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Environmental Assessment

Maki Creek Area Projects

Big Piney Ranger District, Bridger-Teton National Forest

Sublette County, Wyoming

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Summary

This Environmental Assessment (EA) for the Cottonwood Watershed projects (Maki Creek area) displays analysis of site-specific environmental effects of proposed natural resource management activities. Projects originally proposed and scoped included vegetation management, improvement of recreational facilities, and road rehabilitation and improvement work in the North and South Cottonwood Creek drainages. Detailed analysis was focused on management activities only in the Maki Creek area, a portion of the North Cottonwood Creek drainage. These activities are designed to improve the vegetation, wildlife habitat and watershed resources in that area, using timber harvest, tree cutting, prescribed fire as well as associated road and culvert work. This EA is not the decision document. The District Ranger will document the decision in a decision notice (DN) and finding of no significant impact (FONSI). Future analysis or decision documents will address other projects in the Cottonwood analysis area.

The total analysis area of ~ 48,500 acres is located in the North and South Cottonwood Creek watershed on the Big Piney Ranger District of the Bridger-Teton National Forest. The Maki Creek area of ~ 7,080 acres is a portion of the larger North Cottonwood Creek drainage. The analysis area is approximately 25 miles north of Big Piney, Wyoming on the east slope of the Wyoming Range. All lands within the analysis area are National Forest System lands, within Sublette County, Wyoming. The legal description includes portions of T33N, R114W: See the EA map for specific boundaries.

The purpose of this proposal is to improve Forest resource conditions in the North and South Cottonwood Creek drainages, bringing them closer to desired conditions. To best meet the most critical aspects of the purpose and need, the Interdisciplinary (ID) Team focused current detailed analysis efforts in the Maki Creek portion of the North Cottonwood drainage. Desired conditions would help restore healthy ecosystem functions and support sustainable resource use. Desired conditions were identified in the CPIS and refined during the environmental analysis, through public input and extensive interdisciplinary review.

Alternative 3: Issue/Concern Driven Alternative

This alternative was developed to respond to public issues from scoping, changes in resource demand since the CPIS and recent resource issues. This alternative is also designed to improve forest resource conditions as identified in the scoping. The original proposed action was modified for this alternative, with changes made to specific projects and some new projects added to respond to the new issues and resource concerns

Alternative 1: No Action

This alternative is required under NEPA regulations and also serves as a baseline of information for comparison of other alternatives. Though this alternative does not respond to the purpose and need for action, it does address some issues.

Under the no action alternative there would be no management of vegetation in the area. Routine maintenance of existing roads and trails would continue as well as fire suppression activities and sale and harvest of district-wide firewood and Christmas trees. The Maki Creek area roads would remain gated with limited access. Activities such as range management, outfitting and oil and gas activities covered under other site specific decision documents or permits would also continue to occur.

Summary

Alternative 2: Proposed Action

This alternative was developed to address opportunities to improve Forest resource conditions as identified in the CPIS. The full, original alternative was outlined in the Scoping Statement for this project. Only that portion of the alternative that addresses vegetation treatment in the Maki Creek area is analyzed in detail.

Alternative 4: Additional Snag and Lynx Habitat Alternative

This alternative was derived from Alternative 3 only to provide for additional lynx and snag habitat conservation measures beyond what already exist.

CHAPTER 1 - PURPOSE AND NEED

Section 1.1 – INTRODUCTION

This Environmental Assessment (EA) for the Cottonwood Watershed projects (Maki Creek area) displays analysis of site-specific environmental effects of proposed natural resource management activities. Projects originally proposed and scoped included vegetation management, improvement of recreational facilities, and road rehabilitation and improvement work in the North and South Cottonwood Creek drainages. Detailed analysis was focused on management activities only in the Maki Creek area, a portion of the North Cottonwood Creek drainage. These activities are designed to improve the vegetation, wildlife habitat and watershed resources in that area, using timber harvest, tree cutting, prescribed fire as well as associated road and culvert work. This EA is not the decision document. The District Ranger will document the decision in a decision notice (DN) and finding of no significant impact (FONSI). Future analysis or decision documents will address other projects in the Cottonwood analysis area.

This analysis is tiered to the 1990 Land and Resource Management Plan (LRMP) and Environmental Impact Statement (EIS) for the Bridger-Teton National Forest. The LRMP is also known as and will be referred to in this document as The Forest Plan. The Cottonwood Plan Implementation Study (CPIS) (1993)[1] was an interdisciplinary approach to identify opportunities to improve resource conditions and implement the land use direction and standards and guidelines of the LRMP in the North and South Cottonwood Creek drainages. This analysis area is Management Area 25, Cottonwood Creek in the LRMP. Proposed projects address opportunities identified in the CPIS to implement the LRMP. This EA documents site-specific analysis of any environmental effects of the proposal and alternatives to that proposal. For more complete information and details, these documents are available for review at the Big Piney Ranger District office in Big Piney, Wyoming and the Bridger-Teton Forest Supervisors office in Jackson, Wyoming.

The total analysis area of ~ 48,500 acres is located in the North and South Cottonwood Creek watershed on the Big Piney Ranger District of the Bridger-Teton National Forest. The Maki Creek area of ~ 7,080 acres is a portion of the larger North Cottonwood Creek drainage. The analysis area is approximately 25 miles north of Big Piney, Wyoming on the east slope of the Wyoming Range. All lands within the analysis area are National Forest System lands, within Sublette County, Wyoming. The legal description includes portions of T33N, R114W: See the EA map for specific boundaries.

Section 1.2 - PURPOSE AND NEED FOR ACTION

The purpose of this proposal is to improve Forest resource conditions in the North and South Cottonwood Creek drainages, bringing them closer to desired conditions. To best meet the most critical aspects of the purpose and need, the Interdisciplinary (ID) Team focused current detailed analysis efforts in the Maki Creek portion of the North Cottonwood drainage. Desired conditions would help restore healthy ecosystem functions and support

[1] Compared existing conditions (EC) to desired future conditions (DFC) and displayed proposed projects to the DFC.

sustainable resource use. Desired conditions were identified in the CPIS and refined during the environmental analysis, through public input and extensive interdisciplinary review. Current conditions in need of improvement in the Cottonwood analysis area include:

- A majority of conifer forests are in older age classes with declining growth and health, heavy fuel loading and high tree densities for site conditions. Desired conditions would maintain 15% to 20% of stands in seedling sapling stages, maintain forest structure in snags, down logs and tree clumps, maintain lower tree densities in many areas and promote natural regeneration. Most conifer stands in the Maki Creek area are greater than 120 years old. The lodgepole pine and subalpine fir in particular are experiencing high mortality rates from density related factors.

- Many of the reforested areas have high tree densities, prohibiting optimal tree growth. Desired conditions would maintain lower tree densities to improve tree growth and health and retain lower branches longer. There are approximately 163 acres of reforested harvest units in the Maki Creek area. Tree densities are high, but no treatment will be planned in order to be compliant with guidelines in the lynx conservation strategy.

- Aspen forests are predominantly old age classes being encroached by conifers and in declining growth and health. Desired conditions would maintain 50% to 55% of aspen stands in younger age classes. The Maki Creek area has more aspen stands than any other drainage in the Cottonwood Creek analysis area. Aspen is particularly important wildlife habitat.

- Many recreation trails are not up to standards and trailhead facilities are lacking. Desired conditions would bring trails and trailheads up to standard to provide consistent, quality user experiences and prevent degradation of soil, water and vegetation resources. Recreation resources were not analyzed in detail in the Maki Creek area. Improvement of recreation resources will be addressed in future decision documents.

- Some roads and road culverts are substandard contributing to sedimentation in streams, damage to riparian areas and impairing fish passage and habitat. Rehabilitating roads and culverts to desired conditions would improve adjacent resource conditions including stream and riparian habitat. Identified problems in the Maki Creek area include a secondary road crossing over Little Maki Creek.

- Native Colorado cutthroat trout populations are declining in the analysis area. Desired conditions would maintain healthy populations of Colorado cutthroat trout in the drainage. In the proposed project area, there are 3.6 miles of Maki Creek containing Colorado cutthroat trout.

- Dispersed camping and other associated recreation use concentrated around Soda Lake have caused soil, riparian and vegetation damage. Desired conditions would limit resource damage to smaller, confined, more resilient areas while still providing desired recreation use levels. This does not apply to the Maki Creek area and will be addressed in a separate analysis or decision.

- Maki Creek and other drainages in the analysis area are identified as important wildlife range in the LRMP. They provide important spring, summer and fall range for elk and other wildlife species. Aspen

stands are important parturition and transition range for elk. Most aspen stands in this area are older with little understory and/or encroached by conifer. Opportunities exist to treat aspen and older sagebrush. Vegetative treatment (cutting or prescribed fire) will encourage regrowth of younger structure, composition and age classes. Desired vegetation conditions would provide improved elk, moose and mule deer foraging, parturition, and transition ranges. The Jewett Feed ground adjacent to the Maki Creek area sustains an objective of 650 elk during winter months. It is anticipated (and supported by Wyoming Game and Fish) that additional and improved quality forage areas in the Cottonwood watershed would hold elk longer on Forest land before they move down to the confined area of the winter feed ground.

- Increased recreational use of off-highway vehicles (OHV's) and lack of areas designated for that purpose has resulted in soil and vegetation damage and conflicts with other recreation users. Desired conditions would provide designated areas for OHV use, mainly on old roads where resource damage would be limited to existing altered areas and user conflicts could be significantly reduced. This is not a concern nor addressed in the Maki Creek area.

The extensive site objectives (37) and management opportunities identified in the CPIS to improve resource conditions in the area were the basis for the proposed projects contained in project scoping and further refined for detailed analysis in the alternatives. The original proposed action (Alternative 2) was taken directly from management opportunities in the CPIS study. The objectives and project design of Alternative 3 were refined and focused during environmental analysis based on interdisciplinary input and the public scoping. Alternative 4 was derived from Alternative 3 to address some specific wildlife issues. Other objectives and opportunities in the CPIS dealing with range conditions; oil and gas and mineral development; and some other resources have been or will be dealt with in other documents outside this analysis.

The Alternatives section details proposals to improve conditions. The Affected Environment section contains site-specific details on resource conditions The Environmental Consequences section explains how resource conditions are affected by the alternatives. Refer to the EA Map for specific locations of projects.

Section 1.3 - FOREST PLAN DIRECTION AND RELATIONSHIP TO OTHER PLANS AND DOCUMENTS

The Land and Resource Management Plan for the Bridger-Teton National Forest (LRMP)

Goals and objectives of the LRMP, approved in 1990 are to guide all management on the Forest The proposed projects identified here for the Maki Creek area are consistent with standards and guidelines and management direction in the LRMP. The Forest was mapped into Desired Future Condition (DFC) areas to guide management of Forest resources. The following DFC areas are in the analysis area and the Maki Creek area[2]:

DFC 1B: *Cottonwood analysis area***:** 19,604 acres **(**41% of the area); Maki *Creek Area*: 917 acres (13 %): Substantial commodity resource development with moderate accommodation of other resources.

DFC 10: *Cottonwood analysis area*: 18,207 acres (37% of the area); *Maki Creek Area*: 6035 acres (87 %):

[2] DFC totals include all acres.

some resource development while having no adverse and some beneficial effects on wildlife.

DFC 12: *Cottonwood analysis area:* 5,769 acres (12% of the area). *Maki Creek Area*: 0 acres (0 %): High quality wildlife habitat, escape cover, dispersed recreation.

DFC 2A: *Cottonwood analysis area:* 4,920 acres (10% of the area); *Maki Creek Area*: 0 acres (0 %): Unroaded area, for primitive recreation experience.

The Cottonwood Plan Implementation Study (CPIS)

The CPIS was completed in 1993 using an interdisciplinary process and public input. It identifies objectives and potential management opportunities and practices that will implement the LRMP and achieve desired resource conditions in this area. The action alternatives in the original proposal would help meet objectives 1-5, 7, 8, 13, 15, 18, 19, 21-25, 30, 32, 34, and 36[3]. Potential management opportunities are the basis for most resource projects in this proposal.

The North Cottonwood and South Cottonwood Allotment Management Plans

Set direction for improving rangelands in the area and managing grazing use in the analysis area. An Environmental Assessment to set direction for grazing in the area was completed in 1998. Grazing as allowed for in these plans will continue.

MA 25 Oil and Gas Leasing Environmental Assessment and Soda Field Environmental Assessment

Provides direction for management of oil and gas resources in the area. Leasing and management of oil and gas resources will continue and will be guided by these processes.

The Bridger West Travel Plan

Sets direction for road management and use in the area. An Environmental analysis was completed for this Plan in 1991. Additional watershed restoration projects will be considered under this current analysis.

Section 1.4 - PROPOSED ACTION

The following is a summary of the proposed action. The original scoping included proposed actions in the entire Cottonwood watershed. During project analysis and in consideration of issues that surfaced, the ID team determined that only proposed vegetation management actions and alternatives in the Maki Creek area (a subset of the Cottonwood watershed) would be the focus of detailed analysis. The detailed analysis looked at vegetation management of 195 to 2,450 acres using a combination of timber harvest, tree cutting or prescribed burning. Actions from the original scoping in the Maki Creek area are noted below in item 1, "Sustainable Forests". Refer to Alternative 2 for the detailed description of the proposed action in the Maki Creek area. Refer to Alternatives 3 and 4 for detailed descriptions of alternatives to the proposed action in the Maki Creek area.

The following projects are specific only to the Maki Creek area (refer to scoping statement for projects in the entire area).

1. Sustainable Forests:

[3] Listed in the Cottonwood Plan Implementation Study.

Project 1A (Pre-commercial thinning): There are 148 acres in Maki Creek area with dense tree stocking that would benefit from pre-commercial thinning but due to lynx conservation strategy guidelines, there is no pre-commercial thinning proposed.

Project 1B (partial cutting): In the Maki Creek area 129 acres would benefit from partial cutting to thin overstocked conifer forests while maintaining a forested appearance.

Project 1C (regeneration harvest): In the Maki Creek area 26 acres of clearcutting to provide for regeneration of the declining lodgepole pine and mixed conifer forests and for age class diversity across the landscape

Project 1D (aspen treatment): In the Maki Creek area mechanical treatment of 40 acres of aspen stands being treated with mechanical treatments (commercial timber sale) and prescribed fire to regenerate healthy aspen and remove conifers.

2. Recreational opportunities:
Project 2H: Adjust the road closure gate at the Maki Creek area to allow horse travel.

Section 1.5 – ISSUES[4]

Public Involvement

Public scoping for the Cottonwood projects began during initiation of the CPIS in 1991. Throughout 1991 and 1992 there were a series of public mailings, meetings and field trips to discuss implementation of the LRMP in the Cottonwood area. Public input received during this period was used to develop desired future resource conditions and site objectives to reach the desired conditions. These were then carried forward to the development of specific project proposals that are analyzed in this EA.

A scoping letter, describing proposed actions in the Cottonwood watershed, was sent to the Big Piney Ranger District mailing list on May 14, 1999. The list of 127 individuals, groups, organizations and agencies notified is in the project file. There was also a news release at the same time. A field trip to the area was conducted on August 10, 1999. Comments were requested on the proposal by September 1, 1999. A total of 8 comment letters were received. The project file contains copies of these letters and a summary of how each comment was addressed during analysis.

Personnel from the Wyoming Game and Fish Department actively participated throughout the analysis process in aspects of the proposal dealing with aspen and sagebrush management.

Issues

ID Team input and the public scoping process identified the significant issues listed and grouped below. These issues are used in the development of alternatives and for mitigation and monitoring requirements for the alternatives.

1) Vegetation Condition and Diversity:

a. Several comments expressed concerns that the amount or types of vegetation treatments in the proposed

[4] See Chapter 2, Table 2.4 for Units of Measures.

action were insufficient to meet either Forest Plan DFC or the site objectives stated in the CPIS. Forest vegetation conditions will continue to degrade in the absence of treatments.

b. Forest health was an issue; specifically, the high proportion of older age class conifer stands and declining tree growth, dwarf mistletoe infection levels in lodgepole pine and high fuel loadings from dead and down material.

c. Several comments expressed a need for additional aspen treatments including prescribed fire, to rejuvenate older, declining stands. In the absence of treatment aspen stands will continue to deteriorate and younger age classes will become non-existent.

d. Retaining old growth and mature vegetation for lynx and security cover other habitat for elk is essential. Vegetation treatments may impact old growth and wildlife security habitats.

2) Recreation Opportunities:

There was overall support for the recreation projects that were scoped as long as primitive and roadless recreational opportunities are maintained. Improvement of recreational facilities in the Soda Lake area was an identified need. Other recreational facilities such as improved trails and trailheads will provide for increased levels of recreational use, while protecting soils and other resources.

3) Fisheries and Water Quality:

Maintaining and improving habitat and water quality to support the Colorado cutthroat trout, listed as a sensitive species, in the major streams in the area. Fine sediment measurements ranged from 20 – 40%, which is above accepted levels. Currently, fine sediments in streams measured ranges from 20 to 40%, which is above accepted levels. Project activities may increase sediment levels. Opportunities also exist to decrease levels.

4) Wildlife Habitat and Species:

a. The Maki Creek area provides important spring, summer, fall and transition range(s) for elk as well as a variety of other wildlife species. Aspen stands are important parturition (birthing) and transition range. Most stands in this area are older, lack vegetation diversity and/or encroached by conifers. Opportunities exist to treat aspen and sagebrush (cutting and prescribed fire) to enhance the regrowth of younger stands, increase composition and seral stages. Existing habitat is lacking an assortment of seral stages (age classes), and vegetative diversity.

b. The listing of Canada lynx as Threatened and meeting the conservation objectives of the Canada Lynx Conservation Assessment and Strategy (2000) (CLCAS) to maintain and improve lynx habitat is a new issue since the completion of the CPIS and scoping. Large acreages of timber harvest and prescribed burn activities may affect lynx habitat by increasing the size of unsuitable habitat blocks, and disrupting travel corridors. All management activities and vegetative treatments will comply with the CLCAS. .

c. Proposed timber harvest may reduce lynx foraging habitat (snowshoe hare habitat) in the short term, but will improve the area once the stands are reforested and the height of the conifers reach above 12 feet

and have more than 225 stems per acre.

d. Proposed vegetative treatment (cutting and prescribed burning) may impact Threatened, Endangered and Proposed (TEP) and Sensitive species.

e. Timber harvest and prescribed activities may reduce elk and mule deer transitional and parturition range habitat-in the short term.

Other issues and public concerns considered by the ID Team are summarized in the project file. Some of these issues such as grazing management, and oil and gas development although important were outside the scope of this analysis. Other comments pertained to compliance or standards and guidelines which will be incorporated in all alternatives of the analysis. Some comments dealt mainly with format or content of the scoping statement or were voices of support for particular parts of the proposal. A few comments will be dealt with by applying mitigation measures or project design criteria to all alternatives. A list of mitigation measures is included in Chapter 2.

CHAPTER 2 - ALTERNATIVES

This chapter describes the proposed action and alternatives to the proposed action, including those eliminated from detailed study. It also explains mitigation measures associated with the alternatives and compares the alternatives by summarizing their environmental consequences.

The proposed action was developed as a result of the multidisciplinary Forest Plan implementation process, which included public involvement. Alternatives to the proposed action were developed based on issues identified through scoping and from new issues that have surfaced since the plan implementation study was completed. A range of alternatives that address the significant issues, are consistent with LRMP direction, and also meet the purpose and need for action were considered..

2.1 – Alternatives considered but eliminated from detailed study.

Several alternatives considered by the ID Team were not analyzed in sufficient detail to reach a sound decision. Following is a description of these alternatives and reasons for eliminating them from detailed analysis.

Several responders to the scoping requested greater timber harvest levels to implement opportunity areas (11,339 acres) identified in the CPIS. They pointed to forest health problems, advanced age of timber stands, harvest rotations and DFC's as justification. Age class and diversity goals were also mentioned. While there were additional timber harvest opportunities in aspen/conifer areas proposed in Alternative 3 and 4, overall timber harvest levels proposed are well below the identified opportunity areas. There are several reasons why the team did not consider full implementation of timber opportunities in detail.

- While the CPIS did identify greater areas of opportunity for timber harvest, the timeframe envisioned for implementing the opportunities was longer than the 3 to 5 year duration anticipated for projects in this analysis. Future harvest entries would be needed to fully implement the CPIS, which would involve further detailed, site- specific analysis. Implementing all identified opportunity areas in a short time period would result in exceeding created opening standards in the LRMP.

- Wildlife issues that have arisen since the CPIS such as conservation of Canada lynx and cutthroat trout habitat, as well as the National roadless initiative would preclude harvest of all opportunity areas identified in the CPIS.

