM. TSA ensures compliance with current provisions.</td>
<td>IDT, Pre-sale forester, Marking crew, TSA</td>
<td>High</td>
<td>B6.3, CB.6, BB.61</td>
<td>All units with RPM's and STAs</td>
</tr>
</tbody>
</table>

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To determine tractor loggable ground during transportation and berm clearances, ETT has identified loggable ground and its extent to determine impacts and restrictions for land disturbance activities. Pre-sale forests will prepare a TSC that includes provisions for marking areas and conditions that loggable soil will operate.

HARVESTING AND DESIGN - To reduce the site area for excessive disturbance and accelerated erosion and to maintain the integrity of the riparian areas and other sensitive areas.

To identify locations to be disturbed and to determine how to avoid or mitigate erosion and water quality degradation.

To identify locations where sediment settling ponds is needed. ETT must agree to marking locations proposed by the purchaser. Approved locations will be the criteria for minimal treatment, nearroad, and road works to avoid or mitigate erosion and water quality degradation, and have proper drainage.

To prepare and submit an erosion control plan that includes provisions for marking areas and conditions where erosion control measures are needed. ETT must agree to the erosion control plan prepared by the TSA. Once the plan is finalized, the site will be used for harvesting.

To prevent erosion and sedimentation during the timber sale process, ETT's Special Erosion Measures during the timber sale process shall be conducted reasonably for the mitigation of the site's potential impact on the environment and on the riparian areas and other sensitive areas.

To establish a South Pinal debris area for locations needing special stabilization measures. Any areas were identified that require special soil and water resources considerations into transportation planning.

To establish vegetation and fertilizer mix to be used in the project area with outlines on the road to which it should be applied. TSA is responsible to see that operations are done correctly and in a timely manner. For this project, the purchaser will be responsible for revegetation immediately after the completion of harvest. Funds will be collected for this purpose to do the follow-up revegetation in post-burn and the after burn.

To protect water quality by minimizing erosion and sedimentation derived from soil and water resources considerations into transportation planning.

To determine areas needing control measures. Recognize aerial and ground elevations and locations of exposed soil and water in the project area. Vehicular or handling equipment shall not be used on measures except where needed. Roads, landings, and roadway measures are approved. Unless otherwise agreed, fees listed into measures shall be induced by the owner, and resulting loggable soil shall be removed, where necessary to protect cover, soil and water.

To identify the location of the site's erosion control measures before sale closure. To ensure the adequacy of required erosion control measures on timber sales. A careful review of erosion prevention work performed by the TSA before harvest and lot to be considered complete. The inspection will determine if the work is acceptable and will meet the standards of the erosion control feature. A feature is considered not acceptable if it does not meet standards, or are not expected to protect soil and water resources. Technical assistance will be used as necessary.

To modify the TSC if new circumstances or conditions arise so that the timber sale will cause the HS water resource requirements. This condition will be met if the timber sale will cause the HS water resource requirements. The HS water resource requirements are met if the timber sale is completed.

To establish soil conservation objectives, and mitigation measures. ETT will agree to a contract that satisfies the objectives. ETT will be held responsible to satisfy the objectives. ETT will be held responsible to satisfy the objectives.

To establish soil conservation measures and implementation of erosion control practices. The HS has determined that the location and design of the riparian areas and special soil and water quality degradation prior to the initiation of construction by best implementation of erosion control practices.

To establish soil conservation measures and implementation of erosion control practices. The HS has determined that the location and design of the riparian areas and special soil and water quality degradation prior to the initiation of construction by best implementation of erosion control practices.
APPENDIX

<table>
<thead>
<tr>
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<th>BEST MANAGEMENT PRACTICE DESCRIPTION</th>
<th>PERSONS RESPONSIBLE FOR IMPLEMENTATION</th>
<th>BMP EFFECTIVENESS</th>
<th>CONTRACT CLAUSES</th>
<th>APPLICABLE UNITS/ROADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.08</td>
<td>SLOPE EROSION CONTROL</td>
<td>To reduce sedimentation and prevent erosion of streambanks.</td>
<td>ITD, ESA, C8.15, C8.2, C8.6</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.09</td>
<td>DIVERSION OF FLOWS AROUND CONSTRUCTION SITES</td>
<td>To divert flows during storm events.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.10</td>
<td>STREAM CROSSINGS ON TEMPORARY ROADS</td>
<td>To divert flows during storm events.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.11</td>
<td>BRIDGE AND CULVERT INSTALLATION</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.12</td>
<td>REGULATION OF SPOIL PITS, DRAINAGE SOURCES, AND CULVERTS</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.13</td>
<td>CONTROL OF PERMANENT ROAD</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.14</td>
<td>WATER SOURCE DEVELOPMENT</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.15</td>
<td>MAINTENANCE OF ROADS</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.16</td>
<td>TRAFFIC CONTROL DURING WET PERIODS</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
<tr>
<td>15.17</td>
<td>DREDGELING OF TEMPORARY ROADS</td>
<td>To prevent erosion and sedimentation.</td>
<td>ITD, ESA</td>
<td>High</td>
<td>All new roads</td>
<td>All operations</td>
</tr>
</tbody>
</table>

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A.3 MONITORING

Introduction

The objective of this monitoring program is to determine if land management activities implemented in the affected areas are being implemented correctly, are they effective, and are they meeting Forest Plan standards, guidelines, and objectives. Results will be used to assist in the evaluation of predicted activity affects.

Mitigation applied during land management activities is primarily concerned with reducing or eliminating anticipated adverse environmental effects. Carefully designed mitigation, correctly applied in the field, can adequately meet or protect resource objective or indicate where changes/improvements need to be made, thus applying adaptive management concepts.

To monitor and document mitigation, three questions must be addressed in detail:

A. Are practices (mitigation) implemented?
B. Are these practices (mitigation) effective in reducing or eliminating targeted adverse effects?
C. Are designated beneficial uses being protected?

Monitoring Plans of Operation

The following monitoring "Plans of Operation" have been prepared for the South Manti Decision Area. These measures are not to preclude Forest Plan requirements, but to supplement and further define those standards. As a minimum, the project plans will (1) define objectives, (2) identify sampling station locations, (3) define parameters to be measured, (4) describe methodology, data analysis, and report preparation. The monitoring network may change in response to information needs, technological advances, and ongoing evaluation of monitoring results. Attachments 1-4 are referenced in various plans of operation and follow the plans.

Attachment 1: (Appendix A.2) MLNF BMP Identification Form (MLNF-BMP Form 1)
Attachment 2: MLNF BMP Implementation Documentation Form (MLNF-BMP Form 2)
Attachment 3: MLNF BMP: Implementation and Effectiveness Evaluation Review Form (MLNF-BMP Form 3)
Attachment 4: High Probability Unit/Roads by Alternative

APPENDIX

LAND STABILITY

Location: Ferron/Price and Sanpete Ranger District, Manti-La Sal National Forest

Data storage location(s): MLNF S.O. and District Files

Origination date of Plan: JULY 1995.

Preparer's name: CARTER REED.

OBJECTIVE: Determine if new project roads and hauling on Forest Development Roads cause landslides or reactivate existing landslides.

ITEM TO MONITOR:

Monitor new project road segments and Forest Development Roads used for harvest operations to determine if there are any new landslides or renewed movement along existing landslides.

TYPE OF MONITORING: Implementation and effectiveness

Roads will be field checked in the spring each year as weather allows to map the occurrence of any new landslides or renewed movement along existing slides.

SITE OR AREA LOCATION:

All project roads within lands classified as unstable and moderately unstable will be monitored each year following construction. Haul roads within unstable and moderately unstable areas will be monitored just prior to and each year after hauling operations begin. Reports of landslides or road damage by operators, Forest personnel, and the public in the project area will be investigated.

METHODS/PARAMETERS:

A field check for landslide occurrence will be conducted each spring as weather permits along project roads and other haul roads.

If landslides, cracks, or other road damage that can be attributed to landslide activity will be mapped, on primary base series maps (1:24,000) and photographed. If features other than cracks are found simple field methods for monitoring land movement will be used to monitor movement (measure distance between semi-permanent stake locations within and outside of the movement area).

FREQUENCY/DURATION:

Field checks will begin the next spring after construction of project roads and will continue each year until the roads are reclaimed or for three years after project activity is completed.

Haul roads will be field checked each year during hauling activities and for at least one additional year after hauling is terminated.

ANALYSIS AND REPORTING PROCEDURES:

Responsibilities: Forest personnel, including but not limited to professional geologists, will conduct the yearly inspections for the occurrence of landslides/road damage. Forest geologists will conduct investigations of reported occurrences to determine the damages are the result of landslide activity and whether site-specific monitoring of landslides is needed. Site-specific landslide monitoring will be completed by professional geologists or engineers.

Annual Progress Report/Documentation: Results of Monitoring will be summarized yearly as part of the Forest Plan Monitoring Report. This summary will also indicate if contracts need to be modified and/or BMPs adjusted to protect water quality, roads, and other Forest uses.
PROJECTED COSTS AND FUNDING:

Workforce: Annually - 5 days District Geologist (GS-11)
5 days 2 person crew (GS-5)

Total Cost: $2,500 per year.

MONITORING RESPONSIBILITY: District Ranger and Forest Geologist

OBJECTIVE:

To specify the BMP's to be incorporated into the Timber Sale Contract for the Proposed Action, document the SWCP objective to be met on a unit by unit basis, document what BMPs were implemented to meet a specific SWCP and where they were applied, and provide an explanation of how the specific BMP was applied.

Relationship to beneficial uses/Expected results of this project:

The first step in protecting beneficial uses is to identify the SWCP needed to be enforced on the ground. This is accomplished via Appendix A.2 (BMP-Form-1). It is there that the specific SWCP objective is identified by unit/road.

The completion of the MLNF-BMP Form-2 then documents what BMP(s) were used to meet SWCP objectives and why that practice was used. If problems develop, the TSA is responsible to use whatever means available to ensure that the SWCP objectives will be met.

TYPE OF MONITORING: Implementation and effectiveness

SITE or AREA LOCATION: Scheduled Projects

METHODS/PARAMETERS:

Parameters to be measured: SWCP's as identified in Appendix B (BMP's) in the FEIS (MLNF-BMP Form 1) that are applicable to each timber sale.