- Timber harvest in a short time period, to meet opportunity levels stated in the CPIS would not fully comply with the purpose and need desired conditions.

The original Alternatives 2 and 3 developed by the ID team, for the entire Cottonwood Watershed, were not analyzed in sufficient detail to reach a sound decision. The ID team recommended that in order to allow sufficient time for site-specific analysis, only those proposals and alternatives in the Maki Creek area portion of the analysis area are analyzed in detail. These alternatives are discussed in Section 2.2, Alternatives Analyzed in Detail. The ID team considered projects in the Maki Creek area as best prospects for aspen regeneration in

response to significant issues 1C (vegetation condition - aspen) and 4A (wildlife habitat – elk). Maki Creek area projects also have the greatest potential to treat vegetation in response to the purpose and need. None of the project proposals outside of the Maki Creek area were analyzed in detail.

2.2 – Alternatives analyzed in detail.

Alternative 1: No Action

This alternative is required under NEPA regulations and also serves as a baseline of information for comparison of other alternatives. Though this alternative does not respond to the purpose and need for action, it does address some issues.

Under the no action alternative there would be no management of vegetation in the area. Routine maintenance of existing roads and trails would continue as well as fire suppression activities and sale and harvest of district-wide firewood and Christmas trees. The Maki Creek area roads would remain gated with limited access. Activities such as range management, outfitting and oil and gas activities covered under other site specific decision documents or permits would also continue to occur.

Alternative 2: Proposed Action

This alternative was developed to address opportunities to improve Forest resource conditions as identified in the CPIS. The full, original alternative was outlined in the Scoping Statement for this project. Only that portion of the alternative that addresses vegetation treatment in the Maki Creek area is analyzed in detail and described below.

Treatment Summary

- Timber harvesting to achieve desired conditions on 155 acres of conifer forest. This includes 129 acres of "partial cutting" and 26 acres of regeneration harvest using clearcutting.
- Aspen regeneration and fuels reduction treatments on 40[5] acres using commercial timber harvest to facilitate aspen regeneration.
- Silvicultural and sale area improvement projects, utilizing KV funds when available, would include: stand exams and stocking surveys following harvest; cutting undesirable, damaged or diseased trees in some areas; planting trees in clearcut (non-aspen) areas; site scarification or preparation for natural regeneration where needed, especially shelterwood and group selection areas; additional aspen treatments in and adjacent to stand 47-10 to ensure successful suckering.

[5] Includes pure aspen stands and stands where conifer has encroached in the aspen.

2 Alternatives

Treatment Description

Treatments would be located in the following areas:

Table 2.1: Vegetation Treatment by Stand: Alternative 2

LOCATION & SITE NUMBER	ACRES	PROPOSED ACRES TREATED/DFC	CC	TH	SW	S	GS	ASPEN	Area Untreated
		DFC 10							
47-3	87	30				20	10		57
47-5	175	30			30				145
47-10	104	40						40	64
47-20	60	15			15				45
47-21	39	10					10		29
47-29	30	10			10				20
47-30	64	20					20		44
47-34	122	40	26				14		82
TOTALS	681	195	26	0	55	20	54	40	486

CC: Clearcut (up to 5% residual trees retained)
TH: Thinning (40 to 60 % residual basal area retained)
SW: Shelterwood (40 to 50 % of residual basal area retained)
S: Sanitation Salvage (50 to 80% of healthiest overstory trees retained)
GS: Group Selection (Groups of trees up to 2 acres in size removed. At least 60% of entire stand retained)
ASPEN: Merchantable conifer trees removed in aspen stands.

"Partial Cut" treatments on approximately 129 acres would harvest some of the trees on the site, utilizing wood products (approximately 3 to 10 MBF per acre) and reducing forest fuels to achieve desired forest conditions. At least 40%, and in most areas over 50% of the trees in the canopy cover would be retained. Treatments would meet some wildlife habitat needs for mature forest structure, maintaining forested appearance and leaving the healthiest trees for future needs including regeneration. Slash from harvesting would be treated by: piling slash concentrations (25% of the area); lopping and scattering along with whole tree harvesting (50% of the area); or hand piling (25% of the area).

Silvicultural methods used would include shelterwood, sanitation salvage and group selection. Shelterwood harvest would occur on 55 acres where healthy, mature overstory trees occur that would help regenerate the site in the future. Approximately 40 to 50% of the healthiest overstory trees as well as snags would be retained in this entry. Douglas-fir and Engelmann spruce would be favored for leave trees. Most understory, damaged and diseased trees would be removed while retaining sufficient trees to maintain a forested appearance, forest structure for habitat and watershed protection, and a seed source for regeneration.

Sanitation salvage would occur on 20 acres where there are mature and over mature forests and significant tree mortality or damage has occurred. Approximately 50 to 80 % of the healthiest overstory trees would be retained as well as a few snags to maintain forested appearance and structure. Healthy understory trees would

also be retained. Sound dead, severely damaged and diseased trees would be removed.

Group selection would occur on 54 acres where an uneven aged, diverse canopy cover occurs. Groups of trees up to 2 acres in size would be removed, retaining all other trees on the site. At least 60% of the trees in the entire stand would be retained. Areas where trees are removed would favor regeneration of Engelmann spruce. Within the larger groups, a few snags or trees would be retained.

Approximately 3.5 miles of temporary roads and skid roads would be required which does not exceed Forest Plan road density standards. These roads would be obliterated and closed following harvest. No new permanent roads would be required.

See Appendix C for a summary of the stand exam data, as well as representative FVS (Forest Vegetation Simulator) information. See Alternative 2 map for stands to be treated.

The CPIS identified over 5,600 acres in need of treatment in the Cottonwood analysis area.

Clearcut harvest trees on up to 26 acres would provide for regeneration of declining lodgepole pine and mixed conifer forests and for age class diversity across the landscape. These treatments would be in stand 47-34 containing mature to overmature conifers, and experiencing declining tree growth. Historically, periodic stand replacing fires have regenerated new tree growth here. During this treatment, most trees would be removed, providing wood products (Forest Plan Goal 1.1 a. - c.), and reducing forest fuels. Some trees (up to 5% of the forest canopy) would be retained to provide forest structure for wildlife habitat, regeneration, visual relief and biological diversity. These would be individual trees and snags and clumps of trees. Slash would be treated with piling and burning, while leaving some large down logs and woody debris (5 to 20 tons per acre) following harvest. This would still result in a net reduction of fuel loading and continuity. Created openings would average 10 to 15 acres. Regeneration of new trees would be accomplished by replanting with lodgepole pine and Engelmann spruce, and by natural regeneration. No treatment would take place on slopes greater than 30%. Treated slopes would average 10 to 15 %.

Aspen treatments using timber harvest would regenerate 40 acres of mature and overmature aspen in Stand 47-10. Conifers are encroaching into the stand and replacing the aspen component. Following the treatment, aspen regeneration from root suckers will provide cover and feed for elk and other wildlife. Slash would be treated with piling and burning. There will be some natural conifer regeneration establishing in these areas, but the primary objective is to regenerate the aspen component. This treatment would provide conifer and some commercial aspen products. Surveys will be taken following treatments to monitor regeneration success and indicate any protection measures required.

Alternative 3: Issue/Concern Driven Alternative

This alternative was developed to respond to public issues from scoping, changes in resource demand since the CPIS and recent resource issues. This alternative is also designed to improve forest resource conditions as identified in the scoping. The original proposed action was modified for this alternative, with changes made to specific projects and some new projects added to respond to the new issues and resource concerns

Treatment Summary

- Timber harvesting to achieve desired conditions on 150 acres of conifer forest. This is all accomplished with "partial cutting". Harvest on 55 of these acres is planned to facilitate prescribed burning on adjacent aspen and sagebrush areas.

- Aspen regeneration, rejuvenation of sagebrush/grass communities and fuels reduction treatments on 2,300 acres using primarily prescribed fire with some mechanical methods. Within this treatment area there are 1,131 acres of aspen with over 90 percent with conifer intrusion and 1,169 acres of sagebrush/grass community types. Removal of commercial conifer trees on 123 [6] acres of mixed aspen/conifer forest types will be allowed to facilitate aspen regeneration. The harvest operation will provide fuels to facilitate post-harvest prescribed burning. Burning operations will be conducted during conditions that will favor a mosaic burn across the treatment area. A major objective of this treatment is improved spring dispersal of elk from the nearby Jewett winter feedground.

- Sale area improvement projects, utilizing KV funds when available, would include: stand exams and stocking surveys following harvest; limited cutting of damaged or diseased trees in some areas; cutting of some sub-merchantable conifer trees in preparation for burning in stand 55-3; cutting conifer and some aspen trees to facilitate burning or promote aspen vigor or suckering on 100 acres adjacent to stand 47-35 and in aspen pockets in stands 47-4 and 47-34; pre-treatment of stand 46-17 to facilitate prescribed burning; site scarification or preparation for natural regeneration where needed and noxious weed treatment in disturbed areas.

[6] These are the areas from the plots made in GIS and maps.

2 Alternatives

Treatment Description

Partial cut treatments and aspen treatments involving commercial harvest would be located in the following areas:

Table 2.2: Vegetation Treatment by Stand (Using timber harvest): Alternative 3

LOCATION & SITE NUMBER	ACRES	PROPOSED ACRES TREATED/DFC	CC	TH	SW	S	GS	ASPEN	Area Untreated
		DFC 10							
47-3	87	20					20		67
47-4	101	20						20	81
47-5	64	20			20				44
47-30	64	20					20		44
47-34 [7]	122	50				15	20	15	72
55-3	50	50						50	0
55-10	30	25		25					5
55-11	22	15				15			7
55-12	15	15				15			0
47-35	27	20						20	7
46-17	18	18						18	0
TOTALS	600	273	0	25	20	45	60	123	327

CC: Clearcut (up to 10% residual trees retained)
TH: Thinning (40 to 60 % residual basal area retained)
SW: Shelterwood (40 to 50 % of residual basal area retained)
S: Sanitation Salvage (50 to 80% of healthiest overstory trees retained)
GS: Group Selection (Groups of trees up to 2 acres in size removed. At least 60% of entire stand retained)
ASPEN: Merchantable conifer trees removed in aspen stands.

"Partial Cut" treatments on approximately 150 acres would harvest some of the trees on the site, utilizing wood products and reducing forest fuels to achieve desired forest conditions. At least 40%, and in most areas over 50%, of the trees in the canopy cover would be retained. Treatments would maintain forested appearance, meet wildlife habitat needs for mature forest structure, and leave the healthiest trees for future needs including regeneration. Slash from harvesting would be treated by: piling slash concentrations (25% of the area); lopping and scattering along with whole tree harvesting (50% of the area); or hand piling (25% of the area). Scattered slash piles would be left for snowshoe hare shelter. Silvicultural methods used would include commercial thinning, shelterwood, sanitation salvage, and group selection.

Commercial thinning would occur on 25 acres in stand 55-10 where healthy but less than mature trees exist in dense stands. Approximately 40 to 60 % of the basal area, representing the healthiest overstory trees would be retained. Leave trees would be dispersed through the treatment area, at approximately 20 to 25 foot spacing,

[7] Refer to Areas 47-34A, B and C on alternative 3 map.

allowing variance for selection of healthy leave trees and providing diverse site conditions. Some clumps of unthinned trees would be left, as well as scattered snags (except near boundary with burn areas). Trees cut will be mostly lodgepole pine. Where there are a few small scattered pockets of aspen, conifer cutting will be heavier to favor aspen regeneration. Most of the Douglas-fir and spruce (approximately 10% of the trees) in this stand would be left. Except in the scattered clumps, most of the understory trees would be removed, thereby reducing tree density and fuel loading while retaining forest structure, forested appearance and healthy tree cover. A portion of this stand (approximately 10 acres) that is a "dog hair" lodgepole type with shorter trees could be offered as a commercial, small sale post and pole area. Slash would be treated by yarding tops to a landing area and burning and piling slash concentrations with small equipment or by hand. The thinning and slash treatments would reduce fuels and reduce risk of escape fire from adjacent aspen/sagebrush burning. A fuelbreak would be provided as part of harvesting operations. Temporary roads or skid trails at the east edge of the stand would be utilized, as well as heavier thinning of trees along the edge adjacent to burn area.

Shelterwood harvest would occur on 20 acres in stand 47-5, leaving 44 acres of the stand un-treated. Harvest would occur in areas where healthy, mature Engelmann spruce and Douglas-fir are abundant in the overstory to regenerate the site in the future. Approximately 40 to 50% of the healthiest overstory trees as well as snags would be retained in this entry. Douglas-fir and Engelmann spruce would be favored for leave trees. Most understory, damaged and diseased trees would be removed in the 20 acres that are treated. Retained trees and clumps of trees would maintain forested appearance; provide habitat, watershed protection, and a seed source for regeneration. Much of the area adjacent to past, regenerating harvest units would remain un-harvested. Where harvest does occur, greater numbers of trees will be left, to provide wind firmness and forest structure.

Sanitation salvage would occur on 45 acres in stands 47-34, 55-11 and 55-12, where there are mature and over mature forests and significant tree mortality or damage has occurred. Approximately 50 to 80 % of the healthiest overstory trees would be retained as well as a few snags to maintain forested appearance and structure. Douglas-fir and Engelmann spruce would be favored for retention and comprise a greater proportion of the residual stand. Lodgepole pine and subalpine fir, in greater stage of deterioration would be selected for cutting and comprise a smaller proportion of the post-harvest stands. Healthy understory trees would also be retained. Dead, severely damaged and diseased trees would be removed. In patches of trees dominated by Engelmann spruce and Douglas-fir, few trees would be removed and most residual structure and composition would be retained. In patches of aspen, most conifer would be removed. The treatment for stand 47-34 (15 acres) would provide fuel reduction and fuel breaks for adjacent burning in aspen/sagebrush areas. Fewer trees would be left at the edge of the burn unit and ladder fuels would be reduced. In stand 55-11, one third of the stand, adjacent to regenerating past clearcuts, would remain un-harvested and retain all existing structure, including snags, and composition.

Group selection would occur on 60 acres in stands 47-3, 47-30 and 47-34, where an uneven aged, diverse canopy cover occurs. Groups of trees up to 2 acres in size would be removed, retaining all other trees on the site. At least 60% of the trees in the entire stand would be retained. In stand 47-3, 77% of the stand would be retained. Areas where trees are removed would favor natural regeneration of Engelmann spruce and Douglas-fir. Groups to cut would be selected so as to leave healthy Douglas-fir and spruce at the unit edges for a seed source. Groups of trees to be cut in stands 47-30 and 47-34 would be located to provide fuel breaks for adjacent burning in aspen/sagebrush areas. Within the larger groups, a few snags or trees would be retained.

Removal of commercial conifer would occur on 123 acres of aspen/conifer stands to rejuvenate and regenerate aspen. In stand 47-4, all aspen would be felled and slash concentrations piled. In stands 47-34, 55-3, 47-35 and 46-17 aspen would be left standing and broadcast burning of slash would occur after harvest to reduce fuels and stimulate aspen suckering. This burning would be coordinated with burning on adjacent aspen/ sagebrush areas. Some fuelbreaks would be done as part of harvest operations, especially in stand 47-34. In stand 47-35, large, fire resistant Douglas-fir would also be retained. All healthy Douglas-fir greater than 16 inches in diameter would be left. Slash would be pulled back from the base of residual Douglas-fir trees. In stand 46-17, no harvesting would occur at the bottom of the stand near the draw. Some healthy Douglas-fir (5 to 10 per acre), greater than 18 inches DBH, would be retained.

Approximately 3.0 miles of temporary roads and skid roads would be required, not to exceed Forest Plan road density standards and these would be obliterated and closed following harvest. This is 0.5 miles less than Alternative 2 and 0.2 miles more than Alternative 4. No new permanent roads would be required. The Maki Creek area road system that is currently gated for administrative motorized use and public non-motorized use would remain that way following harvest.

See Appendix C for a summary of stand exam data, as well as representative FVS (Forest Vegetation Simulator) information. See Alternative 3 map for stands to be treated.

The CPIS identified over 5,600 acres of conifer forest in the Cottonwood Analysis area in need of treatment to reach desired age class and desired stand conditions.

Approximately 2,177 acres of this project will utilize prescribed burning, with some tree cutting without removal, to provide aspen regeneration and rejuvenation of adjacent sagebrush/grass community types. This will be accomplished primarily through prescribed fire, and with limited tree cutting without removal to facilitate burning or aspen suckering. This will also reduce forest fuels in these areas. This treatment is being done in cooperation with the Wyoming Game and Fish Department to improve spring dispersal of elk from winter feedgrounds. Vigorous aspen suckering would be expected on 1,008 acres of aspen forest following burning, which would provide additional quality elk browse in the spring. This is in addition to the 123 acres of aspen treatment utilizing commercial timber harvest followed by fuel treatments. Treatment should occur in large enough blocks to achieve maximum success in survival of aspen suckers. There will be some cutting of conifer trees to release the aspen stands for subsequent burning for regeneration. These will be mostly subalpine fir understory trees of little or no merchantable value. The intent is to treat 80 to 100 % of selected stands to regenerate sufficient aspen to achieve 1,000 or more stems per acre that would be at least 10 feet tall after 10 years.

Approximately 1,169 acres of sagebrush/grass/forb vegetation areas adjacent to aspen areas will be renewed and regenerated by prescribed burning. The objective of burning sagebrush is to provide a patchy mosaic of 40 to 60% of the type with early seral stage plants, increasing percent cover of herbaceous vegetation by at least 40% after 2 growing seasons. At least 40% of sagebrush areas with a canopy cover of > 20% would remain untreated. Treatment will avoid the mountain silver sagebrush types which occur primarily adjacent to riparian areas. A watershed objective is to return ground cover to at least 50% after the second growing season and to 80% cover after the fifth season.

Monitoring should occur prior to burning and at the end of the second and fifth growing seasons in at least 1 site per treatment area. These areas are located primarily in older aspen, aspen/conifer forests and adjacent sagebrush/grass areas near the Jewett feed ground and migration corridors in the drainages of Little Maki, Maki, South Horse, Pass and Elk creeks. The combination of juxtaposed aspen and sagebrush areas form logical burn units with mutual natural boundaries.

These units are adjacent or in close proximity to private and BLM lands. Coordination will be important prior to any prescribed burning.

An approved burn plan will be prepared and approved before any burning.

Alternative 3 stipulations and mitigation: (For additional mitigation see Section 2.4)

- Follow WGFD recommendations to treat a minimum of 1,000 acres of aspen to avoid concentrating elk use because of nearby Jewett feedground.
- Livestock grazing will be deferred until ground cover reaches 60 percent.
- North facing slope above Maki Creek is a past tie hack area of concern both from a historic perspective (old cabins present) and as lynx habitat. Special care is needed so as not to burn this area by accident during prescribed burn operations.

Alternative 4: Additional Snag and Lynx Habitat Alternative

This alternative was derived from Alternative 3 only to provide for additional lynx and snag habitat conservation measures beyond what already exist.

Treatment Summary

- Timber harvesting to achieve desired wildlife habitat conditions on 60 acres of conifer forest. This is all accomplished with "partial cutting". Harvest on 25 of these acres is planned to facilitate prescribed burning on adjacent aspen and sagebrush areas.
- Sale area improvement projects, utilizing KV funds when available, would include: stand exams and stocking surveys following harvest, noxious weed treatment, and some pre-burn aspen treatments adjacent to harvest units.
- Aspen regeneration and fuels reduction treatments on 1,111 acres and sage/grass treatment on 1,169 acres for a total of 2,280 acres treated using primarily prescribed fire with some mechanical methods. This is located in aspen and adjacent sagebrush/grass vegetation types. This includes timber harvest to remove commercial conifer trees on 103 [8] acres of mixed aspen/conifer forest types to facilitate aspen regeneration. This is 20 acres less than Alternative 3 and 63 more acres than Alternative 2.

[8] These are the areas from the plots made in GIS and maps.

Treatment Description

Treatments would be located in the following areas:

Table 2.3: Vegetation Treatment by Stand: Alternative 4

LOCATION & SITE NUMBER	ACRES	PROPOSED ACRES TREATED/DFC DFC 10	CC	TH	ITM	SW	S	ASPEN	Area Untreated
47-34 /1	122	50			35			15	72
55-3	50	50						50	0
55-10	30	25		25					5
47-35	27	20						20	7
46-17	18	18						18	0
TOTALS	247	163	0	25	35	0	0	103	84

CC: Clearcut (up to 10% residual trees retained)
TH: Thinning (40 to 60 % residual basal area retained)
SW: Shelterwood (40 to 50 % of residual basal area retained)
S: Sanitation Salvage (50 to 80% of healthiest overstory trees retained)
ITM: (60 to 80% of the overstory retained, including all DF >8 inches DBH)
ASPEN: Merchantable conifer trees removed in aspen stands.