Field Techniques: Before the timber sale contract is completed, the Pre-Sale forester will schedule, with the IDT, a review of the contract. The review will focus on any concerns with unit layout and a consistency check between the contract and the NEPA document. The consistency check will include a review of whether or not contract clauses from BMP-Form-1 have been included into the contract.

The SWCP objectives applicable to each unit in a timber sale (from BMP-Form-1 in Appendix A.2) will be listed on the BMP Implementation Form (MLNF-BMP Form 2). Form-2 will then be placed in the timber sale package for the timber sale administrator. The BMP Form 2 will then be completed by the TSA or COR as the activities in the sale are being completed. If the TSA or COR finds that BMPs are not being implemented or that the SWCP objectives listed for that activity are not being met, it is their responsibility to see that corrective measures are taken to insure that all SWCP objectives will be met by the BMP. If a unit has been identified by the IDT as being at risk for direct effect on water quality, the TSA or COR will schedule an Implementation and Effectiveness review (MLNF-BMP-3) with the district watershed specialist before that activity is completed (see Attachment 4 for list of applicable units/roads).

Sampling design with reliability requirements: Timber Sale Administrators and CORs will fill out the BMP Implementation Documentation Form MLNF-BMP Form 2 on all timber sales resulting from this decision.
APPENDIX

FREQUENCY/DURATION:
Start Date: Beginning of Project.
Completion Date: Final close-out of all sales identified in the South Manti decision area.

ANALYSIS and REPORTING PROCEDURES:

Responsibilities: The District Ranger is responsible for ensuring that implementation documentation forms (MLNF-BMP Form 2) are completed and forwarded to the Forest Hydrologist by the completion date.

Completion Date: December 31 of each year until completion of the sales.

PROJECTED COSTS AND FUNDING:

Workforce: Timber Sale Administrator/COR, Forest Hydrologist, District Watershed Specialist

Capital Costs: $2,000 (estimated) per sale, per year.

MONITORING RESPONSIBILITY:
The District Ranger is the primary responsible official for all BMP monitoring.
The IDT is responsible for completing BMP-Form-1.
The Timber Sale Administrator and COR are responsible for the timely completion of the BMP-Form-2.

APPENDIX

BMP IMPLEMENTATION & EFFECTIVENESS REVIEWS

Location: Ferron/Price and Sanpete Ranger District, Manti-La Sal National Forest

Data storage location(s): Original Forms - In Sale Folder or Project File; Copies - In SO Forest Hydrologist Files

Origination date of Plan: July 1995

Preparer’s name: David Haffield

OBJECTIVE:
To document that SWCP objectives in the EIS were included in the Timber Sale Contract and implemented, determine if BMPs were appropriate to meet SWCP objectives, and visually determine if the BMPs were effective (successful) in meeting the objective of the appropriate SWCP, IDT review provides a means to evaluate how well specific BMPs are meeting SWCP objectives and provides feedback for future projects.

TYPE OF MONITORING: Implementation and effectiveness

SITE or AREA LOCATION:

BMP Implementation andEffectivenessReviews (BMP-Form-3) will be conducted on all units/roads with special watershed concerns (see Attachment 4 for list of applicable units/roads) by the district watershed specialist and sale administrator. Review will occur yearly on at least 10% of all units/roads associated with the South Manti decision document. Criteria for selection of the sites to be monitored will include proximity to larger ephemeral or perennial streams or other factors that could cause a concern for soilwater values. The District watershed specialist and District Ranger will determine which units/roads will be in each year’s evaluation.

METHODS/PARAMETERS:

Parameters to measure: BMPs identified on MLNF BMP Identification Form 1 (Appendix A.2) for the unit.

Field Review Techniques: Monitoring the qualitative effectiveness of BMPs is accomplished by an interdisciplinary team (IDT) selected by the District Ranger. IDT membership will normally include a Hydrologist and/or Soil Scientist and an Engineer but may include Foresters, Wildlife or Fisheries Biologists, or other resources as needed.

Actual Review is accomplished by completing the MLNF BMP Implementation and Effectiveness Form (MLNF-BMP Form 3). Effectiveness of each identified practice is measured through on-site observation. The BMP is evaluated as it is reflected on the ground, and the observations are compared to the SWCP objective for that BMP. The effectiveness score recorded on the form will be the consensus opinion of the IDT.

IDT review for units/roads without special watershed concerns will occur once yearly. The units will be selected from all sales resulting from this decision document. At least ten percent of the units (active or completed) in each sale will be evaluated. District watershed specialist review of units/roads with special watershed concerns will occur on 100% of those units/roads.

Sampling design with reliability requirements: An evaluation on at least 10% of those units/roads without special watershed concerns, coupled by a review of 100% of the high-risk units in all sales will provide a representative review of site conditions and BMP effectiveness. Specialist review of units/roads with special watershed concerns before unit acceptance will ensure that if SWCP objectives are not being met, corrective measures can be made before sale closure.

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South Manti Timber Salvage Sales EA, Page A - 22
APPENDIX

FREQUENCY/DURATION:
Start Date: Sale award
Completion Date: Timber sale closeout and acceptance at sale closure.

ANALYSIS AND REPORTING PROCEDURES:
Responsibilities: The District Ranger is responsible for the Monitoring. Forest hydrologists/District watershed specialists will assist with analysis and reporting.

PROJECTED COSTS AND FUNDING:
- Workforce: District
- Capital Costs: $2,500 Annually (estimated)

MONITORING RESPONSIBILITY:
The District Ranger is responsible for collecting this information. Timber Sale Administrator and COR are responsible for the timely completion of the BMP-Form-2.

APPENDIX

AQUATIC HABITAT

Location: Ferron/Price and Sanpete Ranger District, Manti-La Sal National Forest

Data storage location(s): Ferron Work Center Files, F-Base Aquatic Database

Preparation date: June 1995.

Preparer's name: Jil Dutour

OBJECTIVE: Assess aquatic habitats and monitor effects from timber salvage and related activities; including road construction and reconstruction.

ITEM TO MONITOR:
Complete RI/R4 Basin-Wide Aquatic Habitat Inventories (USFS Intermountain Research Station, 1995) in 1995 on Little Horse Creek, Duck Fork Creek, Lake Fork Creek. Complete the inventories on Upper Samie and Twelvemile drainages, Black Fork, Mill Fork, Slide Fork, and Fish Creek if resources are available in 1996. These inventory data will be used to describe the pre-sale baseline condition. Should an action alternative be chosen, these inventories will be repeated five years post-cutting and the results will be used to assess mitigation effectiveness and improve future planning for this type of timber harvest. Inventory data will also be used to delineate biologically important areas that might be particularly sensitive to disturbance.

An aquatic macroinvertebrate station was established at the mouth of Duck Fork Creek in 1995. Baseline data will continue to be collected twice annually (spring and late summer) until cutting occurs to describe the "pre-" conditions. Sampling will continue for five years following cutting (on the same schedule) to determine mitigation effectiveness.

TYPE OF MONITORING: Implementation and effectiveness

SITE or AREA LOCATION:
Legal Descriptions: Highest priority drainages for monitoring are in the Upper Ferron Creek subwatershed. If time allows in 1996, portions of the Upper Muddy Creek, Upper Samie, and Upper Twelvemile Creeks will be studied.

A macroinvertebrate station was established in lower Duck Fork Creek during baseflows in 1995.

METHODS/PARAMETERS:
RI/R4 Basin-Wide Aquatic Habitat Inventories (USFS Intermountain Research Station, 1995) will be used. All of the parameters that are being assessed are listed on data forms. Copies of the data forms are found in Attachment S. Standard USFS protocols will be used for macroinvertebrate sampling to determine Biotic Condition Indices (BCI).

FREQUENCY/DURATION:
Pre-sale Basin-Wide Inventories began on July 2, 1995 and should be completed by October 1, 1996. Post-sale follow-up inventories will be scheduled so that they are conducted five years after harvest has been completed in the affected drainage(s). A more formal schedule will be developed when an alternative is chosen.

Pre-sale macroinvertebrate sampling at the Duck Fork Station will continue until harvest begins (if an Action Alternative is chosen). It will be conducted twice annually, spring and fall. Post-sale follow-up assessments will be conducted twice annually at the same station (spring and fall) for five years after harvest has been completed in the affected drainage(s). A more formal schedule will be developed when an alternative is chosen.

ANALYSIS AND REPORTING PROCEDURES:
Responsibilities: The MLNF Fisheries Biologist will be responsible for maintaining and collecting Basin-Wide Inventory Data and macroinvertebrate data.
APPENDIX

Reporting: Results of Basin-Wide Inventories and macroinvertebrate assessments will be summarized in a report to the Project summary report will be written to assess the effectiveness of prescribed mitigations and convey findings to Forest decision-makers.

PROJECTED COSTS AND FUNDING:

Workforce: Year 1: 10 days Forest Biologist, 90 days two-person crew.
Year 2-4: 5 days Forest Biologist.
Year 5: 10 days Forest Biologist, 90 days two-person crew.

Total Costs:
- Total Pre-Sale Inventory: $10000.00 (includes labor, truck, materials)
- Total Post-Sale Inventory: $12000.00 (includes labor, truck, materials)
- Total Macroinvertebrate Sample Processing: $1,000.00

MONITORING RESPONSIBILITY: District Ranger and Forest Fisheries Biologist

APPENDIX

VISUALS

Location: Ferron/Price and Sanpete Ranger Districts, Manti-La Sal National Forest

Data storage location(s): MLNF S.O. and District Files

Origination date of Plan: July 1995

Preparer's name: Kevin Draper

OBJECTIVE: Monitor visual resource for effects from salvage operations in relation to meeting Forest Plan VOO’s.

ITEM TO MONITOR: Visually sensitive areas identified in the analysis or later determined in the field.

1. Complete appropriate order of visual inventory and, as appropriate, further investigations in areas where scenic resources could be impacted by timber harvest operations such that they would not meet the adopted VOO as displayed on the Forest Plan Visual Quality Map (FP, III-17).

2. Assure that appropriate mitigative measures are taken during salvage operations relative to blending with the natural landscape (FP, III-17 and others listed below), so as to minimize the potential of not meeting Forest Plan VOO’s.