"Partial Cut" treatments on approximately 60 acres would harvest some of the trees on the site, utilizing some wood products and reducing forest fuels to achieve desired forest conditions. In most areas over 50%, of the trees in the canopy cover would be retained. Treatments would meet wildlife habitat needs for mature forest structure and maintaining forested appearance as well as resulting in a more fire resistant stand of Douglas-fir. Slash from harvesting would be treated by: piling slash concentrations (25% of the area); lopping and scattering along with whole tree harvesting (50% of the area); or hand piling (25% of the area).

Silvicultural methods used would include commercial thinning, individual tree marking, and removal of commercial conifer trees from aspen stands. Commercial thinning would occur on 25 acres in stand 55-10, where healthy trees that have not reached maturity exist in dense stands. In stand 46-17 (depending on slopes, soils, and access) the objective will be to enhance aspen and Douglas-fir.

Individual tree marking would occur on 35 acres in stand 47-34. Approximately 60 to 80 % of the overstory trees would be retained as well as snags to maintain forested appearance and structure. All Douglas-fir trees over 8 inches DBH would be retained. Healthy understory trees would also be retained. The treatment for stand 47-34 would provide fuel reduction and fuel breaks for adjacent burning in aspen/sagebrush areas while favoring Douglas-fir. Heavier tree retention would be concentrated adjacent to old harvest units as buffer from transition and "hard" edges. Forest Plan snag guidelines will be followed to facilitate retention groupings of standing timber.

Removal of commercial conifer would occur on 103 acres of aspen stands. In stands 47-34, 55-3, 47-35 and 46-

17, aspen would be left standing and broadcast burning of slash would occur after harvest to reduce fuels and stimulate aspen suckering. This burning would be coordinated with burning on adjacent aspen/ sagebrush areas.

Approximately 2.8 miles of temporary roads and skid roads would be required, not to exceed Forest Plan road density standards, and these would be obliterated or closed following harvest. This is 0.7 miles less than Alternative 2 and 0.2 miles less than Alternative 3. No new permanent roads would be required.

See Appendix C for a summary of stand exam data, as well as representative FVS (Forest Vegetation Simulator) information. See Alternative 4 map for stands to be treated.

Approximately 2,177 acres of this project is to provide aspen regeneration and rejuvenation of adjacent sagebrush/grass community types, primarily using prescribed fire. This will also reduce forest fuels in these areas. This treatment is being done in cooperation with the Wyoming Game and Fish Department to improve spring dispersal of elk from winter feedgrounds. Vigorous aspen suckering would be expected on the 806 to 1008 acres of aspen forest following burning, which would provide additional quality elk browse in the spring. This is in addition to the 103 acres of aspen treatment listed above where commercial conifer will be removed. Ideally, treatment should occur within a 1 to 3 year period, to achieve maximum success in survival of aspen suckers. There will be some cutting of conifer trees to provide sufficient fuels to release the aspen stands for subsequent burning for regeneration. These will be mostly subalpine fir understory trees of little or no merchantable value. The objectives for aspen, to be monitored, is to burn 80% to 100% of selected stands and regenerate at least 1,000 stems/acre greater than 10 feet tall after 10 years.

Approximately 1,169 acres of sagebrush/grass/forb vegetation areas adjacent to aspen areas will be renewed and regenerated by prescribed burning. The objective of burning sagebrush is to provide a patchy mosaic of 40 to 60% of the type with early seral plants, increasing percent cover of herbaceous vegetation by at least 40% after 2 growing seasons. At least 40% of sagebrush areas with a canopy cover of > 20% would remain untreated. Treatment will avoid the mountain silver sagebrush types which occur primarily adjacent to riparian areas as well as areas with slopes greater than 30%. A watershed objective, to be monitored following burning, is to return ground cover to at least 50% after the second growing season and to 80% cover after the fifth season.

Monitoring should occur prior to burning and at the end of the second and fifth growing seasons in at least 1 site per treatment area. These areas are located primarily in older aspen, aspen/conifer forests and adjacent sagebrush/grass areas near the Jewett feed ground and migration corridors in the drainages of Little Maki, Maki, South Horse, Pass and Elk creeks. The combination of juxtaposed aspen and sagebrush areas form logical burn units with natural boundaries.

These units are adjacent or in close proximity to private and BLM lands. Coordination will be important prior to any prescribed burning.

Alternative 4 stipulations and mitigation: (For additional mitigation see Section 2.4)

- Sage and aspen treatments should occur August through December to avoid bird nesting season and to avoid elk transition and parturition. Follow WGFD recommendations to treat a minimum of 1,000 acres

of aspen to avoid concentrating elk use because of nearby Jewett feedground. Fall burning will conflict with big game hunting seasons.

- Livestock grazing will be deferred until ground cover reaches 60 percent.

- North facing slope above Maki Creek is a past tie hack area of special concern both from an historic perspective (old cabins present) and lynx habitat. Special care is needed to not burn this area.

- Retention groups. Alternative 4 will retain live and dead standing trees and down material in a range of diameter classes (8-20"+) in patches distributed throughout the treatment stands (47-17, 47-34, 47-35, 55-3), ranging from 1 to 5 acres in size. Retention groups would consist of roughly 8 to 25 trees (both live and dead) of the species preferred by cavity-dependent species. A minimum of 8 to 12 dead trees will be retained in each group in the 8 to 20"+ diameter (DBH) range. This exceeds the Forest Plan Snag Habitat Guideline (USFS 1990, p. 127), to meet site-specific conditions within these units to enhance habitat for woodpeckers and cavity nesters.

2.3 Comparison of Alternatives

Table 2.4 - Comparison of Alternatives – Summary

ISSUES	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1) Vegetation Condition and Diversity				
Vegetation treatment – Maki Creek Area[9]				
Clear Cut –up to 20 percent retention	0 acres	26 acres	0 acres	0 acres
Commercial Thinning-40-60 % trees retain	0 acres	0 acres	25 acres	25 acres
Shelter wood – 40 – 50 % trees retained	0 acres	55 acres	20 acres	0 acres
Salvage – 50 – 80 %of healthiest retained.		20 acres	45 acres	0 acres
Group selection-1/2 stand retained. < 2 acres		54 acres	60 acres	0 acres
Aspen – regeneration cutting.		40 acres	123 acres	103 acres
Partial cut (special wildlife emphasis)		0	0	35 acres
Percent Maki forested area harvested		4 percent	5 percent	3 percent
DFC harvested				
DFC 10	0 acres	195 acres	273 acres	163 acres
Proposed timing of treatment[10]				
Maki	None	2004 - 2005	2004 - 2009	2004 - 2009
Mature aspen regenerated (Includes conifer utilization)	None	40 acres	929-1,131 acres	909-1,111 acres
New seedling/ sapling age class (CC,SW,GS)	None			
Lodgepole		41 acres	5 Acres	None
Spruce/fir		45 acres	25 Acres	None
Douglas-fir		49 acres	50 Acres	None
Forest Health Indicators: (Maki Creek)				
Med/High risk ES/DF acres treated	None	109 acres	80 acres	35 acres
LP dwarf mistletoe acres treated	None	46 acres	45 acres	None
High-density pole and small saw timber size stands thinned.	None	None	25 acres	25 acres
Acres of dead and dying conifer treated(Salvage)	None	20 acres	45 acres	None

2) Recreation Opportunities	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Deferred for future decision				
Mitigation included to reduce recreation conflicts		X	X	X
3) Fisheries and Water Quality[11]	As provided in Travel Plan	As provided in Travel Plan	As provided in Travel Plan	As provided in Travel Plan
Roads closed and rehabbed				
Mitigation and road maintenance included to reduce recreation conflicts.		X	X	X

[9] Acres based on field review and GIS.
[10] See Appendix D for acres and road work.
[11] See additional comparisons in Chapter 4 , Section 4.31

4) Wildlife Habitat	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Aspen acres regenerated for elk/deer habitat	None	40	~929- 1,131 acres	~ 909- 1,111 acres
Sagebrush acres regenerated	None	None	Approximately 580 acres (50% of 1169 acres)	Approximately 580 acres (50% of 1169 acres)
Lynx habitat Disturbed *Aspen*	0 acres	40 acres	927 -1,129 acres	907-1,109 acres
Conifer	163 acres, existing condition	163 acres existing 26 acres CC 129 acres partial cut	163 existing acres 150 acres partial cut	163 existing acres 60 acres partial cut

Alternative 3 has approximately 78[12] more harvest acres treated than Alternative 2. Some of the same stands are treated. However, many treatment stands differ from Alternative 2 due to more detailed review of specific stand data and conditions, including field reviews and to meet new resource issues including roadless area protection. Additional harvest addresses to some extent, public scoping requests to more fully implement the CPIS The CPIS had identified over 5,600 acres in need of treatment. Alternative 3 also has prescribed burn and additional harvest treatments to respond to scoping issues for aspen regeneration for elk and deer habitat.

Alternative 4 has 32 less harvest acres treated than alternative 2 and 110 less harvest acres treated than Alternative 3 as well as additional stipulations restricting harvesting and burning operations and number and size of trees harvested. Aspen and sage burn units in Alternative 4 are the same as Alternative 3.

2.4 – Mitigation Common to all Action Alternatives

Mitigation measures are designed to prevent adverse impacts or to contain non-significant impacts within acceptable limits during project implementation. Following are project design elements and mitigation measures that would accompany selection of any action alternative. These mitigations are specific to proposed projects and the project area. Standard contract provisions to protect other resources, including those that allow termination of contracts to prevent unforeseen environmental impacts will be used for any timber sale projects. Site-specific modifications to these mitigations may occur during project implementation if deemed necessary by the District Ranger through field reviews by an interdisciplinary team (IDT); team members' specialties might include Soil Scientist, Hydrologist, and/or Wildlife and Fishery Biologist Application of best management practices (BMP's)[13]and adherence to Forest Plan standards, current laws, policies and regulations is assumed for all action alternatives. BMP's are found in:

- Silviculture Best Management Practices, Wyoming Non-point Source Management Plan, March, 1997, and Wyoming Forestry Best Management Practices brochure.
- Soil and Water Conservation Practices Handbook (Forest Service Handbook 2509.22).
- Forest Service Specifications for Construction of Roads and Bridges (USDA Forest Service, 1996).

[12] Based on GIS and mapping

Recreation Mitigation

1. Timber hauling will not occur on holidays or during deer and elk season opening weekends.

Scenic Resources Mitigation

1. The sale administor, prior to any ground disturbing activity shall approve all staging/stock-piling areas. An erosion control plan will be prepared prior to any activity commencing.

2. All staging/stock-piling sites shall be screened from open system roads, trails, and popular recreation areas during all phases of project implementation.

3. Top soil shall be preserved and utilized for phased rehabilitation. The timing of the phased rehabilitation shall comply with timing and techniques outlined in the rehabilitation mitigation measures.

4. Construct cut slopes no steeper than 2:1, except where the natural slope makes a 2:1 impossible or in areas of rock cuts. In these areas (> 2:1), the creation of serrations, benches or terraces will be used to help hold the topsoil and vegetation.

5. All cuts/fills shall be shaped to create warped (varied pitches) slopes. The surface shall be left rough (not bladed smooth) so that the topsoil can bond and stay in place.

6. Ditches shall be U-shaped with rounded edges and revegetated.

7. Tops of cuts shall be rounded to blend with uphill topography.

8. Where stable, rock outcroppings on cut and fill slopes shall be retained.

9. All culverts shall have flared ends

10. Topographic breaks and vegetation providing natural screening from critical viewpoints and corridors shall be maintained. Proposed alterations to the landscape shall be oriented and designed to best utilize natural screening potential.

11. Clumps of trees and individual leave trees within the proposed clearcut units shall be marked and retained.

Heritage Resource Mitigation

1. Historic properties determined eligible for the National Register of Historic Places will be avoided by project implementation.

2. Additional inventory and analysis of effects to heritage resources will be required for prescribed burn treatments once a specific burn plan has been developed. This mitigation measure is identified in the Programmatic Agreement among the Advisory Council on Historic Preservation, the Wyoming State Historic Preservation Office, and the Forest Service Regarding Implementation of the Prescribed Fire Program (FS Agreement No. 01-MU-11020000-015).

Watershed Mitigation

1. Where roads are hydrologically connected to the stream system they will be disconnected through various methods to protect aquatic resources.

2. Avoid slopes greater than 30 percent where soil erosion hazard is rated as "High". If access is needed to conduct management activities, follow the natural landscape contours as much as possible, apply surfacing, and construct rolling dips and/or drainage to prevent excessive sedimentation.

3. Where re-vegetation is severely limited due to "slope", avoid ground disturbance on slopes exceeding 24 percent. If these areas cannot be avoided, additional mitigation may be warranted to prevent loss of site productivity once soil is disturbed, i.e., seed and mulching, additional tree planting, and/or application of soil stabilizers.

4. Leave adequate slash (10 – 12 tons/Acre, ≥3" diameter material) to protect soils from accelerated erosion and loss of soil productivity. For lodgepole pine/spruce-fir ecosystems, a minimum of five to ten tons per acre of large woody debris (≥3 inches diameter) would remain scattered throughout the harvest unit to prevent erosion and provide microsites for new growth as well as short and long term nutrient cycling. This will not apply to areas immediately adjunct to prescribe burn units.

5. Designate skid trails and restrict mechanical operations to periods of the year when the surface soil is dry, frozen, snow covered, and/or slash covered to reduce the risk of reducing soil porosity and infiltration characteristics. Heavy equipment would not be used when soil conditions are wet enough to rut, displace and/or bury organic matter and/or in areas where understory vegetation indicates forested riparian conditions. Lopping and scattering limbs and branches on landings and skid trails would be required to help mitigate compaction.

6. Monitor implementation of BMPs. Monitoring of project implementation and watershed protection practices should be developed and included in the KV plan for the timber sale.

7. Meet the Soil Quality Standards and Guidelines (USFS, 1995) using the regional Soil Management Handbook (FSH 2509.18) as guidance to determine mitigation needs during project implementation. .

8. All temporary roads will be treated to bring the disturbed area back into hydrologic function (ripped and water barred) and where designated, seeded with approved seed mixes.

9. Following project activities, review roads for possible additional closures or obliteration.

Mitigation measures will be applied as part of all action alternatives.

Fisheries and TES Species Mitigation Maki Creek area
The primary purpose of these mitigations is to minimize damage to stream channels and fish habitat, and minimize soil loss and water quality deterioration. The following mitigations reference Bridger-Teton National Forest Land and Resource Management Plan (1990), Inland Native Fish Strategy Interim Direction (1995), Wyoming Department of Environmental Quality Forestry Best Management Practices (1997.

Timber Harvest and Prescribed Fire Mitigations
Removal of vegetation cover from timber harvest and prescribed fire activities has both short and long term potential impacts to aquatic resources. Mitigation to protect aquatic systems includes:

1. Prohibit timber harvest on either side of Little Maki and Maki Creeks from outer edges of riparian vegetation to top of inner gorge, or 300 feet slope distance (600 feet total), whichever is greatest.

2. Prohibit timber harvest on either side of remaining perennial and intermittent streams, and wetlands from the outer edges of riparian vegetation to top of inner gorge, or 150 feet slope distance (300 feet total), whichever is greatest.

3. Prohibit prescribed fire ignition, camps, cleared fire lines, storage of hazardous substances (lubricants, gas, retardant, etc.) within streamside areas defined in 1 and 2 above.

4. In cases where riparian buffer cannot be protected from prescribed fire within a reasonable cost constraint, or IDT (member constituent identified above) define a vegetation prescription that allows/recommends lightly burning through riparian, then additional mitigations may apply. These mitigations to minimize soil loss and deterioration to water quality may include seeding and planting disturbed areas, installing water bars or spreading slash.

5. Livestock grazing will be deferred until ground cover reaches 60 percent.

6. Enhance pool habitat in all perennial streams with resident fish populations within the sale area boundary by strategically placing large woody debris (LWD), through the use of KV funds.

Roads Mitigations
Roads design, limitation on use, restoration and maintenance are the primary factors controlling erosion and sedimentation of stream channels.

1. For each existing and planned road (including temporary roads), avoid adverse impacts to aquatic habitats by development and implementation of a Road/Transportation Management Plan. At a minimum, address the following items in the plan:
   a. Road design criteria, elements, and standards that govern construction and reconstruction.
   b. Road management objectives for each road.
   c. Criteria that govern road operation, maintenance and management.
   d. Requirements for pre-construction, construction phase, and post-storm inspections and maintenance.

e. Regulations of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.
f. Implementation monitoring plans for road stability, drainage, and erosion control.
g. Mitigation plan for road failures.
h. Restoration design for each road not needed for future management activities.
i. Maintenance plan for each road needed for future management activities.

2. To avoid sediment delivery to streams from road surface:

   a. Outslope the roadway surface, except in those cases where it would increase sediment delivery to streams or where unfeasible or unsafe.
   b. Route road drainage away from potentially unstable stream channels, fills, and hill slopes.

3. Avoid disruption of natural hydrologic flow path.

4. Side casting of soils or snow is prohibited on road approaches to Little Maki and Maki Creek and it tributaries.

5. Ditch drainage and road surface drainage into live streams or intermittent stream channels is prohibited.

6. Reconstruct Little Maki and Maki Creek stream crossings to accommodate fish passage and 100-year peak flood (including associated bedload and debris).

7. Obliterate and restore road accessing Maki Creek Fire and Timber Sale south of Little Maki Creek.

Wildlife Mitigation
Several mitigation measures listed under other resources also apply to wildlife habitat protection.

1. Follow WGF recommendations and treat a minimum of 1000 acres of aspen to avoid concentrating elk use because of the nearby Jewett feedground. Treatment may occur over a 1 to 3 year period.

2. All roads need to remain closed/gated to maintain wildlife security as per the travel plan unless they are an erosion/sedimentation concern, in which case they should be rehabilitated, and closed once treatments are completed.

3. Forest Plan snag guidelines will be followed.

CHAPTER 3 - Affected Environment

Section 3.1 INTRODUCTION

Described below are the existing biological, physical and social environmental conditions in the project area that may be affected by the proposed action and alternatives. Issues, as listed in Chapter 1 - Section 1.5, are referenced for each topic where relevant.

The CPIS discussed existing and desired future conditions for most resources in the analysis area. You can refer to this study for additional information. Descriptions below contain information that was developed in the CPIS as well as new information and data collected since then.

The analysis area includes the North and South Cottonwood Creek drainages (Forest Plan Management Area 25) with elevations ranging from 8000 to 9500 feet. The area contains Rocky Mountain mixed conifer forests, aspen forests, large open areas of sagebrush and grasses and riparian areas along North and South Cottonwood Creeks and their numerous sub-drainages. Vegetation has historically been shaped by wild fire disturbance. The area provides important wildlife habitat for numerous species including elk, mule deer, moose, lynx and black bear. Colorado cutthroat trout, whitefish and many introduced trout species are present in North and South Cottonwood creeks and their sub-drainages. A system of Forest roads is in place providing access to recreational forest users as well as permittees and others who earn their livelihoods from various forest resources. Livestock grazing occurs in the area and there are some areas where timber harvest has occurred. A system of hiking and horseback trails as well as dispersed camping areas along the roads serve recreation users.

Detailed analysis was focused in the Maki Creek area, which is wholly within the Cottonwood analysis area. This is an area of approximately 7,080 acres in the vicinity of Maki and Little Maki Creek drainages, tributary to North Cottonwood Creek.

Section 3.2 BIOLOGICAL ENVIRONMENTAL CONDITIONS

3.21 Forested Vegetation

Significant issue 1, "Vegetation Condition and Diversity", deals directly with the condition, health and treatment of the areas vegetation resource. The other significant issues (2-4), concerning recreational opportunities, fisheries and water quality, and wildlife habitat are directly or indirectly dependent on the makeup, health and treatment of vegetation as well. The condition of vegetation in the analysis area was well described in the CPIS. The data and information gathered during that study was used to develop the proposed action. Refer to Chapter 2, pages 1 to 6, CPIS, 1993 for that information. This description is a summary of that information, stand exam data and new information available since the study. Intensive stand exam data was gathered on over 7,000 acres in the Cottonwood Analysis Area. Appendix C of the CPIS contains a summary of stand exam data for the area. The data is available for review at the Big Piney Ranger District. In addition, some 54 aspen community plots were taken in the summer of 2000. This information is available in the project file.