3. Set priorities for rehabilitation, considering the following (FP, III-17):
   a. Length of time it will take natural processes to reduce the visual impacts so that they meet the adopted VOO.
   b. Length of time it will take rehabilitation measures to meet the adopted VOO.

TYPE OF MONITORING: Implementation and effectiveness using photo points.

SITE or AREA LOCATION:
Monitoring will be located at established view-points from Skyline Drive and the Ferron-Mayfield Road. Additional view-points may be established as needed prior to, during, or following salvage activity.

METHODS/PARAMETERS:
Establishing and monitoring views from photo-points.

FREQUENCY/DURATION:
Baseline information needs will require that monitoring (both summer and winter seasons) starts before the projected harvest activity begins. Monitoring will continue throughout the duration of salvage operations until 2 years following sale closing. Thereafter, monitoring will occur every 3 years until Forest Plan VOO’s have been fully met.

ANALYSIS and REPORTING PROCEDURES:
Responsibilities: The MLNF Supervisor’s Office will be responsible for maintaining and collecting photos/data.

Annual Progress Report/Documentation: Results of Monitoring will be summarized yearly as part of the Forest Plan Monitoring Report. This summary will also indicate if contracts need to be modified and/or BMP’s adjusted to protect impacted viewsheds.

Within 2 years after sale closes, a final summary report will be written to assess the effectiveness and results of mitigation and monitoring.
APPENDIX

PROJECTED COSTS AND FUNDING:

Workforce: Prior to sale-10 days Landscape Architect; intermittently during operations as required/estimated 5 days per sale, per year. Years 1 and 2 after operations-10 days each year; thereafter-5 days every 3 years until complete. Landscape Architect-$200 per day including travel and supplies (estimated).

Total Cost: 1,000 dollars per sale, per year.

MONITORING RESPONSIBILITY: District Ranger and Forest Landscape Architect.

APPENDIX

NOXIOUS WEEDS

Location: Ferron/Price and Sanpete Ranger District, Manti-La Sal National Forest

Data storage location(s): MLNF S.O. and District Files

Origination date of plan: July 1995.

Preparer's name: David Hatfield

OBJECTIVE and ITEM TO MONITOR:

Document any changes in noxious weed populations along Forest roads leading to the timber sale area and within harvest units and assure the inclusion, implementation, and effectiveness of the following special contract provision:

Special Provision CT5.261f - Noxious Weed Control will be used to prevent the potential spread of noxious weeds into harvest units. Timber purchasers would be required to furnish proof of weed-free equipment. If available, KV funds would be collected to treat any noxious weeds that may invade disturbed areas following operations.

TYPE OF MONITORING: Implementation and effectiveness

SITE or AREA LOCATION:

Known inventoried locations within sale area and roads leading to sale unit.

METHODS/PARAMETERS:

Field Techniques: Visual observations at locations mentioned above. Monitoring and treatment work would be included in the sale area improvement plan.

FREQUENCY/DURATION:

Start Date: Beginning of Sale
Completion Date: One year after completion of sale.

ANALYSIS and REPORTING PROCEDURES:

Responsibilities: District range conservationist will write an annual progress Report documenting monitoring by December 31 of each year.

PROJECTED COSTS AND FUNDING:

Workforce: Two-person noxious weed crew. District range conservationist.

Total Costs: 500 dollars per sale, per year.

MONITORING RESPONSIBILITY: District Ranger, District range conservationist, and sale administrator.
APPENDIX

VEGETATION

OBJECTIVE: Monitor stand structure to determine if the alternative implemented met projections stated in the document for stocking, beetle risk, vegetative structural stage distribution, old growth, snags, and down woody material. Includes field review and analysis of post-sale and stocking surveys.

ITEM TO MONITOR: Vegetation structure on treated stands.

TYPE OF MONITORING: Implementation and effectiveness

METHODS/PARAMETERS: Current stand exam requirements

FREQUENCY/DURATION: After follow-up activities are complete (within 5 years)

PROJECTED COSTS: 2 people for 8 days at $200/day = $1600

REPORTING PROCEDURES: District stand exam files.

RESPONSIBILITY: District Silviculturist, District Wildlife Biologist

VEGETATION

OBJECTIVE: Monitor planted areas to assure meeting survival requirements for first and third years and stocking certification requirements in Silvicultural Prescription within 3 years. This includes monitoring for damage to seedlings caused by livestock, wildlife, or other causes.

ITEM TO MONITOR: Planted areas.

TYPE OF MONITORING: Implementation and effectiveness

METHODS/PARAMETERS: Field review before sale contract is complete to assure adequate slash cleanup and site preparation. Survival and stocking must meet R4 guidelines.

FREQUENCY/DURATION: 1 day before timber sale contract completion and in 1st and 3rd years after planting.

PROJECTED COSTS: Survivals $3.50/acre planted
Stocking Exam $4.50/acre harvested and planted.
Plantation Monitor $900/yr

REPORTING PROCEDURES: R4 RMRS reporting forms.