3 Affected Environment

The Cottonwood area is a landscape comprised of a variety of vegetation types influenced by the broken topography of the east slope of the Wyoming Range. Forested vegetation is primarily lodgepole pine, subalpine fir/Engelmann spruce and aspen interspersed with large sagebrush grass openings. This variety of forested patches and openings with species and age class diversity provides cover and forage habitat for diverse wildlife species discussed below. Forests are mostly subalpine fir habitat types. The forests typically have a dense understory of subalpine fir with some spruce. The fir/spruce forests commonly have a component of older lodgepole or limber pine trees. Most of the aspen forests have an understory or significant component of conifer vegetation. The CPIS identified 1,500 acres of aspen in need of treatment (CPIS, p.4.1). There is also a small amount of Douglas-fir and whitebark pine forests in the area.

Periodic fires occur with probable frequencies of 25 to 150 year intervals (See Forest Fuels and Fire, for a more detailed description of fire intervals). A majority of forested areas have not experienced fire disturbance for over 150 years. There were two (2) large fires in the area. One was the Bare Creek burn, which covered 6,150 acres of the management area in 1940. The other was the Cottonwood fire in 1956 covering 1,100 acres. Most of the Bare Creek burn is not included in the suitable timber base used in the Forest Plan and CPIS vegetation analysis. A lot of this area is either classified as aspen or has greater than 40% slopes. The Bare Creek and Cottonwood areas are now reforested with a diversity of pole size trees, predominantly lodgepole pine and aspen as well as diverse shrubs.

According to Forest Plan GIS mapping, the distribution of vegetation types in the area and relation to the Bridger-Teton National Forest Properly Functioning Condition (PFC) Assessment of 1997 is:

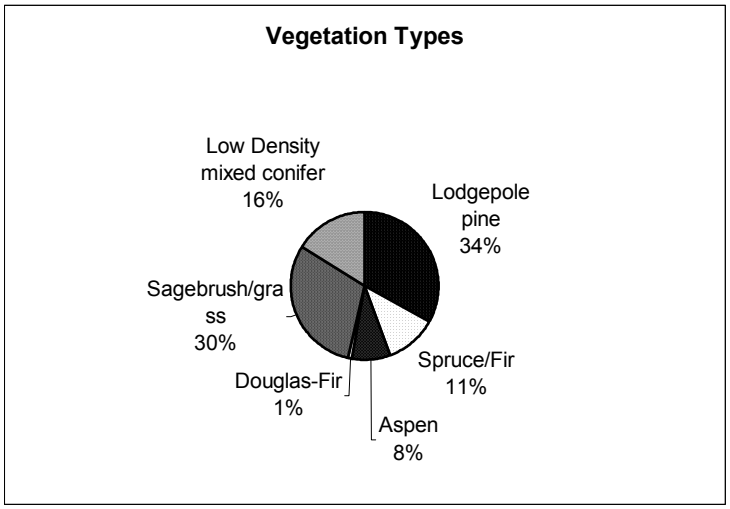
Table 3.1 – Properly Functioning Conditions

Type	% of Analysis area[14]	Forest "Properly Functioning Condition" Notes
Lodgepole pine	34%	Most lodgepole forests in the assessment area are in the mature and old age classes. Structural stages are not balanced throughout the forest. This includes mixed conifer forests with significant subalpine fir component.
Spruce/fir	11%	Structural stages are not balanced throughout the Forest. The majority (70% or more) is in the mature to old age classes.
Aspen	8%	85% of Forest aspen stands are mature or old. Very little young to mid-age aspen are present.
Douglas-fir	<1%	Forest-wide Douglas-fir has an average age of 180 with relatively few areas in the seedling-sapling stage.
Sagebrush/grass	30%	
Low density mixed conifer	16%	Only 10% of whitebark pine stands are in conifer (Lodgepole seedling through mid-aged stages. Mostly limber/whitebark pine high elevation stands spruce-fir Douglas-fir)

[14] Total acres within the Cottonwood Watershed.

3 Affected Environment

Chart 3.21.1 – Vegetation Types



Forests in the analysis area are in similar condition as described in the Forest-wide PFC. Like the Forest PFC, all forest types in the analysis area are at some risk for proper ecosystem functioning, with aspen at the greatest risk for a significant loss of habitat and succession to subalpine fir and lodgepole pine. More than 70% of the forested stands in the analysis area are greater than 100 years old[15]. (In the plan implementation study, suitable timber was used to analyze vegetation and over 75% of suitable timber base is greater than 100 years old.) Most of these stands have severely reduced tree growth, accelerated tree mortality, a variety of insect and disease problems and high fuel loading due to dead and down trees.

Insect and disease agents are currently at endemic levels for this area. The Aerial Insect and Disease Detection Survey did not show any new epidemic problems for the analysis area. However, medium to high hazards for damage from bark beetles in lodgepole and spruce are present in many stands. Most insect and disease occurrence mapped was currently at low levels and in isolated pockets. Mortality in subalpine fir due to western balsam bark and other beetles continued to be the major active insect problem, increasing slightly from the previous year. There were several large pockets of beetle caused tree mortality with the largest detected at approximately 1,000 trees (in a portion of the analysis area with no access). In the Maki Creek area in stand 46-17, 70% of overstory subalpine fir tallied on stand exam plots in 2002 had died. The damage in subalpine fir is compounded by recent dry weather and dense, older stand conditions. Dwarf mistletoe in lodgepole pine, which reduces the health and vigor of trees, also occurs throughout the area, but does not show up in the detection survey. Mountain pine beetle activity in lodgepole pine is increasing with several years of drought recently. There are also endemic levels of spruce budworm present.

Approximately 23,388[16] acres of the Cottonwood analysis area is classified as suitable timber in the Forest Plan. 2,227 [17]acres within the total Cottonwood analysis area have been harvested in this area during the past 40

[15] Based on field exams and past fire and harvest history . See Appendix C and project file for detailed information.
[16] Updated since PI was completed.
[17] Based on field exams.

years, primarily with clearcut methods. The last active sales in the area were completed in 1993. Of these harvested acres, approximately 1,907 acres[18] have regenerated sufficient trees to no longer be considered a created opening. The remaining 320 harvested acres, 1.4 % of the suitable timber area, is reforested but the trees are not tall enough to be considered cover. Most of the initial trees regenerating the harvest areas are lodgepole pine (planted and natural). In many areas, Engelmann spruce and subalpine fir are beginning to establish in the understory. There was also selective harvesting of trees for railroad ties ("tiehacking") in the 1920's and 1930's throughout the area. This harvesting removed lodgepole and Douglas-fir trees of certain sizes suitable for railroad ties but left many larger trees, subalpine fir, and smaller, understory trees on the site. Since this logging occurred, subalpine fir has increased in proportion in these stands. In many areas, there is a dense understory of shade tolerant but released fir growing into the crowns of the remnant overstory.

The Maki Creek area (Compartments 46, 47 and 55) is approximately 7,080 acres in and adjacent to the Maki and Little Maki Creek drainages. Elevation ranges from 7800 to 9000 feet with mostly easterly and northerly exposures. Proposed treatment areas are mostly at elevations less than 8500 feet with slopes ranging from 0 to 30%. The forests of this area are a mixture of subalpine fir, lodgepole pine, Engelmann spruce, Douglas-fir and aspen. Approximately 40 percent are dominated by subalpine fir, 30 % by lodgepole pine, 15% by Engelmann spruce and 15% by Douglas-fir and aspen. Approximately 30% of the stands dominated by conifer are seral aspen stands. There is still sufficient aspen to successfully reestablish following disturbances, though it is rapidly declining with little suckering occurring. The conifers are growing into the crowns and over topping aspen in most of these areas. The aspen stands are primarily aspen/subalpine fir community types with mountain snowberry and meadow rue understories. They provide important transition range for elk moving off winter range and the nearby feedground. There have been approximately 163 acres of past harvesting in the Maki Creek area, all regenerated but not sufficiently grown to reach cover status. The harvesting was done between 1978 and 1981, except for the Maki fire salvage (20 acres) in the late 1980's. Regenerated trees are dense enough on 148 acres of this area where tree growth would benefit from pre-commercial thinning.

Most forests in this drainage are greater than 150 years old. Current damage from insects and disease is low levels, except for patches of heavy damage to subalpine fir from bark beetles and patches of lodgepole dwarf mistletoe damage. Density of overstory trees ranges from 40 to over 200 trees per acre in the mature stands. The understory is dominated by subalpine fir.

Following is a summary of Maki Creek area stands considered for treatment: (From stand exam and field visit information; Refer to Appendix C for more information)

Stand 47-3: This stand is composed of older (>120 years old), dying lodgepole pine and subalpine fir with 10 to 20% healthy Engelmann spruce and Douglas-fir. Lodgepole pine and subalpine fir each compose about 40% of the overstory. Over 30% of the subalpine fir overstory trees have died out. There is little aspen in the stand.

Stand 47-4: There are pockets of aspen in this over-mature mixed conifer stand. Significant mortality is occurring in the subalpine fir and lodgepole pine. Most aspen is decadent (10% or less live crowns) with lots of dead, down aspen on the ground. A few smaller openings in the stand have evidence of regenerating aspen.

[18] Based on field exams since 1993.

Stand 47-5: This is an overmature (>200 years old) mixed conifer stand with approximately 50% subalpine fir, 30% lodgepole pine and 20% Douglas-fir and Engelmann spruce. The lodgepole is experiencing significant mortality. Species distribution in this stand is patchy. Some patches have concentrations of Douglas-fir and Engelmann spruce comprising 50 to 80% of the trees. Regeneration in adjacent clearcuts is healthy and dense.

Stand 47-10: This stand is an 80 to 100 year old aspen stand being encroached by subalpine fir. The subalpine fir stocking is low but overstory trees have reached sufficient heights to over-top aspen. There are pockets of dense subalpine fir. The understory is predominantly subalpine fir.

Stand 47-20: This is predominantly a spruce-fir stand with a whitebark and lodgepole pine component. Subalpine fir is the dominant species in both the overstory and understory, with Engelmann spruce making up approximately 20% of the overstory with pockets of greater concentrations. The stand originated over 200 years ago, but is uneven aged with a wide diversity of heights, ages and diameters represented.

Stand 47-21: This is a mature conifer stand with subalpine fir, Engelmann spruce and Douglas-fir all well represented with minor amounts of lodgepole pine. Engelmann spruce makes up almost 60% of the basal area and includes the largest and oldest trees on the site. Subalpine fir composes most of the understory.

Stand 47-29: This stand is a mature mixed conifer stand with conifer-encroached aspen pockets. The majority of the overstory is comprised of lodgepole pine, with a significant component of subalpine fir and Engelmann spruce. The aspen is all over-topped by conifer.

Stand 47-30: This mixed conifer stand has moderate to heavy down fuels and an understory of subalpine fir to provide ladder fuels to overstory crowns. Douglas-fir of mixed ages and sizes comprises over 50% of the overstory stand. A significant portion of the subalpine fir has died in the last 10 years due to drought related bark beetle damage. The lodgepole pine component is over-maturing with significant mortality.

Stand 47-34: This stand is a mature mixed conifer stand with medium to heavy down fuels from past tree mortality and a heavy understory of subalpine fir up to 30 feet in height providing potential ladder fuels. Lodgepole pine, subalpine fir and Douglas-fir dominate the overstory. Douglas-fir makes up approximately 40% of the merchantable timber volume, with many trees over 17 inches in diameter. Douglas-fir has persisted for over 200 years, surviving some past fires. Lodgepole pine is up to 150 years old and declining. Aspen occurs in pockets in the stand, particularly along the edges, adjacent to other aspen stands. Aspen is being over-topped by conifers and dying out.

Stand 47-35: This is a mixed conifer stand, with pockets of aspen, adjacent to aspen dominated stands. The overstory is dominated by old Douglas-fir with a component of younger subalpine fir, lodgepole and Douglas fir. Most Douglas-fir is healthy. There is a dense understory of subalpine fir. As much as 70% of the original aspen have died out and crown ratios of surviving aspen average around 10%. Approximately 50% of the subalpine fir has died out. Dying trees are adding to a buildup of down fuels.

Stand 55-3: The stand is just over 100 years old and has mature aspen throughout with dense encroaching

conifer, primarily subalpine fir. Much of the subalpine fir is sub-merchantable, ranging from 2 to 5 foot whips up to 8-inch diameter and 50 foot tall trees but there is a merchantable component including scattered pockets of dense merchantable timber. Approximately 15% of subalpine fir has died. The fuels on the ground are light to medium, representing aspen and subalpine fir mortality. Along the southwest edge of this stand there is approximately 5 acres where the aspen is healthy with little conifer encroachment.

Stand 55-10: The stand, approximately 90 years old, is primarily dense post and pole and small sawlog size lodgepole pine, averaging approximately 1300 trees (> 3.0 inches in diameter) per acre. There is also scattered Douglas fir, subalpine fir and Engelmann spruce amounting to 10 to 20% of the overstory and a few small, scattered aspen pockets. Most of the stand includes healthy lodgepole with good crowns. There is potential for a seed collection site in the southern portion of this stand. Approximately 20 to 25% of the stand is "dog-hair" with over 2500 trees of pole size or greater (> 3.0 inches in diameter) per acre. Trees in this portion of the stand are almost all of post and pole size and 10 to 15 feet shorter than the rest of the stand.

Stand 55-11: This stand is a mixed, multi-layered conifer stand, heavily stocked and approximately 180 years old. Subalpine fir dominates the overstory, with significant amounts of Douglas-fir, lodgepole pine and Engelmann spruce as well as a few small aspen patches. The understory is dense, suppressed subalpine fir mostly 2 to10 feet in height. The lodgepole pine is dying out and dead trees contribute to down fuel loadings. There are pockets of heavy subalpine fir mortality as well.

Stand 55-12: This is a mature Engelmann spruce, subalpine fir stand approximately 160 years old, with patches of pure spruce in the overstory. There are pockets of subalpine fir mortality. There is a small lodgepole pine component remaining from a larger component that has mostly died out or been cut out by past tiehacking.

Stand 46-17: This stand is a stringer of mature mixed conifer and aspen timber in the middle of a proposed burn unit of sagebrush/grass and aspen. Most of the aspen that was present in the stand has died out and much is on the ground as forest fuel. There is a component of old, large diameter Douglas-fir trees that has survived past fires. Much of the subalpine fir trees in the overstory have died in the past 5 years.

Aspen - Conifer stands proposed for burning: Stand data was taken by Wyoming Game and Fish personnel for 40 aspen stands on 981 acres in the Maki area. In 27 of these stands, representing 87% of the area (851 acres) there were aspen greater than 100 years old. Almost all stands had some degree of encroaching conifer, primarily subalpine fir. In at least 20% of the area the conifer overstory trees out-numbered and over-topped the aspen.

3.22 Rangeland Vegetation

There are approximately 14,578 acres of sagebrush/grass types in the Cottonwood analysis area including approximately 2,000 acres in the Maki Creek area. The rangeland condition of the sagebrush/grass communities based on the range analysis conducted in 1962 indicates a fair condition in all project areas except 4B that was in poor condition. Observations made by the district range staff, in 2001 and 2002 estimate these areas are still in a fair rangeland condition. The prescribed burn project proposals, coupled with appropriate livestock management mitigation should greatly improve the overall rangeland conditions and health.

Vegetation community types represented in the Cottonwood sagebrush/grass burn treatment area are Mountain Big Sagebrush/Idaho Fescue and or Slender Wheatgrass. Mountain Silver Sagebrush/Shrubby Cinquefoil communities are found adjacent to the riparian areas and other areas with high soil moisture conditions.

3.23 Wildlife Habitat

Introduction

Significant issue 4, "Wildlife Habitat", deals directly with the quality of the area's habitat, particularly for elk, mule deer and Canada lynx.

The Cottonwood analysis area and the Maki Creek area provides habitat for many wildlife species. Species range from mammals and birds such as rabbit, grouse, beaver, lynx and coyote to harvested species such as elk, deer, antelope, moose and bear. The area serves as summer, winter, and parturition range for these species and also contains important migration corridors between summer and winter ranges.

Management Indicator Species

Some species in the project area are management indicator species (MIS) designated in the Bridger-Teton Land and Resource Management Plan (1990). Management Indicator Species are those species used to indicate the effects of habitats changes associated with forest management activities. MIS include harvested species, ecological indicator species, Forest Service Sensitive Species and federally listed Threatened and Endangered species: Table 3.2 indicates the wildlife species that are in, or might be within the analysis area.

Neotropical migrant birds are also discussed as required by Executive Order 13186 (2001).

Table 3.2 Management Indicator Species

Species	Scientific Name	Habitat	Population Data Source
Grizzly Bear Bald Eagle	*Ursus arctos* *Haliaeetus Leucocephalus*	Forest and Meadows Lakes, Marshes	Data obtained from US Forest Service and US Fish and Wildlife Service
Peregrine Falcon Whooping Crane Kendall Dace	*Falco peregrinus* *Grus americana* *Rhinichthys o. Thermalis*	Cliffs, Valleys, Meadows Wetlands, Fens Kendall Warm Springs	Data obtained from US Forest Service and US Fish and Wildlife Service
Co.River Cut.Trout Rainbow Trout	*Oncorhynchus mykiss* *Oncorhynchus clarkia Pluuriticus*	Streams, Lakes Streams, lakes	Data obtained from Wyoming Game and Fish
Elk Mule Deer Moose Bighorn Sheep Pronghorn Antelope	*Cervus elaphus* *Odocoileus hemionus* *Alces alces* *Ovis canadenis* *Antilocapra Americana*	Forest, aspen, meadows Forest, aspen, meadows Forest, riparian, wetlands Cliffs, mountain areas Sagebrush, prairie	Data obtained from Wyoming Game and Fish
Pine Marten Brewer's Sparrow	*Martes Americana* *Spizella breweri*	Coniferous Forests, OG Sagebrush, Willows, Prairie	Data obtained from US Forest Service Regional Guide,Breeding Bird Survey (BBS) data from 1968 through 2002, trapping records G/F
Sweet Jasmine Payson's Milkvetch Shultz's Milkvetch Wy. Tansymustard Boreal Draba Weber's Saw-wort	*Androsace chamaejasm* *Astragalus paysonii* *Astragalus shultziorum* *Descurainia torulosa* *Draba borealis* *Saussurea webberii*	Montane Rock Crevices Disturbed Areas, Burns Steep Rocky Sparsely Vegetated Slopes Breccia, Sandstone Slopes Limestone Slopes, Cliffs Alpine Talus, Gravel Fields	Data obtained from US Forest Service Regional Guide, Nested Frequency and Wyoming Natural Diversity Database.

General Setting and Vegetation

The project analysis area used in this vegetation assessment consists of the Maki Creek area, a portion of the Cottonwood Project area and within the Cottonwood lynx analysis unit (LAU). Elevation ranges from 7,975 to 9075 feet with drainages tending to run northwest to southeast.

The human influences of timber harvest, cattle grazing, and past road building have somewhat altered the ecosystem structure, pattern, and process in the drainage. There have been approximately 163 acres of past (1970's) timber harvest in the analysis area plus tie hacking (partial cutting to remove trees suitable for railroad ties) which occurred during the 1920's - 1940's. The forested regeneration in the 1970's timber sales are now 10 to 15 feet high on the average and dominated by lodgepole pine. Approximately 7.8 miles of road are present

which provided access to the harvest units. All roads are closed to motorized access (except snowmobiles) to provide wildlife security. Some roads and trails are used for recreation access by foot, horse, and snowmobiles as well as for administrative use (cattle management and fire suppression). Closed road density within the DFC 10 portion of the Maki Creek area is .8 miles per square mile. In addition, there is an old fire area, approximately 20 acres, located at the head of Little Maki Creek. The burned timber on 15 acres was harvested and the area was replanted. The timber has not regenerated sufficiently to be providing elk hiding cover or lynx/hare habitat at this time**.** Timber harvest, wildland fire, and cattle grazing have also occurred both to the north and south of the Maki Creek area.

There is no Forest Plan designated old growth within the Maki Creek areas. Old growth forest types do occur in the Maki Creek area including Engelmann Spruce-Subalpine fir (code 206), interior Douglas-fir (code 210), aspen (code 217), and lodgepole (code 218).

Forest Plan direction

The majority of the Maki Creek area where vegetation treatment is proposed is DFC 10: Simultaneous Development of Resources, Opportunities for Human Experiences, and Support for Big Game and a Wide Variety of Wildlife Species: An area managed to allow for some resource development and roads while having no adverse and some beneficial effects on wildlife. You may find some sheep, cattle and pack animals throughout the area. Recent livestock grazing is evident in some areas but not in others. You may encounter traffic delays while livestock are being moved.