RESPONSIBILITY: District Ranger and District Silviculturist
### APPENDIX

**ATTACHMENT 2: BMP IMPLEMENTATION DOCUMENTATION FORM (MLNF-BMP-2)**

**DATE**

**BMP IMPLEMENTATION DOCUMENTATION**

<table>
<thead>
<tr>
<th>TIMBER SALE NAME</th>
<th>FOREST</th>
<th>DISTRICT</th>
<th>LEGAL DESCRIPTION</th>
<th>NAMED STREAM BELOW ACTIVITY</th>
<th>REVIEWER</th>
<th>STAGE OF OPERATION</th>
<th>UNITS/ROADS WITH SPECIAL WATERSHED CONCERNS</th>
<th>REASON FOR CONCERN</th>
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<tbody>
<tr>
<td></td>
<td>MANTI-LA SAL NATIONAL FOREST</td>
<td>FERRON/PRICE RANGER DISTRICT and SANPETE RANGER DISTRICT</td>
<td>T_____ R_____ S__________</td>
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<thead>
<tr>
<th>SWCP OBJECTIVES IDENTIFIED IN NEPA DOCUMENT FOR ACTIVITIES IN THIS SALE</th>
<th>UNITS/ROADS THAT OBJECTIVE APPLIES</th>
<th>WHAT BEST MANAGEMENT PRACTICE(S) WERE USED TO MEET THIS OBJECTIVE?</th>
<th>WHERE WERE THE PRACTICE(S) APPLIED?</th>
<th>EXPLAIN HOW THE PRACTICE(S) WERE APPLIED</th>
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</table>
**APPENDIX**

**ATTACHMENT 3: MLNF BMP IMPLEMENTATION AND EFFECTIVENESS EVALUATION REVIEW FORM (MLNF-BMP-3)**

**DATE _____**

**BMP IMPLEMENTATION AND EFFECTIVENESS DOCUMENTATION BY IDT REVIEW**

TIMBER SALE NAME ___________________  UNIT # / ROAD # ____________

FOREST MANTI-LA SAL NATIONAL FOREST  DISTRICT FERRON/PRICE RANGER DISTRICT and SANPETE RANGER DISTRICT

STAGE OF REVIEW ____________________

(FINAL OR INTERIM)

LEGAL DESCRIPTION T _______ R _______ S _________

NAMED STREAM BELOW ACTIVITY ________________________________

REVIEWERS _______________  COMPLETED ACTIVITIES _______________

**IMPLEMENTATION EVALUATION**

1. INSTALLATION EXCEEDS REQUIREMENTS OF CONTRACT/BMP's
2. INSTALLATION MEETS REQUIREMENTS OF CONTRACT/BMP's: SATISFACTORY IMPL ON ALL SPECIFIED AREAS
3. MINOR DEPARTURE FROM INTENT OF CONTRACT/BMP: IMPL OK BUT ONLY ON 2/3 OR MORE OF AREA SPECIFIED
4. MAJOR DEPARTURE FROM INTENT OF CONTRACT/BMP: INCORRECT IMPL AND/OR IMPL ON LESS THAN 2/3 OR MORE OF AREA SPECIFIED
5. NON-IMPLEMENTATION OF BMP: BMP EITHER NOT IMPLEMENTED OR BMP IMPL ON 10% OR LESS OF AREA SPECIFIED

**EFFECTIVENESS EVALUATION**

1. BMP INSTALLATION AFFORDS SOIL/WATER PROTECTION THAT MEETS SWCP OBJECTIVE OVER THE ENTIRE AREA/PROJECT.
2. BMP INSTALLATION AFFORDS SOIL/WATER PROTECTION ON 2/3 OF THE AREA/PROJECT THAT MEETS SWCP OBJECTIVE. 1/3 OF THE AREA/PROJECT MAY NOT HAVE SWCP OBJECTIVE MET. EXPLAIN THE LIKELY EFFECTS AND DESCRIBE WHAT SHOULD HAVE BEEN DONE TO MEET OBJECTIVE.
3. BMP INSTALLATION AFFORDS SOIL/WATER PROTECTION ON LESS THAN 2/3 OF THE AREA/PROJECT. REMAINING AREA MAY NOT HAVE SWCP OBJECTIVE MET. EXPLAIN THE LIKELY EFFECTS AND DESCRIBE WHAT SHOULD HAVE BEEN Done TO MEET OBJECTIVE.
4. BMP IMPLEMENTATION does NOT AFFORD ANY SOIL/WATER PROTECTION. EXPLAIN THE LIKELY EFFECTS AND DESCRIBE WHAT SHOULD HAVE BEEN DONE TO MEET OBJECTIVE.
5. NOT REVIEWED

<table>
<thead>
<tr>
<th>SWCP OBJECTIVES DESIGNATED FOR THIS UNIT/ROAD</th>
<th>IMPL (1-5)</th>
<th>EFFECT (1-5)</th>
<th>COMMENTS; EXPLANATION OF LIKELY EFFECTS; DESCRIPTION OF WHAT WAS NEEDED TO MEET SWCP OBJECTIVE.</th>
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## APPENDIX

### ATTACHMENT 4: UNITS/ROADS WITH POSSIBLE DIRECT EFFECTS ON WATER QUALITY BY ALTERNATIVE

Example road designation for new roads: NE-36. Example road designation for existing roads needing reconstruction: RF-2. Existing forest roads on our inventory will already have a Number Designation: 5024. HP>HE-4