In the Maki Creek area, DFC 10 areas total ~ 6,035 acres (85%). Crucial wildlife range covers 301 acres (5%); most of the proposed vegetation treatments are outside crucial wildlife range and DFC 10 except units 46-17, 12, and 13. Proposed units 47-17, 12 and 13 are in DFC 1B.

Forest Plan Standards and Guidelines of particular relevance to wildlife and fish:

Created Opening Dispersion Guideline: No more than 20 percent of the suitable timber base…should be in a created opening condition over a 3-decade period.

Silvicultural System Restriction Standard: Silivcultural systems on soils identified as stable/marginally stable on slopes greater than 70 percent, or soils identified as unstable less than 40 percent, will be limited to openings of two acres or less.

Snag Management Guideline: Snags left standing for wildlife should be marked, or access to those snags reduced, to prevent them from being cut. Firewood permit holders should be apprised of the restrictions. Firewood gathering should be controlled by signing, marking, or limiting access to limit removal of down woody material..

Snag Habitat Guideline: Within a timber sale area or vegetative treatment area, forested stands containing dead or down and green trees should be retained to serve as wildlife snag patches. Only silvicultural practices which achieve desired snag attributes should be used in stands managed as wildlife snag patches. The snag patches should be 5 acres or more in size and well distributed. An average of 60 acres per section should be retained and be unavailable for timber harvest or firewood cutting. A mixture of snag species and

diameters should be maintained for diversity. Retention of groups of snags in and adjacent to timber harvest units should be considered when opportunities are available.

Old Growth Standard: Twelve percent or more of existing old-growth Douglas-fir and spruce forest will not be harvested in order to provide for viable populations of old-growth dependent species. Designated old-growth stands will be at least 200 acres contiguous patches, generally spaced 1 to 2 miles apart, but attached by stringers of forested riparian areas or mature timber.

Harvested Species

The project area provides parturition (birthing) for elk and summer range for elk, moose and deer. Antelope may pass through the lower reaches of the Maki Creek area in the sagebrush communities. No bighorn sheep inhabit the analysis area. Bighorn sheep and their habitat will not be evaluated further. Black bear, bobcat, coyote, and mountain lion are also present. With the exception of coyote, harvest seasons for these species are set each year by the Wyoming Game and Fish Commission.

Population levels for elk, mule deer, and moose are currently above objective levels set by the Wyoming Game and Fish Department (WGFD). Antelope populations are below WGFD objectives. Population objectives are not "carrying capacity". Objectives are set utilizing a number of environmental and social factors such as desired hunting opportunity, carrying capacity of native winter ranges, and feed ground objectives. Population numbers may vary by 10%, either higher or lower, and still be within desired levels.

The following (Table 3.3) indicates the individual herds and herd units that are found in the Cottonwood Watershed and overlap within the Maki Creek area.

Table 3.3 Harvested MIS Species Crucial Range and Populations

SPECIES	CWR ACRES	PART. ACRES	SSF OR MIGRAT.	EXIST. POP (2001)	OBJECTIVE
ELK Piney (Herd Unit 106)	No	Yes	Yes	2,535	2,424
MOOSE Sublette	No	-	Yes	5,665	5,500
MULE DEER Sublette	No	No	Yes	34,700	32,000

CWR = Crucial winter range
PART. = Parturition (birthing)
SSF = Spring, Summer, or Fall range
MIGRAT. = migration route
EXIST. POP = existing population
OBJECTIVE = WGFD population objective

Elk

The Piney Elk Herd Unit (#106) is located on the east slope of the Wyoming Range in the Bridger-Teton National Forest and extends eastward to Highway 189 and the Green River. Forest Service system lands provide spring, summer, and fall habitat as well as providing important travel corridors between summer and winter ranges. There is vehicle access into this herd unit although all roads are closed to public motorized travel to provide for wildlife security. Historically, many of these elk migrated to winter ranges in the desert to the east and south. However, these historic migration paths crossed private lands where livestock operations and hay production led to conflicts between elk and the livestock industry. In an effort to reduce damage problems, four feed grounds (Jewett, Franz, North Piney, and Finnegan) were established adjacent to the eastern fringe of the National Forest to stop elk before they reached private land.

Jewett feed ground is approximately 3 to 4 miles from the Maki Creek area. Elk from this feed ground use the project area year round, but predominantly spring, summer, and fall. The Jewett feed ground supported 675 elk in 2001/2002, which is higher than established objectives (650 elk).

Aspen areas are especially important for elk spring transition range and parturition. Many aspen stands are currently older aged and/or heavily encroached by conifers. These aspen stands are at risk of being converted to conifer and/or losing vigor and reproductive capacity if not treated in the near future.

Mule Deer

The Sublette Deer Herd Unit (#104) is located along the Wyoming Front. These mule deer use Forest Service system lands spring, summer and fall. Tall forb communities in the project area are especially valuable to summering mule deer. Deer are above objective numbers. Management concerns for deer in the Sublette herd include pressures from expanding subdivisions and development of natural gas reserves, occurring off Forest on BLM and private lands.

Moose

The project area is a portion of the Sublette Moose Herd Unit. Moose typically summer on Forest at higher elevations using spruce/fir forests as well as riparian willow bottoms. There are both habitats available for moose in the project area, especially along Maki and Little Maki Creeks. Depending on snow levels, moose will

move downward in elevation during winter and use willow bottoms and spruce/fir forests off Forest. Moose numbers are slightly above objective level.

Antelope
Antelope use a small percent of the analysis area for summer range as a portion of the Sublette Antelope Herd Unit and will not be considered further.

Ecological Indicator Species

Ecological Indicator Species are those species restricted to a specific habitat, because it provides important life requirements. The two species listed below represent groups of species associated with key habitats that could be affected by management activities.

Pine Marten (Martes americana)
Old Growth Forest
Pine marten inhabit old growth forests and probably occur in the project area. There is 2,575 acres of suitable habitat available (37 percent of project area). There is no "designated old-growth" within the Maki Creek area.

Brewer's sparrow (Spizella brewer)
Sagebrush
Brewer's sparrows inhabit sagebrush communities and are probably common, summer residents within suitable habitat, near the eastern edge of the project area and on adjacent public lands. There are approximately 2,000 acres of sage/grass type within the Maki Creek area. Brewer's sparrows are neotropical migrants, summering in the project area, and wintering in Central or South America. Studies on the adjacent Pinedale Ranger District indicate Brewer's sparrows are common in suitable habitat (Dieni 1996). Nationwide, however, their populations are in decline.

Brewer's sparrow is a sagebrush obligate, so is restricted to sagebrush habitats during the breeding season and perhaps year-round. They build cup nests of grass, rootlets, and forbs, low in a live sagebrush shrub or on the ground at the base of a live sagebrush. They are a common cowbird host and parasitized nests are occasionally deserted. They feed on insects and seeds gleaned from the ground (Nicholoff 2003).

Brewer's sparrow is a Level 1 priority species for Wyoming. See definition below.

Neotropical Migrant Birds

Executive Order (EO) 13186, signed January 10, 2001, lists several responsibilities of federal agencies to protect migratory birds. Additional direction comes from the Memorandum of Understanding (MOU) between USDA Forest Service and USDI Fish and Wildlife Service, signed January 17, 2001.

Neotropical migratory birds (NTMB) use a variety of habitats in the project area during the breeding season. Priority species identified in the Wyoming Bird Conservation Plan (Nicholoff 2003)[19] are listed in Species

[19] The Wyoming Bird Conservation Plan (Nicholoff 2003) was developed by Wyoming Partners in Flight, a state-wide voluntary coalition of government agencies, conservation groups, academic institutions, private businesses, and concerned citizens dedicated to

Priority Table found in the planning record. Level I and Level II priority species have been considered for this analysis and are defined as follows:

- Level 1 priority bird species are those that clearly need conservation action. Declining population trend and/or habitat loss may be significant. This includes species of which Wyoming has a high percentage of and responsibility for the breeding population, monitoring, and the need for additional knowledge through research into basic natural history, distribution, etc.

- Level II: The action and focus for these species is monitoring. Declining population trends and habitat loss are not known to be significant at this point. Level II includes species of which Wyoming has a high percentage of and responsibility for the breeding population, species whose stability may be unknown, species that are peripheral for breeding in the habitat or state, or additional knowledge may be needed.

Population trends for the priority species have been calculated from data from the Breeding Bird Survey. Aspen forests are habitats within the project area that can be impacted. This habitat is a high priority habitat identified in the Wyoming Bird Conservation Plan (Nicholoff 2003). Vegetation treatment can result in decreased diversity of the structure and composition of these plant communities. The distribution and diversity of birds is highly associated with vegetation structural diversity (MacArthur and MacArthur 1961, Yasuda et. al. 1993). Studies show that where vegetation treatment simplifies vegetation structure or maintains vegetation in early seral condition, bird diversity and abundance generally decreases, particularly in the subcanopy (Scott et. al. 2003, Yasuda et. al. 2003). This result may benefit some species that use more open and simplified habitats such as mountain bluebird, robin, and brown-headed cowbird (Bock et al. 1992, Goguen and Mathews 2000), though generally species responding positively to vegetation treatment effects are not high priority species and their viability is not of concern. In the case of the brown-headed cowbird, its range expansion and increase in population over the last century has negatively affected other species of songbirds through its practice of nest parasitism. Species requiring heavy shrub or herbaceous ground cover in riparian areas for nesting and/or foraging include yellow warbler and MacGillivray's warbler (Saab 1999, Nicholoff 2003). Species such as Wilson's warbler, common yellowthroat, savannah sparrow, and Lincoln's sparrow also require heavy shrub or herbaceous ground cover in riparian areas (Bock et. al. 1992).

"keeping common birds common" and reversing downward population trends of declining species.

Sensitive wildlife and plant species

A Biological Evaluation has been prepared for the Maki Creek area and can be located in Appendix B. The determination of effects can be located within the BE. A sensitive species is defined as those plants and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:

1) significant current or predicted downward trends in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670.5).

The Forest Service objective for sensitive species management is to "develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions" (FSM 2670.22). There are numerous sensitive species that do or could occur within the Maki Creek area.

The following species have been designated as Sensitive by the Intermountain Region of the Forest Service and could possibly occur in the analysis area:

Table 3.4 Forest Service, Region 4 Sensitive Species and their habitats.

Common Name Scientific Name	Habitat Requirements Presence or Absence
Spotted Frog *Rana pretiosa*	Fish-free, spring fed creeks and ponds; Habitat is present in the project area
Peregrine falcon *Falco peregrinus*	Far ranging flier, lives, roosts in /on cliffs; Habitat is not present within the area.
Common Loon *Gavia immer*	Breeds in lakes greater than 9 acres; Habitat is not present
Trumpeter Swan *Cygnus buccinator*	Breeds in remote marshes, lakes, and ponds 5-10 acres or larger; Habitat not present within project area
Harelequin Duck *Histrionicus histrionicus*	Undisturbed, low gradient, meandering mountain streams; Habitat not present within project area
Boreal Owl *Aegolius funereus*	High elevation spruce-fir forests; Habitat is present within project area.
Flammulated Owl *Otus flammeolus*	Breeds in mature open canopied aspen and Douglas-fir or mixed coniferous/deciduous forests; Habitat is present in project area
Great Gray Owl *Strix nebulosa*	Mature coniferous and mixed coniferous forests interspersed with small clearings; Foraging habitat is present within the project area
Northern Goshawk *Accipiter gentilis*	Mature coniferous and mixed coniferous forests interspersed with small clearings; Foraging habitat is present within the project area, no observations during two year survey.
Greater Sage Grouse *Centrocercus urophasianus*	Mixed seral stands of sagebrush; Habitat is present but is not targeted for treatment.
Three-Toed Woodpecker *Picoides tridactylus*	Mature conifer and mixed conifer forests; capitalizes on dead standing timber left by stand replacing fires; Habitat is present
Spotted Bat *Euderma maculatum*	Caves, roosts in rock crevices on steep cliff faces; Habitat is not present in project area
Pygmy Rabbit *Brachylagus idiahoensis*	Mature heavy old growth Great Basin Sagebrush;Habitat is not present within the project area.
Western Big-Eared Bat *Plecotus townsendii*	Hibernates in caves, rock outcrops, and mine shafts; roosts in hollow trees and snags; Potential roosting habitat not present; no known hibernacula present; no observations
Wolverine *Gulo gulo*	Generalist, utilizes a variety of habitats spanning all elevations; needs large roadless areas (36-250 mi2); Habitat is present in project area. Species not present in project area.
Fisher *Martes pennanti*	Mature and old growth forest, closed canopy coniferous forests at mid- to lower elevations; may be limited by snow depth; habitat is not present in project area. Species not present in project area.
Fine Spotted Cutthroat Trout *Oncorhynchus clarki spp.*	Lakes and Streams, cool, clear, well oxygenated streams; gravel for spawning; Spawning habitat is not present in project area
Colorad River Cutthroat Trout *Oncorhynchus clarki pleuriticus*	Lakes and streams, cool, clear, well oxygenated streams; gravel for spawning; Spawning habitat is present in project area

3 Affected Environment

See Appendix B for detailed discussion on Sesentive species.

Fish are covered separately in section 3.23.

Table 3.4a Existing condition - sensitive plants

The following sensitive plants could occur in the Maki Creek area:

BRIDGER-TETON NATIONAL FOREST SENSITIVE PLANT SPECIES

SPECIES	HABITAT/COMMUNITY	ELEVATION	SUCCESSION	PHENOLOGY
Agoseris lackschewitzii Pink agoseris	Subalpine wet meadow, saturated soils	8500-10600	Mid to late	Flowering/Fruiting July-August
Androsace chamaejasme ssp. *carinata* Sweet-flowered rock jasmine	Montane rock crevices in rocky limestone or domolite soils	8500-10800	Mid to late	Flowering/Fruiting May-July
Aster mollis Soft aster	Sagebrush grasslands and mountain meadows in calcareous soils	6400-8500	Early to mid	Flowering/Fruiting July-September
****Astragalus paysonii* Payson's milkvetch**	Disturbed areas and recovering burns on sandy soil	6700-9600	Early	Flowering/Fruiting Jun-Aug/Jul-Oct
Descuraania torulosa Wyoming tansymustard	Sparely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone	8300-10000	Early to mid	Flowering/fruiting July-September
Draba borealis Boreal draba	Moist north-facing limestone slopes and cliffs and shady stream sides	6200-8600	Mid	Flowering/Fruiting Jun-Aug/Jul-Sep
Haplopappus macronema var. *linearis* Narrowleaf goldenweed	Semi-barren, whitish clay flats and slopes, gravel bars, and sandy lake shores	7700-10300	Mid to late	Flowering/Fruiting July-September
Lesquerella paysonii Payson's bladderpod	Rocky, sparcely-vegetated slopes, often calcareous substrates	6000-10300	Mid to late	Flowering/Fruiting May-August
Physaria integrifolia var. *monticola* Creeping twinpod	Barren, rocky, calcareous hills and slopes	6500-8600	Mid	Flowering/Fruiting Jun-Jul/Jun-Aug
Primula egaliksensis Greenland primrose	Wet meadows along streams and calcareous montane bogs	6600-8000	Mid	Flowering/Fruiting May-Jul/Jun-Aug

**Astragalus paysonii*, Payson's milkvetch, has been located within the project area within the Maki Creek area. It typically occurs on disturbed areas and in recovering burns on sandy soils. It has low palatability for grazing, requires disturbance to become established, and moderate to high vulnerability to fire suppression or competition with exotics.

Vegetation management can have both beneficial and adverse effects on threatened, endangered or sensitive species within the analysis area. The degree to which species are impacted depends on the management implemented and degree of overlap between these species habitats and management activities. A number of the above sensitive plants occupy unique microsites. Other plant species that are designated as Sensitive, but are not known to occur in the project area include:, Slickspot peppergrass. Sensitive plants are addressed in the BE.

Threatened and Endangered Species

The United States Fish and Wildlife Service (FWS) provided the Bridger-Teton National Forest with a Forest-wide list (ES-61411) of threatened, endangered, proposed, and candidate species which may occur on the Forest in April 2001. Threatened and Endangered species possibly occurring are presented in Table 3.5. Fish are covered in Section 3.24. Also included is The Nature Conservancy's Heritage Ranking. A Biological

Assessment will be forwarded to the USFWS for concurrence.

Table 3.5 Threatened and Endangered Species that may occur in the Maki Creek area

COMMON NAME	STATUS	HERITAGE	Species/habitat present and carried through analysis	General habitat
Whooping crane (*Grus Americana*)	Experimental	G1/S1	Not expected/No	Riparian/wetlands
Black-footed ferret (*Mustella nigripes*)	Endangered	G1	Not expected/No	Short-grass prairie, coincident with prairie dog distribution
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened	G3/S1	Possible intermittent use/yes	Riparian
Canada lynx (*Lynx canadensis*)	Threatened	G5/S2	Yes	Generalist
Grizzly bear (*Ursus arctos horribilis*)	Threatened	G4/S1	Possible/yes	Generalist
Gray wolf (*Canis lupus*)	Experimental	G3/S1	Possible/Yes	Generalist
Mountain plover *(Charadrius montanus)*	Proposed		Not expected/No	Short-grass prairie
Ute Ladies'-Tresses (Spiranthes diluvialis)	Threatened		Not expected/No	Wet meadows and riparian habitats

Heritage Rank

G1 - Critically Imperiled Globally
G3 - Either very rare and local throughout its range or found locally
G4 - Apparently secure globally
G5 - Globally common, typically widespread and abundant
S1 - Critically Imperiled in the State
S2 - Imperiled in the State because of rarity or because of other factors demonstrably making it vulnerable to extinction

Under provisions of the Endangered Species Act, Federal agencies are directed to seek to conserve Endangered and Threatened species and to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of their critical habitat. A separate Biological Assessment will be forwarded to the USFWS for concurrence.

Grizzly bear – Grizzly bears once roamed the Wyoming Range, but were extirpated from much of their historic range by the middle of the twentieth century (USFWS 1993). A small population persisted in Yellowstone National Park, north of the project area. Grizzlies were listed as threatened under the Endangered Species Act (ESA) in 1975, and a recovery zone was subsequently delineated. The project area is more than 50 miles south

of the Yellowstone Recovery Area.

Grizzly bears occupy a variety of coniferous forest and rangeland habitats. They are a wide-ranging species that requires adequate space and isolation from humans, suitable den sites, and an adequate food base. Grizzlies are opportunistic feeders, consuming both carrion and vegetation (e.g. plants, bulbs and tubers). Plant matter may be an important diet component in spring and summer and bears may forage in riparian areas, avalanche chutes and big game winter ranges. In summer and fall, they may move to higher elevations and shift their diet to berries and nuts (e.g. whitebark pine).

Reports of grizzly bears in the Wyoming Range are received annually, but the validity of these observations are unknown. A grizzly bear was killed summer 2002 approximately 20 miles to the northwest of Maki Creek area near Deadman Peak. Suitable habitat is present and given the expanding bear population to the north they may be present or could travel through the area.

Gray wolf – Gray wolves were historically found throughout Wyoming, but were virtually exterminated from the western United States by the 1940s (USFWS 1994). In 1995 and 1996, wolves were reintroduced into Yellowstone National Park. Beginning in 1997, two packs successfully established territories within and adjacent to the Jackson and Buffalo Districts of the Bridger-Teton. Observations of wolves have been reported as far south as Kemmerer, but no packs are known to be within or adjacent to the project area. Wolves were observed near the Jewett feedground winter 2001/2002, but no elk kills were reported. Suitable habitat is present and given the expanding wolf population to the north they may be present or travel through the area.

Wolves use a variety of habitats including coniferous forests, montane meadows, and shrubsteppe. Key components of suitable habitat include: sufficient year-round prey base of ungulates and alternate prey, suitable and semi-secluded denning and rendezvous sites, and sufficient space with minimal exposure to humans (USFWS 1987). The project area is considered ungulate spring, summer, and fall range as well as being adjacent to an elk feedground. Preferred wolf prey species of deer, elk and moose are all found in and adjacent to the project area.

Canada lynx – The Canada lynx was listed as a threatened species in March of 2000. The primary forest types used by lynx in the western United States are lodgepole pine, Engelmann spruce and subalpine fir (Agee 1999, McKelvey et al. 1999, Squires and Laurion 1999). The forest cover should consist of a variety of stand ages and structures in order to provide both denning and foraging habitat.