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = New</td>
<td></td>
</tr>
<tr>
<td>R = Reconstruct</td>
<td></td>
</tr>
<tr>
<td>E-3 = Site unit road locale</td>
<td></td>
</tr>
<tr>
<td>b = Second new road needed in unit E-3 (NE-3a designation already assigned).</td>
<td></td>
</tr>
<tr>
<td>F-2 = Sale Unit road locale (no &quot;a&quot; or &quot;b&quot; designation this time because only one road needed reconstruct work.</td>
<td></td>
</tr>
</tbody>
</table>

### ALTERNATIVE 2

#### Road Crossings of Riparian Streams

<table>
<thead>
<tr>
<th>Road</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD-1</td>
<td>NE-3a Tribally Buoy Creek</td>
</tr>
<tr>
<td>RD-2</td>
<td>NE-3a Little Horse Creek</td>
</tr>
<tr>
<td>RD-3</td>
<td>NE-3a Little Horse Creek</td>
</tr>
</tbody>
</table>

#### Road Crossings of Wetlands

<table>
<thead>
<tr>
<th>Road</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD-4a</td>
<td>NE-3a Tribally Buoy Creek</td>
</tr>
<tr>
<td>RD-5a</td>
<td>NE-3a Little Horse Creek</td>
</tr>
</tbody>
</table>

### ALTERNATIVE 3

#### Road Crossings of Riparian Streams

<table>
<thead>
<tr>
<th>Road</th>
<th>Site</th>
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</thead>
<tbody>
<tr>
<td>RD-1</td>
<td>NE-3a Tribally Buoy Creek</td>
</tr>
<tr>
<td>RD-2</td>
<td>NE-3a Little Horse Creek</td>
</tr>
<tr>
<td>RD-3</td>
<td>NE-3a Little Horse Creek</td>
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</table>

#### Road Crossings of Wetlands

<table>
<thead>
<tr>
<th>Road</th>
<th>Site</th>
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</thead>
<tbody>
<tr>
<td>RD-4a</td>
<td>NE-3a Tribally Buoy Creek</td>
</tr>
<tr>
<td>RD-5a</td>
<td>NE-3a Little Horse Creek</td>
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</tbody>
</table>

#### Roads Parallel to Riparian Areas

<table>
<thead>
<tr>
<th>Road</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD-3</td>
<td>NE-3a Little Horse Creek</td>
</tr>
<tr>
<td>RD-4</td>
<td>NE-3a Little Horse Creek</td>
</tr>
</tbody>
</table>

### Example

Example: ATTACHMENT 4: UNITS/ROADS WITH POSSIBLE DIRECT EFFECTS ON WATER QUALITY BY ALTERNATIVE

- **Road Crossings of Riparian Streams**
  - **RD-1**
    - Unnamed Tribally Buoy Creek
  - **RD-2**
    - Crosses Slide Fork
  - **RD-3**
    - Tribally to Mill Fork
  - **RD-4a**
    - Unnamed
  - **ND-5a**
    - Crosses Riparian Area near Blue Lake

- **Road Crossings of Wetlands**
  - **RD-3**
    - Unnamed
  - **ND-4a**
    - Unnamed
  - **NA-5**
    - Unnamed
  - **RA-ZD**
    - Unnamed
  - **NF-5a**
    - Unnamed
  - **RD-3**
    - Unnamed

- **Roads Parallel to Riparian Areas**
  - **RD-3**
    - Little Horse Creek
  - **RD-4**
    - Little Horse Creek
  - **RD-5**
    - Little Horse Creek