Foraging habitat for lynx has typically been described in terms of suitability for their primary prey, snowshoe hares. Hares use young conifer stands that are densely stocked with seedlings or saplings, tall enough to provide browse for snowshoe hares above typical winter snow depth (Koehler and Brittel 1990). Buskirk et al. (1999) suggested that snowshoe hare abundance should be high in both sapling and old, "gap phase" forests, where tree mortality and snag loss created gaps in the canopy that allowed increased understory production. Thus, foraging habitat could be defined as either sapling or old forest structures with high densities of small diameter stems 1-3 m high.

Denning habitat is defined by the presence of ground-level structures that provide security and cover for kittens. Suitable structures are often found in old and mature forests with substantial amounts of coarse woody debris; however, it may also be provided in early successional forests where windthrow and snags are present (Aubry et

al. 1999). Other forest structural stages, such as closed-canopy mid-age to mature forests with little understory cover, are generally not selected for either foraging or denning, but may serve as travel habitat (Koehler and Brittell 1990). Lynx may avoid recent clearcuts that are more than 100 m wide because they lack sufficient cover (Koehler 1990). Such areas may also not be recolonized by prey species (mainly snowshoe hares) until as much as 20-25 years post harvest (Koehler and Brittell 1990).

A small breeding population of lynx occurs in the Wyoming Range (Squires and Laurion 1999), although no lynx sightings have been documented in the immediate project area. Lynx are a highly mobile species and range over large areas. Given their mobility and the fact that their preferred forest cover types are available within and adjacent to the project area, lynx may be present and lack of documented sightings may be due to a lack of survey effort.

The Lynx Conservation Agreement (Lynx CA; USFS 2000) between the USFWS and the USFS specifies that recommendations found in the Lynx CA (Ruediger et al. 1999) will be reviewed and considered prior to making any new decision to undertake actions in lynx habitat. The Maki Creek area falls within lynx analysis unit (LAU), Cottonwood Creek (5th level hydrologic unit code). Potential suitable lynx habitat has been mapped following criteria in the CLCAS (Ruediger et al. 2000) and the August 2000 memo (USFS 2000).

Table 3.6 Lynx Habitat

	Acres	Percent of LAU	Acres/Percent suitable lynx habitat
LAU, Cottonwood Creek	48,500	100 (does not include HUC portions off Forest)	29,134 acres 60% of LAU
Maki Creek area	7,080	11	4,944 acres suitable lynx habitat 70% of Maki drainage 10.1% of LAU
Denning habitat	4,166	59% of Maki area	
Foraging habitat	4,681	66% of Maki area	
"Disturbed" acres existing	2,482	7.8% to 12.2% of LAU suitable lynx habitat	

Bald eagle: No known bald eagle nests occur within or adjacent to the project area. The nearest known nest is approximately 8 miles to the northeast on private land adjacent to National Forest. Eagles could travel through the Maki Creek area, or use gut piles and carrion during hunting season when available. The closest potential nesting habitat is probably along North Cottonwood Creek.

Ute Ladies'-Tresses was listed as threatened on January 17, 1992. Ute ladies'-tresses is currently known from Colorado, Idaho, Montana, Nebraska, Utah, Washington, and Wyoming. In Wyoming this plant is found near the base of the eastern slope of the Rocky Mountains (southeastern and central Wyoming). This species is endemic to mesic or wet meadows and riparian habitats near springs, seeps, lakes, or perennial streams. Project area elevations range from 7,975 to 9075 feet, which is higher than the known population range.

3.24 Fisheries

Introduction

3 Affected Environment

The Cottonwood project area encompasses Forest Service managed lands including North and South Cottonwood Creeks from Maki Creek to South Bare Creek (Figure 1). There are 106.3 miles of streams in the analysis area, including 45.7 miles of perennial stream and 61.6 miles intermittent (Table 1). The Maki Creek area includes 8.4 total stream miles including 4.6 perennial and 3.8 intermittent. These streams are within the Upper Green River subbasin, which includes all of the Upper Green River streams down to Fontenelle Reservoir, not including New Fork River and its tributaries. Subbasin is the recommended ecological unit scale at which salmonids population viability is evaluated (Rieman et al 1993).

The following sections describe the existing condition and affected environment for fish as well as their habitats that could be affected by the proposed activities. The area streams contain populations of both native game and non-game fish species. However, primary analysis focus is on Colorado River cutthroat trout *(Oncorhynchus clarki pleuriticus)* and its habitat, a management indicator species.

Management Indicator Species (MIS)

MIS are those species used to indicate the effects of habitat changes associated with forest management activities (Bridger-Teton Land and Resource Management Plan 1990). MIS may include harvested species, ecological indicator species, Forest Service Sensitive Species and federally listed threatened and endangered species. MIS in the Cottonwood Projects area include Colorado River cutthroat (CRC) trout and rainbow trout (Oncorhynchus mykiss gairdneri) (Table 3.7). Rainbow trout is a non-native introduced species.

Sensitive Species

A sensitive species is defined as those plants and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:

1. Significant current or predicted downward trends in population numbers or density or
2. Significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670.5).

The Forest Service objective for sensitive species management is to "develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions" (FSM 2670.22). There are numerous sensitive species that do or could occur within the analysis area.

The Colorado River cutthroat trout is the only sensitive fish species known to occur within the Cottonwood analysis area. A Biological Evaluation for sensitive species is consolidated into the main text of this EA.

Colorado River cutthroat trout was historically distributed throughout the headwaters of the Green and Colorado rivers as far south as the San Juan River; perhaps occupied portions of the lower reaches of large rivers in winter (Young 1995). Currently limited to a few small headwater streams of the Green and upper Colorado rivers in Colorado, Utah, and Wyoming. CRC are adapted to relatively cold water and thrive at high elevations.[20] CRC habitat requirements are cool, clear water and well-vegetated streambanks for cover and bank stability. Instream cover in the form of deep pools, boulders and logs is also important. There are several CRC populations in the Upper Green River subbasin but are isolated in small stream segments on public lands. The Maki Creek area contains fragmented CRC populations in several streams (Table 3.7).

CRC population decline is related to hybridization with introduced rainbow trout, replacement by introduced

[20] (Spahr et al. 1991, Young 1995).

brook trout, and competition with established populations of non-native salmonids, and habitat alteration/fragmentation from overgrazing by livestock, logging, roads, and water diversion for irrigation (Spahr et al. 1991, Behnke 1992, Young 1995).

Harvest Species

These include brook trout (Salvelinus fontinalis), cutthroat trout, rainbow trout, and mountain whitefish (Prosopium williamsoni). Brook and rainbow trout are non-native introduced species that compete for habitat or in the case of rainbow trout, interbreed with CRC. Wyoming Game and Fish Department (WGFD) establish population objectives, seasons and regulate harvest.

Non-Game Native Species

These include the mottled sculpin (Cottus bairdii) and mountain sucker (Catostomus platyrhynchus)[21]. Mountain sucker is widely distributed through western US and Canada. It prefers clear, cold creeks and small to medium rivers with clear rubble, gravel or sand substrate. Mountain sucker may be a sensitive indicator of native fish and invertebrate assemblages. Mottled sculpin is widely distributed across US and Canada although Green River is believed to contain a unique form. Its habitat is clear, cold to warm (typically cool) headwaters, creeks, springs, small rivers, and lakes, with sand and gravel or (more typically) rocky substrate; habitat preference varies geographically; often under rocks or vegetative cover (Scott and Crossman 1973, Peden and Hughes 1984, Lee et al. 1980, Page and Burr 1991).

Table 3.7 Perennial streams within Cottonwood Projects area that support or contribute to fishery (Source: WGFD Stream Lake Database 2000).

Stream Name	Perennial Stream Length (mi)	Intermittent Stream Length (mi)	Fish Species Present[22]
Maki Cr.	**3.6**	1.4	**CRC, MSC**
Little Maki Cr.	1.0	2.4	None Reported
Halvison Creek	0	1.3	None Reported
Irene Creek	0.3	1.4	CRC, MSC, BKT
Hardin Cr.	1.9	1.3	CRC, MSC, BKT
Ole Cr.	1.3	7.5	BKT
McDougal Cr.	0	1.2	None Reported
Sjhoberg Cr.	2.8	4.5	CRC
Nylander Cr.	2.4	3.3	CRC, MSC, BKT
Chase Cr.	0	1.4	None Reported
S. Cottonwood Cr.	(see appendix E)		

[21] The following species description is from: Nature Serve Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6 . Arlington, Virginia, USA: Nature Serve. Available: http://www.natureserve.org/explorer. (Accessed January 7, 2002).

[22] CRC = Colorado River cutthroat trout; RBT = rainbow trout; = BKT = brook trout; MWF = mountain whitefish; SRC = Snake River finespotted cutthroat trout; MTS = mountain sucker; MSC = mottled sculpin

Threatened and Endangered Species

Under provisions of the Endangered Species Act, Federal agencies are directed to seek to conserve Endangered and Threatened species and to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of their critical habitat. A separate Biological Assessment will be forwarded to the USFWS for concurrence.

The United States Fish and Wildlife Service (FWS) provided the Bridger-Teton National Forest with a Forest-wide list (ES-61411) of threatened, endangered, proposed, and candidate species which may occur on the Forest in April 2001. Threatened and Endangered species possibly occurring or potentially affected by project actions are Kendall Warm Springs dace (*Rhinichthys osculus thermalis*), bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus*)..

Kendall Warm Springs dace: The only known location of Kendall Warm Springs dace is within Kendall Warm Springs that is located approximately 32 miles north of Pinedale, Wyoming. Cottonwood projects area is about 29 miles west of Pinedale, Wyoming and about 35 miles straight-line distance between Kendall Warm Springs and the Cottonwood projects area.

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker: All four endangered species are restricted to the Colorado River system, where distribution and abundance are far below historic levels due to the effects of dams and exotic fishes. Although these four species do not occur within the project area, any water depletion from the Colorado River basin is considered to jeopardize the continued existence or adversely modify the critical habitat of the four Colorado River endangered fish species; the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker.

Aquatic Habitats

Bridger-Teton National Forest Land and Resource Management Plan (LRMP 1990) provides direction in the form of land management goals and objectives, and standards and guidelines for resource protection. Those LRMP Standards and Guidelines used in this evaluation follows.

1. Sensitive Species Management Standard – Quantifiable objectives will be developed to identify and improve the status of Sensitive species and eliminate the need for listing. Crucial habitats of priority I, II, and III species as listed by Wyoming Game and Fish and the Intermountain Region Sensitive Species List will be protected and maintained. The Forest Service will cooperate with the Wyoming Game and Fish on management programs when needed to maintain population objectives of these species, especially with species which have been identified as needing immediate attention and active management to ensure a significant decline in breeding populations do not occur. Information collection and interpretive programs will promote the conservation of these species and their habitats. National Forest managers will participate in species and habitat surveys and monitoring programs needed to gain necessary data to determine population status.
2. Fish Habitat Management Guideline – For fish habitat providing a fishery at or near its potential, fish populations should be maintained at existing levels. For habitat below its potential, habitat should be improved or maintained to at least 90 percent of its natural potential. First priority for improvement should be Colorado River and Bonneville cutthroat trout, which are Sensitive species[23].

[23] Snake River cutthroat trout are also a high priority species because of their Sensitive species designation.

3. Streambank Stability Guideline – At least 90 percent of the natural bank stability of streams that support a fishery, particularly, Threatened, Endangered and Sensitive species, should be maintained. Streambank vegetation should be maintained at 80 percent of its potential natural condition or an HCI rating of 85 or greater.[24] Streambank stability, vegetation, and fish numbers and biomass should be managed by stream type.
4. Restoring Stream Channel Conditions Guideline – Areas suffering from adverse impacts of human activities should be restored.

Inland Native Fish Strategy further defines habitat features and interim objectives to be used to describe existing conditions evaluate effects of project actions.

Aquatic health conditions used in the evaluation of project proposals mitigation and, direct, indirect and cumulative impacts follows.

Fine sediment in spawning areas is one stream measure that is directly related to salmonids production and population health. The higher the amount of fine sediment in spawning gravels, the lower the survival of salmonids embryos and juveniles. Above twenty percent fine sediment in spawning gravels is the amount that has been shown to significantly impact salmonids embryo and juvenile survival (Chapman and McLeod 1987, Tappel and Bjornn 1983, Irving and Bjornn 1984). See Hydrology section for description of stream bottom composition for Cottonwood project area streams.

Streambank stability is an indicator of water quality and channel stability. Generally high percentage of bank instability is associated with high sediment loads, loss of pool and cover habitat. Bank stability greater than 80 percent (INFISH) or at least 90 percent of the natural bank stability (LRMP) are the established guidelines.

Width to depth ratio is another measure of channel stability and fish habitat quality. High width to depth channel measures indicates channels with little cover, shallow and reduced pool frequency, and increased stream sediment. Pool width to average scour pool depth of less than 10 is the recommended guideline.

Pool frequency is a measure of habitat complexity and salmonids production. Generally, increased number of pools is associated with higher salmonids productivity. Pool depth and complexity (wood, bank and root vegetation) provide summer and winter habitat for all life stages. Pool frequency measure varies by stream type and bankfull width.

Large wood debris is a pool forming feature, provides complex fish habitats for all salmonids life stages, and provides overhead cover. Large wood debris frequency in forested habitats greater than 20 pieces per mile is the recommended minimum.

Streams of primary concern are those near proposed project actions that may be affected directly, indirectly or cumulatively (Table 3.7). Stream inventory data collected since 1990 to present indicates past management actions have caused habitat alteration/fragmentation from overgrazing by livestock, logging, and roads, and water diversion for irrigation in the Cottonwood Projects area.

Maki and Little Maki Creek

Cursory stream surveys were completed in 1990. Fish were observed in Maki Creek, but none were seen in Little Maki Creek. Channel characteristics meet both LRMP standards and guidelines, and INFISH guidelines with the exception of high percentage of surface fines. Higher than expected surface fines may be from road

[24] Habitat Condition Indices (HCI) are no longer used as a guideline on the Bridger-Teton National Forest.

surface sediment and livestock grazing. A road crossing Little Maki Creek was identified as a chronic source of stream sediment.

Table 3.8 Channel characteristics of Maki and Little Maki Creek measured in 1990.

Stream and Reach	% Surface Fines	% Bank Stability	Width/Depth Ratio	Frequency Pools #/mi	Frequency Wood #/mi	Bankfull Width (ft)
Little Maki Creek						
Reach 1	>50	94	11.0	[K]11	NR[Γ]	4.6
Maki Creek						
Reach 1	>50	88	7.4	17	NR	8.3

[Γ] NR = Not Recorded.

Road and Stream Crossings: There are 42 stream crossings in the Cottonwood Projects area of which 16 road crossings of perennial streams on system roads have been evaluated for potential point sediment sources and fish migration barriers. Only 1 of these is in the Maki Creek area (Table 3.9). Most of the remaining 24 locations occur at intermittent streams with either a culvert or ford.

Table 3.9 Stream crossing within the Maki drainage with fisheries information

Stream Name	FS Road Number	Sediment Source	Migration Barrier Low Water	Migration Barrier High Water	Beaver
Little Maki Creek	10120	Yes	Yes	Yes	No

Chronic source of sediment was observed at 11 of the 15 stream crossings investigated in the Cottonwood drainage. Field observations of a sample of those un-cataloged stream crossings supports the conclusion that a significant amount of sediment is entering area streams at those crossings. Assuming a corresponding ratio of those cataloged crossings generating sediment (73%), there are an additional 19 stream crossings that are point sources for sediment. Assuming 528 lbs sediment delivery to streams per road crossing each year[25], then there is an estimated 7.7 tons of sediment entering Cottonwood Project area streams per year from those 30 stream crossings. Within the Maki Creek area there would be an estimated 528 pounds of sediment. It should be noted that the survey methods did not include a comprehensive measure of amount of sediment at each crossing.

Stream Habitat Restoration; There have been 3 stream habitat restoration projects completed in the Cottonwood analysis area for the purpose of improving CRC habitat. None of these are in the Maki Creek area.

3.25 Livestock Grazing Management

Grazing management decisions are not directly covered by this analysis. However, grazing management and the condition of rangelands are associated with the significant issues of this analysis regarding vegetation

[K] Number of beaver ponds in Little Maki Creek skews pool frequency.

[25] Assumes at each road crossing contributing sediment to streams: 200' lineal road length x 0.66 lbs sediment yield per lineal foot road length per storm event x 4 storm events per year = 528 lbs sediment delivery to stream per road crossing per year (Kennedy 1997, Tysdal et al 1999).

condition, recreation opportunities, water quality and fisheries and wildlife habitat. The projects in this analysis will be coordinated with ongoing range management. The Cottonwood Analysis Area encompasses portions of the North Cottonwood C&H, South Cottonwood C&H, Triple Peak S&G, Martin Creek S&G, and Bare Mountain S&G livestock allotments. An Environmental Assessment was conducted in 1998 on the North Cottonwood C&H and South Cottonwood C&H. The EA for the Triple Peak S&G, Martin Creek S&G and Bare Mountain S&G was done in 1981. These documents describe the livestock management and rangeland vegetation condition for the project area in this assessment. These two documents have been included in the project file and will be referenced if needed in the evaluation of direct, indirect and cumulative effects.

Vegetation management activities are meant to enhance the diversity of plant communities and various successional stages of those plant communities within the management area. Vegetation treatment projects are designed to retain diverse age or size classes, species composition and structural diversity. In rangeland communities, forage is provided to livestock, recreational pack stock and wildlife on a sustained-yield basis that protects rangelands, watershed and wildlife values and meets other resource needs.

The LRMP provides the long-term management direction to move the resources toward the desired future condition. The following lists the Forest Plan goals and objectives for livestock management and rangeland vegetation most pertinent to the proposed actions in this assessment.

3.26 Forest Fuels and Fire

Forest fuel conditions and fire ocurrence have a direct impact on all the significant issues of this proposal. Prior to the appearance of the tie hack industry, fire played the dominant role in maintaining diversity of species and age classes. In the last 75 years, management activities have modified fuel continuity through road construction, fuelwood gathering along existing roads, past timber harvest, brush disposal, grazing and past burns.

Introduction

The Cottonwood analysis area has historically been shaped by fire but more recently fire exclusion has begun to re-shape the landscape. The current conditions within the analysis area were derived from on-site observation and analysis of available vegetation data. A description of the vegetation conditions is displayed in the vegetation section and will not be re-stated.

This chapter conveys the current vegetation conditions as they relate to fire/fuels management. It is important to note the appropriate management response for the analysis area has been suppression of all ignitions. Due to fire exclusion, fire has been removed as the agent that shaped this landscape. This condition is referred to as "out of the historic range". A broad scale assessment referenced in the Bridger-Teton N.F. 2002 Fire Management Plan states 5% of the Forest is out of historical range. On-site observations and analysis of vegetation data at a finer scale confirms this figure to be misleading for the project area. In an average fire season wildfires are successfully suppressed over 90% of the time, under any fuel condition. Ten percent of the time, control is not achieved in the initial burning periods and fires grow in size and complexity. We have to analyze fire suppression and fire behavior for that 10% of the time when fires burn actively under 90th percentile conditions.

3 Affected Environment

The Bare Creek and Cottonwood fires (S. Cottonwood Drainage) are two fires that escaped initial suppression efforts in the larger Cottonwood analysis area. The effects from these two fires are evident from the vegetation present today. Many more ignitions were suppressed as very small fires and are not easily identified. A fire history for the analysis area is difficult to display due to the effectiveness of fire suppression efforts and related fire exclusion. Past fires within lands managed by fire suppression reveal that ignitions occurred and fire was available to play its role. . Fire suppression will continue to be a vital component of any fire program, but the issue of fire exclusion will be addressed by treating fuels (mechanically, prescribed fire, or a combination of both). The goal of active land management will also address historic disturbance processes, preferably at the landscape level. Continued fire exclusion will continue to degrade properly functioning ecosystems. The Maki Creek area is characterized by fire regime 3, with fire frequency of 35- 100 years.[26] Most timbered stands are greater than 100 – 150 years old. Most of the analysis area has not burned in the past 35 to 100 years. Many landscapes out of historic range display a tendency toward an altering of the fire regime.

Regimes with a 35-100 year frequency are now likely to burn more frequently due to the accumulation of fuels. As the last 10 years of fire suppression efforts can attest, fires are more intense, severe, and harder to bring under control. The resiliency of ecosystems is on the decline. The timbered stands in the analysis area are no exception.

The Maki Creek area is composed of four distinct fuel complexes with different fire frequencies, forming a natural mosaic across the landscape:

Older-aged mixed conifer stands (spruce/fir/lodgepole);
aspen stands in varying degrees of succession;
regenerating stands (timber harvest);
sagebrush/forb/grass communities.

A majority of the *mixed conifer stands* are older aged, decadent, and diseased. Subalpine fir dominates the understory in typical climax succession. Fuel loads range from 20 to 80 tons per acre. Heavy surface fuel loads combined with a subalpine fir understory and dense canopies in a multi-storied environment allow for frequent torching, spotting, and short crown runs. These factors make controlling fires during times of prolonged drought and seasonal drying of fuels challenging and risky to firefighters. Tactically, it requires fire personnel to retreat to areas where fuel conditions change to gain control. Changes in fuel conditions may be due to old burns, fuel type changes (mixed conifer to sage/grass), and past mechanical treatments.

Aspen is found throughout the Maki Creek area in various levels of succession but is generally old, decadent, and in need of disturbance to regenerate. In some cases, mixed conifer has replaced the aspen clone entirely or only small remnants of the clone remain. Herbivory is evident and may be contributing to the lack of regeneration. Pure stands, aspen/lodgepole, aspen/mixed conifer, and aspen/sage/grass are all evident in the area. Early successional aspen fuel types exhibiting low to moderate fire behavior have been observed as resistant to fire growth. Fire behavior in early successional aspen fuel types is generally low to moderate and has been observed as areas resistant to fire growth. Fire managers look to these areas as places where fire behavior will moderate and fires can be controlled. Torching and crowning are nonexistent and surface fires are

[26] 1/ Schmidt, et al, "Development of coarse-scale spatial data for wildland fire and fuel management", RMRS-GTR-87, 2002

slow moving due to low fuel loads. As the stand ages, slower growing conifers establish in the understory and fuel loads from dead and dying vegetation increases. The addition of conifer species in the understory changes fuel conditions to varying degrees depending on the stocking level, but regardless, fire behavior will increase with conifer encroachment and surface fuel buildup. In late successional aspen stands, which are common in the analysis area, conifers are well established and aspen is on the decline. These stands can be multistoried, providing a ladder for fire to reach the canopy. Torching, spotting, and isolated crowning are part of the expected fire behavior. The fire behavior in these stands will be very similar to those presented for mixed conifer stands. Fuel loads are heavy, subalpine fir dominates the understory, and aspen, if present, is found only in isolated pockets. Late successional aspen stands are an artificial situation produced by successful suppression efforts, fire exclusion, and a lack of disturbance for renewal of the stand.

Regenerating harvest units comprise a smaller portion of the analysis area. Fire behavior within these areas will vary depending on current surface fuel loads, stocking level and age of stand. In harvested areas, fuels were treated by piling or broadcast burning and some areas were subsequently thinned. These areas have proven to be resistant to fire growth and excellent areas to build firelines and carryout fire suppression operations. Typically, fire behavior is limited to spotting into the regeneration and creeping, smoldering surface fires. Residual activity fuels can contribute significantly to potential fire behavior and can lead to the loss of the regenerating stand in the event of a wildfire. A bigger fuel problem is created if activity fuels are not treated. The thinning of some regenerating stands has not been completed. These stands are susceptible to crown fire due to their tight canopy spacing. As an unthinned stand ages and surface fuels increase, crown fire potential magnifies. Densely stocked conifer regeneration does exist and contributes to hazardous fuel conditions.

A good portion of the Maki Creek area is composed of *sagebrush/forb/grass communities* in various stages of succession. These areas provide a natural mosaic on the landscape and break up the fuel continuity of the timbered stands. These communities don't pose a particularly hazardous fuels condition or suppression concern. At elevations exhibited in the Maki Creek area, curing of these fuels does not occur until late summer, inhibiting fire growth. Late successional communities with a large component of decadent sagebrush are the exception and will carry fire more readily. Due to the ease of control and safety considerations, these areas are used by suppression personnel to gain control of growing fires. Encroachment by conifers is noticeable throughout the analysis area due to fire exclusion. Herbivory is evident and alters fuel characteristics and loadings by slowing succession and reducing the amount of fine fuels.

The exclusion of fire has re-shaped the Maki Creek area and altered the vegetation, fire and fuels conditions. The Maki Creek area is characterized by fire regime 3 (an area which historically burned every 35 – 100 years). Current vegetation and fuel conditions are artificial and out of historic range. Fuels are the only manageable component of the fire triangle (fuels, weather, and topography). The re-introduction of fire (prescribed and natural) and mechanical vegetation treatments at the landscape level are needed to begin the process of bringing the area back into its historic range and provide a safer work environment for suppression personnel.

The purpose and need for the Maki Creek area identifies needed improvements, including the need to lower tree densities, fuel loadings, and provide a range of successional conditions. Aspen forests are specifically targeted for treatment due to decadence and conifer encroachment. A goal for aspen management is to maintain half in younger age classes. The proposed wildlife management goals for the Maki Creek area and desired fire/fuels conditions can be managed to compliment each other. Ninety years of fire exclusion has altered the

landscape. Modification of current fuel conditions with the use of a complete range of mechanical and prescribed fire options must be applied to achieve the desired effect. Strategically placed mechanical treatments and use of prescribed fire to initiate disturbance will begin the process of re-introducing fire and its desired effects.

Section 3.3 PHYSICAL ENVIRONMENTAL CONDITIONS

3.31: Watershed Resources

Introduction

The Maki Creek area includes several tributaries to North Cottonwood Creek. The named streams are Maki Creek and Little Maki Creek. The entire project area is within the 6th Hydrologic Unit Code (HUC) named Upper North Cottonwood Creek. The Maki Creek assessment area is about one third of this HUC. The Forest boundary cuts across all but one of the tributaries before they reach North Cottonwood Creek. The Forest Service lands make up half of the 6th HUC. The affected environment area used for effects analysis includes the watersheds draining out of the Maki Creek area. However, the cumulative impacts assessment area includes the North Cottonwood watershed down to where the last Maki project tributary joins North Cottonwood.

Table 3.10 Relationship between evaluation criteria, resource concerns, existing conditions and desired range.

Evaluation Criteria	Concern addressed	Existing Condition	Confidence in existing condition	Desired Ranges
Detrimentally disturbed soils	Proposed management activities may cause detrimental compaction and puddling, increased erosion, and loss of organic matter	Currently the road system is the main disturbance. ECA range is less than 15%	Low – road field survey but no inventory of past harvest units	Less than 15% detrimentally disturbed soils
Unstable Areas	Projects should not be located on unstable landforms to prevent landsliding or excessive erosion	There are several soils with marginally unstable and/or unstable areas, and landslides areas	Moderate – Forest and State maps	No projects located on marginally unstable and unstable soils, and/or landslides
Road Density	Roads change water runoff patterns, cause increases in sedimentation, and hillslope stability	Road densities are generally low and road locations are good	Moderate to high – GIS modeling and field checking	Maintain road densities below 2.5%
Hydrologically connected roads	Roads segments that are connected to the stream system are chronic sediment sources	Few segments in MCPA; more in N. Cottonwood - mostly stream crossings	Moderate – field data	The road drainage system is disconnected from the stream system
Equivalent Clearcut Area	Vegetation removal may increase water runoff and erosion	Little Maki Cr. 4.6% Maki Creek 2.8% Maki Project area 1.3% N. Cottonwood 3.6%	Moderate – GIS modeling and vegetation information	Less than 20% ECA in any watershed. Forest Plan: < 30% in 2nd or higher order watersheds
Stream channel disturbance	Potential increases in water runoff from vegetation removal could affect stream channel stability	Little Maki 6-10% eroding streambanks Maki 10-12% eroding	Moderate –Fisheries inventory	Management related activities do not increase stream channel instability
State Water Quality Criteria	The proposed project may degrade water quality in the upper North Cottonwood watershed	The waters appears to meet beneficial uses according to the State DEQ	Low – we have no biological or chemical data	See state water quality criteria listed above
Percent Fine Material	Degree of sedimentation; Compliance with Forest Plan and WYDEQ water standards. Impacts fish survival	Approx 33 –35% in the main stem of North Cottonwood Creek.	Low to moderate – field data	20% fine sediment in trout spawning gravels (< 6.4 mm in dia.)

The North Cottonwood watershed area has a cool, humid, slightly windy, clear sky climate. Daily and seasonal temperature varies widely primarily due to the presence of dry air and subsequent heat radiation back to the atmosphere. Occasional deep, cold Canadian air masses penetrate the basin area and cause the coldest temperatures. Seventy-five to ninety percent of the annual precipitation falls as snow. Mean annual high elevation precipitation is 50 to 60 inches of water. In comparison, mean annual low elevation precipitation is 30 to 40 inches of water. Snow sublimation and other non-biological evaporative losses reduce available water by 10 to 20 percent. Windswept sites lose up to 60 percent. As a result, approximately 30 of the 37 inches of precipitation is available to the land's hydrologic systems.

The geology of the North Cottonwood watershed is dominated by the Hoback Range Thrust and the associated Hoback Mountains, a part of the Overthrust Belt. Formation of the current landscape involved uplifting along

thrust faults and glaciation. Tectonic forces faulted and folded older rock stratigraphy above the younger formations. The older rock of the Mississippian, Permian, Triassic and Jurassic Periods are generally more resistant to weathering and are composed of dolomitic limestones, quartzitic sandstones, siltstones, and shales. The younger sediments of the Cretaceous and Tertiary periods are composed of softer sandstones, limestones, siltstones, shales and conglomerates, which have all but worn away or are covered up in some locations. The toe slopes have a mixture of parent materials from the upper mountain slopes and cirque basins, including glacial till, slope wash, and landslide deposits. These materials form a mantle overlying older geologic sediments.

The North Cottonwood watershed has experienced fire suppression, timber harvest, road building and maintenance, grazing, and recreational use. The vegetation, fire, and wildlife habitat sections describe the changes to the vegetation communities from these past management activities. Currently the watershed's vegetation is not in properly functioning condition. The proposed projects attempt to start moving the vegetation communities toward properly functioning condition.

Natural and Human Related Disturbances

Floods: Gauging records from the Wyoming Range and the upper Green River watershed show that the typical spring snowmelt peak runoff happens between late April and early July. Some of the larger peaks occurred during 1918, 1971, and 1997.

Beaver: Beaver play a significant role in developing and maintaining dam and pond complexes. They play a significant role in regulating the movement of the stream channel (i.e. channel migration), streamflow, sediment transport, and woody vegetation transport in a system. They are active in most of the stream channels including the main stem of North Cottonwood. They also play a vital role in floodplain development, maintaining the riparian and wetlands communities, and fisheries habitat.

Wildfire: The vegetation in a watershed greatly influences the water runoff patterns and streamflow regime. Changes in the type or amount of vegetation can lead to changes in water runoff. The prominent natural physical processes that maintain the landscape vegetation are wildfire, insects, and disease. There is only one wildfire that burned in the Maki Creek area during historic records. It burned about 20 acres at the head of Little Maki Creek, and 16 acres of burned timber was harvested.

Timber Harvest: Past timber harvest activities have occurred in Little Maki and Maki Creeks within the assessment area and throughout the Upper Cottonwood Creek watershed.

Grazing: Livestock grazing occurs on National Forest, Bureau of Land Management, and private lands throughout the North Cottonwood watershed. Bank trampling has destabilized channel banks along localized portions of the mainstem and tributaries, but the impacts are not widespread. These impacts are discussed in Fisheries and grazing reports in the project file. Upland range vegetation changes have resulted from the fire suppression efforts and livestock management activities. Fire reintroduction to the landscape and the restricted use after prescribed fire will help allow the upland vegetation to return to a 'properly functioning condition.'

3 Affected Environment

Soils

Soil Map Units: Each soil series or map unit has an erosion hazard, compaction rating, revegetation potential, and inherent stability rating. These ratings are sometimes associated with slope ranges. The rating is more likely to apply above the slope given. The ratings provide information for the proper management of the soils.

The conditions of vegetation resources are impacted and constrained by soil types and associated slopes. The map units listed below categorize the different soils in the analysis area. Potential soil disturbing activities such as timber harvest and road building are located in map units 202, 303, and 345. Most proposed activities are on mild slopes, generally less than 20%.

Table 3.11 Maki Project Area Soil Management Interpretations from the Bridger-West Soil Survey

Soil Map Unit #	Erosion Hazard	Compaction Hazard	Revegetation Limitation	Slope Stability
202° *	High – slow water percolation	High – surface characteristics and features	Severe – slopes generally > 24%	Marginally unstable
203*	High – slopes generally > 30%	High – surface characteristics and features	Severe – slopes generally > 24%	Marginally stable
205*	High – slopes generally > 30%	High – surface characteristics and features	Severe – slopes generally > 24%	Unstable
255*	High – slopes generally > 30%	High – surface characteristics and features	Severe – slopes generally > 24%	Unstable
303° *	High – slopes generally > 30%	High – surface characteristics and features	Severe – slopes generally > 24%	Marginally unstable
311*	High – slow water percolation	High – compacts easily	Severe: Too clayey	Stable
345° *	High – slow water percolation	High – compacts easily	Severe – slopes generally > 24%	Marginally unstable
402*	High – slow water percolation	High – surface characteristics and features	Severe – slopes generally > 24%	Stable
412	High – slopes generally > 30%	Moderate – surface characteristics and features	Severe – slopes generally > 24%	Stable
432*	High – moderately slow water infiltration	High – surface characteristics and features	Severe – slopes generally > 24%	Stable
462*	High – slow water percolation	High – surface characteristics and features	Severe – slopes generally > 24%	Stable

° Most proposed projects are located in these soil map units

* Sensitive ground – High rating for erosion and compaction hazard, and severe revegetation limitation

Climate and soils on the Maki Creek areas influence the kinds and amounts of vegetation produced. Three general community types are supported in the project area: sage brush/forb/grass, aspen, and mixed conifer (spruce/fir/ lodgepole and Douglas fir) communities. Soil patterns are a function of parent material, climate, organisms, topography, and time. Each soil series is mapped on orthoquads and numbered. Each map unit

(MU) defines the location of a soil containing similar properties. The following is a short description of a common map unit found in the project area:

> Map Unit 303 is found on the northern aspects of the lower parts of the Little Maki and Maki Creek watersheds. The soil components are the Chedsey family, clayey, approximately 35%, the Whiz family 30%, the Cundiyo Family 20%, and 15% includes Granmount and Ansel Family soils. "The map unit consists of sideslopes paralleling drainages. Parent material is colluvium derived from mudstone, sandstone, and lenses of conglomerate from the Tertiary Wasatch geologic formation. Elevation ranges from 8,000 to 9,500 feet. The aspect is north. Average annual precipitation ranges from 25 to 50 inches. The stability is marginally unstable. (BTNF Soil Survey, 1997)." Management of this map unit should keep in mind that the unit has a high erosion hazard rating, primarily in slopes greater than 30%, a high compaction hazard rating because of the surface characteristics and textures, and a revegetation limitation on slopes greater than 24%.

Erosion Hazard: A review of the interpretations for Erosion Hazard (Table 3.11) indicates that "Slope" is the predominant element for the High Erosion Hazard ratings. The High Erosion Hazard is a result of a predominance of slopes greater than 30 percent within the map unit. These map units are prone to accelerated erosion when the surface soil is mechanically disturbed. Best Management Practices must be implemented. Avoid slopes greater than 30 percent where feasible.. Roads needed to conduct management activities should follow the natural landscape contours as much as possible. Treatment units should leave adequate slash (10 – 12 tons/Acre) to protect soils from accelerated erosion and loss of soil productivity. Vegetative buffers need to be maintained along riparian areas as specified in the BTNF Forest Plan to reduce the risk of excessive sedimentation.

Compaction Hazard: A review of the interpretations for Compaction Hazard (Table 3.11) indicates that "Compacts Easily" is the predominant element for the Moderate and High Compaction Hazard ratings. The Moderate Compaction Hazard rating is due to the lack of rock fragments in the surface soil or a result of soil textures prone to compaction forces. The High Compaction Hazard rating is due to the lack of rock fragments in the surface soil and soil textures prone to compaction forces. Best Management Practices must be implemented: use of designated skid trails, and restricting mechanical operations to periods of the year when the surface soil is dry and/or frozen, and/or leaving slash lowers the risk of reducing soil porosity and infiltration characteristics.

Revegetation Limitation: A review of the interpretations for Revegetation Limitation (Table 3.11) indicates that "Slope" is the predominant element for Severe Revegetation Limitation ratings. The Severe Revegetation Limitation rating is due to a predominance of slopes greater than 24 percent and clay content within the area. Special mitigation measures will be needed to prevent accelerated erosion and loss of soil productivity.

Sensitive Ground: A sensitive ground interpretation was developed in 1995 to help focus fieldwork to areas of the Bridger-Teton National Forest where management impacts were likely to occur in concert with management activities. Sensitive ground is defined as areas where soils have a "High" rating for Erosion and Compaction Hazard with a "Severe" revegetation limitation. This rating is meant to express the cumulative behavior of several soil quality characteristics. Often these areas are easily damaged unless special mitigation is incorporated into management prescriptions. Overall, sensitive areas are slower to recover (establishment of

protective ground cover) after they are disturbed.

Soil Stability Ratings; Each map unit is rated on its overall stability:

- Stable – Evidence of past landslide activity has not been discerned and the observable characteristics of the land are evidence that the probability of landslides in the future is low.
- Marginally Stable – Evidence of past landslide activity has not discerned but there are some land characteristics that suggest a landslide potential may exist.
- Marginally Unstable – Evidence of past landslide activity is discernable but none are of recent origin, i.e. within the last 50 years. The assumption is that the area is gaining stability but certain disturbances at critical locations could reactivate mass movements.
- Unstable – Evidence of recent mass movement or fresh tension cracks are discernable. Probabilities of additional mass movements are high.

The soil map unit stability ratings are listed in table 3.11 and are discussed below:.

Hillslope stability/Landslides: Instability is common on steep, soil covered hillslopes. Mass wasting events (e.g. landslides) are naturally occurring disturbances that have had and will continue to have an influence on the project area. Man-caused disturbances such as road construction and timber harvest can increase the potential for mass wasting events. Landslides have been documented as the dominant form of sediment delivery to streams in western Wyoming (Bailey, 1972). The principal types of mass wasting in the project area are slumps, debris slumps, and earthflows (WYGS, 2001).

Ground reconnaissance of the project area identified several locations of slope instability as a result of natural and management activities. Natural landslides are most common in the form of slumps or earthflows in soils series 203, 205, 303, and 345 (WYGS, 2001). The amount or number of natural landslides was not quantified for this analysis. The management-related landslides that have been identified are mostly small, localized road cut and fillslope failures (slumps) throughout the project area.

The Maki Creek area is on the eastern side of the Overthrust Belt. Landslides are a function of slope, gradient, slope shape, aspect, soil depth, bedrock, and soil moisture. There are also several faults in the analysis area, which could trigger landsliding.

The proposed projects may change the hillslope stability. Given the topography in the area, the dominant erosional process moving sediment downhill is most likely surface erosion vs. landsliding. Surface erosion is a function of the slope, material strength, and vegetation cover. A management activity may trigger a landslide if placed on a steep slope and unstable terrain. However, with proper road placement (low slopes and minor cuts) and adequate ground cover left after mechanical treatments the surface erosion can be limited.

Hydrologic Function (Watershed Runoff Processes)

The Road System: There are approximately 20 miles of "roads" in the Maki Creek area within Forest boundaries. This includes seldom used 2-tracks, closed roads, and all roads ever used. Many of these have

been rehabilitated. There is an additional 16.5 miles of mostly 2-track roads in the Maki drainage area off-forest on private ranch land. The majority of the roads are in the Little Maki and Maki Creek watersheds. The inventory began at the intersection of the FS boundary and FS Road #10120. The inventory area encompasses Forest Service Road #10120 and three spur roads, FS Rd #10120-A, and two access roads to the north of Maki Creek.

Road Density: The road density calculations were made using all possible roads in the watersheds, including off-Forest 2 track roads where indicated. Roads once built never fully recover unless they are completely obliterated, which means the hillslopes, soils, and vegetation are restored. If roads are allowed to revegetate, they will reduce the water and sediment runoff, but probably not completely eliminate the runoff. The hillslope drainage is still disrupted by the hardened road surface and disconnect from the upper hillslope to the lower hillslope. This assessment assumes that all roads were equal in their effects on the water runoff processes. The road density estimates provide reasonable information for comparison of the Alternatives and not detailed sediment modeling calculations.

Table 3.12 Existing (Alternative 1- No Action) Road Densities and Mileages

Road Density and Road Mileages	L. Maki Creek	Maki Creek	Maki Project Area (FS)	Maki Area (Includes off-Forest land)	North Cottonwood Drainage (Includes off-Forest land)
Density	**2.4**	1.2	1.8	2.1	2.1
Mileage	2.8	5.3	20.0	36.5	97.0 (Includes 16.5 mi located outside FS boundary)
Drainage Area (sq mi.)	**1.2**	4.3	11.1	17.6	46.9

Hydrologically Connected Roads*:* Another important consideration is if the road system is hydrologically connected to the stream system. This means that sediment laden road water runoff can flow into the stream system. This is a more detailed project level indicator for determining the effects of roads. A road-sediment inventory of the assessment area was used to examine where the road system was hydrologically connected to the stream system. The assessment will detail only the Maki Creek area.