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### APPENDIX

#### ALTERNATIVE 4

**Road Crossings of Riparian Streams**

<table>
<thead>
<tr>
<th>Road Crossing</th>
<th>Description</th>
<th>Species Affected</th>
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<tbody>
<tr>
<td>ND-5a</td>
<td>Crosses Black Fork</td>
<td>X</td>
</tr>
<tr>
<td>RD-1</td>
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</tr>
<tr>
<td>ND-1</td>
<td>Tributary to Mill Fork</td>
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<td>ND-1s</td>
<td>Crosses Riparian Area near Blue Lake Sliding Fork</td>
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</tr>
<tr>
<td>50169</td>
<td>Crosses Reservoir Creek</td>
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</tr>
<tr>
<td>NE-1</td>
<td>Unnamed Tributary to Admin. Site</td>
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<td>NE-1s</td>
<td>Unnamed Tributary to Admin. Site</td>
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<tr>
<td>ND-1a</td>
<td>Crosses Riparian Area near Blue Lake Sliding Fork</td>
<td></td>
</tr>
<tr>
<td>SWSW Sec 22</td>
<td>T19S, R4E, SLBM</td>
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</tr>
<tr>
<td>NESE Sec 21</td>
<td>T19S, R4E, SLBM</td>
<td></td>
</tr>
<tr>
<td>ND-2</td>
<td>Tributary to Mill Fork</td>
<td></td>
</tr>
<tr>
<td>ND-3</td>
<td>Tributary to Mill Fork</td>
<td></td>
</tr>
<tr>
<td>NC-5c</td>
<td>Tributary to Mill Fork</td>
<td></td>
</tr>
<tr>
<td>5002R</td>
<td>Crosses Twelve Mile Lake Fork</td>
<td></td>
</tr>
<tr>
<td>RF-3</td>
<td>Lake Fork</td>
<td></td>
</tr>
<tr>
<td>RF-4</td>
<td>Lake Fork</td>
<td></td>
</tr>
<tr>
<td>Road Crossing of Wetlands</td>
<td>SESE Sec 3</td>
<td>T19S, R4E, SLBM</td>
</tr>
<tr>
<td>NWSE Sec 4</td>
<td>T20S, R4E, SLBM</td>
<td></td>
</tr>
<tr>
<td>NESE Sec 21</td>
<td>T19S, R4E, SLBM</td>
<td></td>
</tr>
<tr>
<td>NC-5c</td>
<td>Tributary to Mill Fork</td>
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</tr>
<tr>
<td>5002R</td>
<td>Crosses Twelve Mile Lake Fork</td>
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<td>NESE Sec 3</td>
<td>T19S, R4E, SLBM</td>
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<tr>
<td>Road Parallel to Riparian Area</td>
<td>SESE Sec 3</td>
<td>T20S, R4E, SLBM</td>
</tr>
<tr>
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<td>Black Fork Creek</td>
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</tr>
<tr>
<td>ND-5a</td>
<td>Black Fork Creek</td>
<td></td>
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<tr>
<td>ND-5a</td>
<td>Black Fork Creek</td>
<td></td>
</tr>
<tr>
<td>ND-5a</td>
<td>Black Fork Creek</td>
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</tr>
<tr>
<td>Helped Riparian</td>
<td>SWSW Sec 22</td>
<td>T19S, R4E, SLBM</td>
</tr>
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### A.4 BIOLOGICAL ASSESSMENT SUMMARY

#### LISTED SPECIES BIOLOGICAL ASSESSMENT

**SUMMARY OF CONCLUSION OF EFFECTS**

<table>
<thead>
<tr>
<th>Project Name: South Manti Salvage Timber Sale - Alternative II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
</tr>
<tr>
<td>1. Humpback chub</td>
</tr>
<tr>
<td>2. Bonytail chub</td>
</tr>
<tr>
<td>3. Colorado squawfish</td>
</tr>
<tr>
<td>4. Razorback sucker</td>
</tr>
<tr>
<td>5. Heliotrope milkvetch</td>
</tr>
<tr>
<td>6. Bald eagle</td>
</tr>
<tr>
<td>7.</td>
</tr>
<tr>
<td>8.</td>
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<tr>
<td>9.</td>
</tr>
<tr>
<td>10.</td>
</tr>
<tr>
<td>11.</td>
</tr>
<tr>
<td>12.</td>
</tr>
</tbody>
</table>

Prepared by: /s/ Rod Player /s/ Jill A. Dufour
Approved by: /s/ Rod Player /s/ Jill A. Dufour /s/ Bob Thompson
Date: 11/8/95
* Requires written concurrence from the FWS and/or NMFS
** Categorical exclusions are not appropriate if this is the determination

Form 1 (R-1/A/3/2670-95)

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### APPENDIX
**PROPOSED SPECIES BIOLOGICAL ASSESSMENT**
**SUMMARY OF CONCLUSION OF EFFECTS**

**Project Name:** South Manti Timber Salvage Sale

<table>
<thead>
<tr>
<th>Species</th>
<th>No Effect</th>
<th>Not Likely To Jeopardize or Destruction Or Adverse Modification Of Proposed Critical Habitat. Go To Step 2</th>
<th>Likely To Jeopardize Or Result in Destruction Or Adverse Modification Of Proposed Critical Habitat*</th>
<th>Step 2 - If Species Were Listed What Would The Determination Be?** and ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
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<tr>
<td>5.</td>
<td></td>
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</tr>
<tr>
<td>6.</td>
<td></td>
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</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prepared by: [Signature]
Date: [Date]

Approved by: [Signature] [Signature] Botanist

* Categorical exclusions are not appropriate if this is the determination

** Choices include: 1. May Effect - Not Likely To Adversely Affect (NLAA) 2. May Effect - Likely To Adversely Affect (LAA)**

*** Note: If a LAA conclusion is made, categorical exclusion is not appropriate

---

### APPENDIX
**SENSITIVE SPECIES BIOLOGICAL EVALUATION**
**SUMMARY OF CONCLUSION OF EFFECTS**

**Project Name:** South Manti Timber Salvage Sale

<table>
<thead>
<tr>
<th>Alternative: Alternative II</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>No Impact</th>
<th>May Impact Individuals Or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing or Loss Of Viability To The Population Or Species</th>
<th>Will Impact Individuals Or Habitat With A Consequence That The Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bonneville cutthroat</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Colorado cutthroat</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Spotted frog</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Maquere campion</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Carrington daisy</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Musinee groundsel</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Spotted bat</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Townsend’s Big-eared bat</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Flammulated owl</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Northern goshawk</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Three-toed woodpecker</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>12.</td>
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<td></td>
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</tr>
</tbody>
</table>

Beneficial Impact

Prepared by: [Signature] [Signature]
Date: 11/8/95

Approved by: [Signature] [Signature] Botanist

* Considered a trigger for a significant action in NEPA

** Note: The rationale for the conclusion of effects is contained in the NEPA document

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