Road Sediment Inventory: A Road Sediment Inventory was completed in the project area in June 2002. The purpose of the inventory was to identify and describe all road-related sediment sources with hydrologic connection to the drainage system and to assess, where applicable, the viability of aquatic organism passage through the site. Hydrologic connection typically occurs at stream crossings and cross-drain sites. In addition, road-induced erosional features may contribute sediment to streams either directly or indirectly by depositing in a hydrologically connected inboard ditch. The Roads Inventory was completed using protocol outlined by USDA-Forest Service (1999 and 2002).

The road network in the area receives only administrative vehicular use and accordingly the road surfaces throughout the network are mostly revegetated by weeds, grasses, sagebrush and, in places, pine saplings. The roads are typically located along ridges or terraces reducing contact with the drainage system and the amount of

surface flow collected and transported by the road itself. Generally, revegetation and proper placement of roads within the landscape has limited, though not extinguished, the formation of channelized flow along the road surfaces. The three spur roads associated with FS RD #10120, all of which depart prior to the Little Maki Creek crossing, exemplify this description. These roads are not hydrologically connected to the drainage system, are vegetated, and show minimal signs of road surface runoff. Similar conditions were observed along FS Rd #10120-A and along FS Rd #10120 from the Little Maki Creek crossing to the crossing of an intermittent tributary to Maki Creek. In fact, only two sites, the Little Maki Creek crossing (Maki-RX1) and the intermittent tributary crossing (Maki-RX2), met the requirements for inventory. Data for the sites is summarized below.

Maki-RX1: FS Rd #10120 crosses Little Maki Creek at this site. This crossing was inventoried for road sediment hydrologic connectivity, culvert and road fill condition, and aquatic organism passage. Hydrologic connectivity exists at this site in the form of inboard ditches entering both the right and left banks adjacent to the culvert inlet. Both ditches are vegetated by grasses and weeds. A 14' wide and 10' tall unvegetated cutslope of loose sand, gravel and cobble along the right bank adjacent to the culvert inlet contributes sediment to the hydrologically connected right bank inboard ditch. The 35' long and 3' diameter culvert is in good condition, is not plugged and is properly aligned with the stream channel and slope. The road fill is vegetated and shows no sign of erosion or indication that flows have previously overtopped the road surface. Opportunity exists at the RX1 site to prevent inboard ditch flow from entering Little Maki Creek through the introduction of cross-drains. In addition, re-contouring the road around the road fill could reduce or eliminate diversion potential.

Maki-RX2: FS Rd #10120 crosses an intermittent tributary to Maki Creek at this site and ends shortly hereafter in a past logging area. This site was inventoried for road sediment hydrologic connectivity, and culvert and road fill condition. Hydrologic connectivity exists at this site in the form of inboard ditches entering both the right and left banks adjacent to the culvert inlet. Upslope and adjacent to this ditch, water diverts from another inboard ditch, crosses the road, and flows onto the steep forested hillslope below. This flow has channelized down the hillslope and enters the intermittent tributary below the culvert outlet. This area, like the entirety of the road fill, is completely vegetated and does not show signs of erosion. Due to the depression of the road fill surface relative to the adjacent road surfaces, diversion potential does not exist at this site.

Opportunity exists at the RX2 site, through the introduction of cross-drains, to prevent inboard ditch flow from entering the intermittent tributary both at the culvert inlet and below the culvert outlet. This would include addressing the road surface runoff connected with the flow reaching the tributary below the culvert outlet. This crossing is an excellent candidate for removal should the road remain closed. Although the road fill conditions are good at this time, flow indicators suggest there is potential for this crossing to blowout from high water or improper maintenance.

Overall, the road system in the Maki Creek area is not highly connected to the drainage system. The Forest Service road system is currently closed, except for administrative use. This area may represent one of the better examples of timber-related road development and closure on the Bridger-Teton N.F. The roads were generally well placed in the landscape to avoid the drainage system and riparian areas and to minimize road surface interception and transportation of surface and ground water. Upon closure, a section of one spur road was ripped and another section was contoured. This road showed only minimal indication of intercepting and

transporting water. It is recommended that future road development follow suit. Plan roads along ridges, terraces and hilltops, and use techniques such as ripping and contouring upon closure. It is typical for closed roads to become the most problematic with regard to sediment introduction into drainage systems because these roads do not receive routine maintenance

See the Fisheries section (3.24) for effects from road-stream crossings (e.g. culverts and stream crossings).

Water Runoff Processes*:* Another concern is that reductions in vegetation canopy will lead to increases in annual water yield or peak flow runoff. This may adversely alter stream channel morphology and therefore degrade fisheries habitat. The Equivalent Clearcut Area (ECA) method is most commonly used for quantifying the effects that past and proposed mechanical harvest, fire, and road building activities have on water runoff. The procedure used to determine ECA for this analysis is a modified version of the original procedure described in *Forest Hydrology, Hydrologic Effects of Vegetative Manipulation* (USDA Forest Service, 1974). The percent ECA of an area is based on the tree cover or basal area removed and any hydrologic recovery (re-growth) that may have occurred. If a stand is thinned or partially cut, the total area is multiplied by the estimated percent of reduction. Roads are assumed to have complete vegetation removal and remain in a permanent ECA condition.

The ECA process involves several steps: determining the base ECA amount, each alternative additions, the predictive water runoff, the current stream channel conditions, and how the increase in runoff will impact the stream channels. This method is best for comparing alternatives (Table 4.23) and should not be taken as an absolute measure. The method treats all vegetation types in a similar way.

The first step is determining the hydrologic recovery of the previously harvested timber stands and fire areas. Galbraith (1973; 1975) and the USDA Forest Service (1974) have developed hydrologic recovery curves based on habitat types common for the northern Rocky Mountains. In the Cottonwood analysis area, approximately 86% of the previously harvested 2,227 acres was clearcut 30 years ago and that 15% was clearcut 10 years ago.

Several studies conclude that following disturbance: annual water yield increases; the peak flow runoff period advances; and smaller peak flows (bankfull or less) increase in magnitude, while the larger peak flows do not show a measurable increase in magnitude. In general, it appears that more than 20% of a watershed needs to be harvested before a ‘measurable difference’ can be detected. This tracks relatively well with the Forest Plan standard that requires no more than 30% of any second order or higher watershed will be in created opening status during a 30-year period. See Table 3.13 for a comparison of the existing ECA values versus the Forest Plan standard for four areas in the Upper North Cottonwood watershed.

Four segments of the upper North Cottonwood watershed are analyzed: Little Maki Creek, Maki Creek, the Maki Creek project area, and upper North Cottonwood watershed. The Little Maki and Maki Creek watersheds are second order watersheds, contain Colorado River cutthroat, and include most of the proposed timber harvest. The Maki Creek area includes all the possible projects. The upper North Cottonwood watershed is the cumulative effects analysis area for the water resources. The timber harvest and roads ECA percentages are used to examine the amount of soil disturbances.

Road ECA values were calculated by multiplying the mileage by an estimated average road width of 16 feet[27]. The main motorized and hiking trails were multiplied by an average width of four feet[28]. The past timber harvest (163 acres) within the Maki project area were assumed to be about 20 years old. Using Galbraith's (1993) graphs and considering the vegetation type, we assume the past harvest units are 42% recovered. In the upper North Cottonwood area we assumed that 85% of these older cuts were 30 years old and 15% was assumed to be 10 years old. The 85% area was assumed to be 53% recovered.

The ECA in the proposed fire areas was derived from the assumed burn severity. In the aspen it was assumed that there would be a 100% vegetation removal, and in the sage community there would be a 50% vegetation removal. The aspen will recover quickly as the young aspen trees sprouts back up. The sage community will likely be a complex mosaic with a range of 30-60% vegetation retention.

Table 3.13 Forest Plan ECA thresholds and existing openings (% ECA) by watershed.

Watershed	Percent ECA permitted by Forest Plan (30 year period)	Existing ECA (2002)
Little Maki Creek	30 %	4.6 %
Maki Creek	30 %	2.8 %
Maki Project Area (FS)	30 %	1.9 %
North Cottonwood Creek	30 %	3.6 %

Stream Channel Condition/Stability: Stream channel condition is typically determined by a given stream reach's ability to transport the sediment and the water yield of its watershed. The streams in the assessment area are generally in relatively good condition. There are several problem areas such as the ones discussed in the Fisheries section, 3.24. Resource damage to the streams has occurred from livestock and human recreational trampling of the streambanks. Approximately 10-12% of Maki creek and 6-10% of Little Maki Creek's streambanks are considered damaged or unstable. The Forest Plan Streambank Stability Guideline states, "at least 90 percent of the natural bank stability of streams that support a fishery, particularly, Threatened, Endangered and Sensitive species, should be maintained." The majority of this streambank disturbance is management related and could be fixed by management changes.

Water yield increases become a concern when they result in the degradation of stream channels and fish habitat loss. Stream channel sensitivity and stability are key factors in determining the potential effects of an increased water yield. Stream channel stability is on average pretty good, however, the percent fine sediment is high (Table 3.14).

[27] Steve Haydon, pers. comm
[28] Susan Marsh, pers. comm.

Table 3.14 Channel Stability and Percent Fine Sediment of Streams.

Stream	Rosgen Channel Types[1]	Channel Sensitivity Bank Erosion Potential	Channel Stability[2]	Percent Fine Sediment
Little Maki Creek	A3; B3	Moderate	90-94%	%[2]
Maki Creek	A3, B2; C3	Moderate to high	88-90%	%[2]
North Cottonwood Creek	C4	Moderate	--	33-35%[3]

1 – Rosgen 1996
2 – See Fisheries section
3 – Watershed bulk sampling report 2000

Channel conditions within the analysis area, based on in-channel inventories, indicate that bank stability is good for most stream reaches. Channel sensitivity to disturbance, based on channel type (Rosgen 1996), indicates that some tributaries are sensitive to disturbance. Channel type was determined from the in-channel inventories using channel geometry, slope, Wolman Pebble Counts, sinuosity, and slope. Channels with a fine-grained substrate are particularly vulnerable to bank erosion. Extensive data on each tributary was not available. Increasing runoff beyond the ability of a stream to accommodate flows can cause stream channel degradation.

Water Quality: Every two years, the State is required to identify, under the Clean Water Act, streams not currently meeting their beneficial uses in a report called the *303(d) List*. There are no streams within the direct, indirect, or cumulative effects boundaries for this project on the State's *303(d) List*.

Water Quality Criteria*:* The Forest Plan requires compliance with water quality criteria as designated by the Wyoming State, Department of Environmental Quality (WYDEQ). The water bodies within the project area are generally regarded as fully supporting the beneficial uses by WYDEQ. The WYDEQ has classified the surface waters within the project area as 2AB waters, specifically listing North and South Cottonwood Creeks. (WYDEQ, 2001a). The tributaries are included but not specifically listed. The use designations for 2AB waters are drinking water, game fish, non-game fish, other aquatic life, recreation, wildlife, agriculture, industry, and scenic value. WYDEQ also requires that these waters are not degraded by future projects.

Two specific standards that apply to the proposed projects are: Turbidity (Section 23) and Settleable Solids (Section 15) (WYDEQ, 2001b). The Settleable Solids standard allows the Forest to determine what constitutes degradation of aquatic life habitat. The Forest has determined, based on available literature, that fine sediment (<6.4 mm) is the important settleable solid and the desired range of 10-20% fine sediments in the trout spawning gravels would best support the beneficial uses (i.e. cold-water fisheries).

Percent Fines*:* Various authors suggest that cutthroat trout survivability is negatively affected when fine sediment comprises >20% or more of the spawning gravels and declines rapidly above 35% fine sediment levels. (Figure 3.1). Measurements of subsurface fine sediment from 2000 averaged 33.5 % in the mainstem North Cottonwood Creek (Table 3.14). Comparison with the data collected in the South Cottonwood watershed show that the average in North Cottonwood is about 5% higher. The drainages are similar in most ways, but

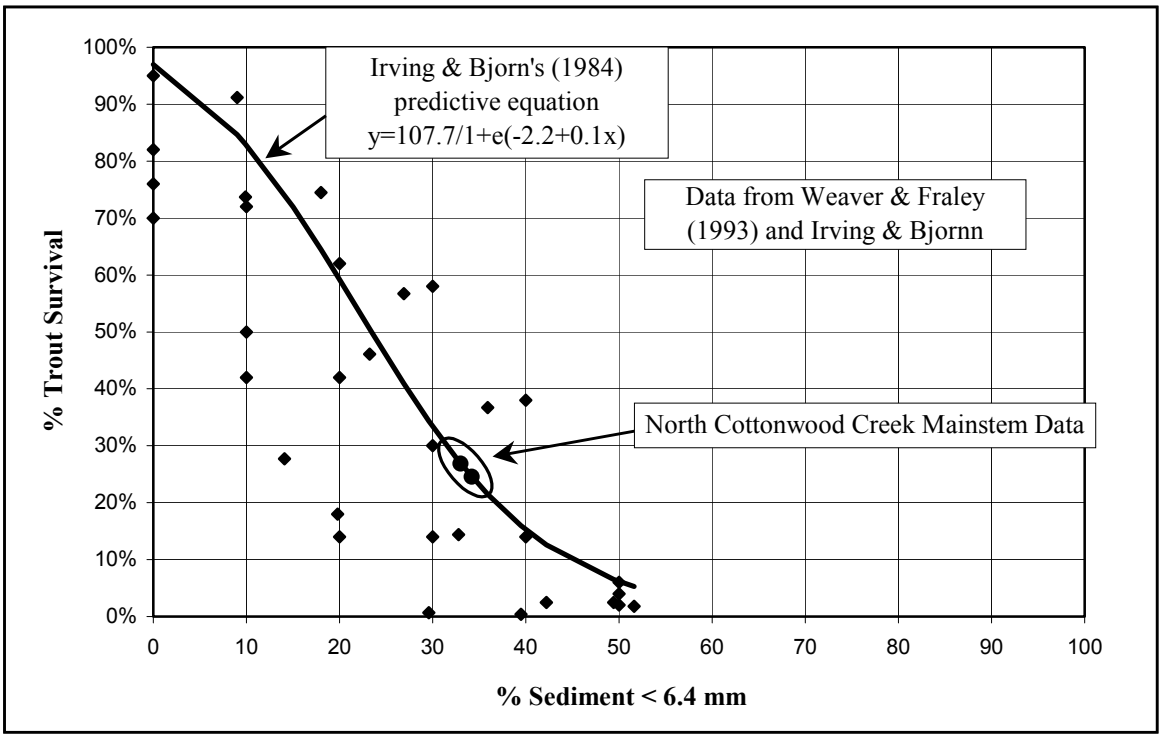
differ in that North Cottonwood Creek has a more extensive road system and harvest history. North Cottonwood also has greater clay deposits. This is evident in Hardin Creek and its bulk sample (76.8% fines). The sedimentation in North Cottonwood Creek, a Colorado River cutthroat trout bearing stream, is exceeding the desired range and may be a threat to trout survival. See the Fisheries section for further discussion on limiting aspects to the local trout populations.

Table 3.15 Estimated fine sediment component of inventoried redds of North Cottonwood Creek and predicted survival of trout embryos using Irving and Bjornn's (1984) equation.

	% Particles	Predicted trout embryo
Location	< 6.4	survival to emergence
NORTH COTTONWOOD		
Irene Creek	38.1	18.0%
Hardin Creek [B]	76.8	0.4%
Below Nylander Creek		
Reach Average	34.2	24.5%
Nylander Creek	31.6	29.8%
Below Sjhoberg Creek		
Reach Average	33.0	26.9%
Stream System Average [C]	35.5	22.1%
[A] One sample collected per riffle.		
[B] Considered an outlying value.		
[C] Does not include the Below Sjhoberg Creek #2 value, nor the Hardin Creek value.		

1/ (Chapman and McLeod 1987, Irving and Bjornn 1984, Tappel and Bjornn 1983, Weaver and Fraley 1993)

Figure 3.1 Percent survival to emergence vs. percent sediment for North Cottonwood Creek from Irving & Bjornn predictive equation (1984.)



3.32: Roads and Transportation

Roads are essential to many management activities in the Cottonwood analysis area and their design, location and number will have an impact on all significant issues. There are many opportunities for improving or rehabilitating existing roads to reduce sedimentation and improve water quality (Issue 3). Table 3.16 displays the road system for the project area. Road Management objectives (RMO) have been completed for the project. Roads are usually passable during the drier months of the year using a high clearance vehicle. Access may be denied, or restricted to certain times of the year. Over the past 9 years, 15 miles of roads have been obliterated that were not on the Bridger West Travel Plan. The majority of these roads were two-tracks. Restrictions are primarily to provide security to big game animals, but also to accomplish other objectives. These include preservation of the road surface, soil and water quality, and non-motorized recreation opportunities. There are 25.0 miles of open classified roads and 29.0 miles of restrictive access classified roads in the Cottonwood analysis area. There is one road restricted in the spring for protection of the road surface. All roads are gated at the point where access changes. Some of the gates will be replaced. Many of the existing roads are managed to meet multiple resource objectives. Existing users include: administrative, commercial and recreational travelers. Commercial users include timber harvesters, outfitters and firewood collectors. Recreational users include hikers, equestrians, anglers and hunters.

In the Maki Creek area there are 3.1 miles of level 1 roads (Roads 10120 and 10120A). The entire road system is gated and motorized use is restricted to only administrative use. The roads are open to non-motorized public use but actual use is low due to limited parking and distance to National Forest lands on right of way across private land. Most use occurs in big game hunting season. The road system has been used in the past for access to tie hack and later timber sales; oil and gas exploration; and fire suppression activities.

Table 3.16 – Road Levels

	Total MA	Level 1	Level 2	Level 3	Level 4
Cottonwood Analysis Area	54.0	29.0	3.4	17.0	4.7
Maki Drainage		3.1			

There are 4.56 miles (8.8 acres) of roads in the Cottonwood Analysis area that either cross, are located or near riparian areas. Best Management practices from the State of Wyoming, and Forest Plan Standards and Guidelines will be used when maintaining, reconstruction or construction of any of these segments.

Roadless Areas: There are 28,228 acres of inventoried roadless areas in the Cottonwood analysis area. There are 6.44 miles of existing roads in some of the areas mapped as roadless, all of which is currently restricted access. These include roads that existed prior to the Roadless Area Review and Evaluation II (RARE II) review as well as roads that have been built in roadless areas since then. There are also a number of non-system, two-track "roads", which have developed over time as a result of off road use. Approximately 58 percent the forested area included in the Cottonwood analysis area is currently classified as roadless. A large portion of the Maki Creek area is classified roadless, including several areas originally proposed for timber harvest under Alternative 2. The Forest Plan allowed both new roads and management activities such as timber sales in areas classified as roadless. In the new Roadless Policy approved since this proposal was scoped, management actions in roadless areas have been restricted. This Policy is reflected in Alternatives 3 and 4. Alternative 2 reflects what was scoped.

The existence of large roadless backcountry in the Maki Creek area contributes to its attractiveness to recreational visitors. Backcountry settings for big game hunting, self-supported pack trips and hiking, and other activities are what this area offers to the visiting public. Most of the trail system within the analysis area (79 percent) is located in roadless. In addition, there are members of the public who do not actually use these areas for recreation, but are interested in maintaining their status as roadless. Although reasons for this differ, common themes from public comments include the following:

- roadless areas have value for watershed health,
- . wildlife habitat,
- scenery, and
- value as a relatively undisturbed forested ecosystem

3.33: Minerals

There are no mining claims in the analysis area. There is an 80-acre coal lease for the Kleinstick mine located in DFC 12 in the North Cottonwood Creek drainage, but outside of the Maki Creek area. During the summer of 1998, the entire mine site and access road was reclaimed.

An application for coal prospecting on over 8,700 acres was turned down in 1973 in order to lease coal in an orderly manner. A lease request for the Cottonwood Mine was also turned down for the above reason.

The project area has leases for oil and gas. This includes the Soda field and Beamer's Bluff field. There are six dry holes (including one in Maki Creek area) and four producing wells (none in Maki Creek area) in the Cottonwood watershed.

Section 3.4 - SOCIAL CONDITIONS and FACTORS

3.41: Recreation

Introduction

Recreation Opportunities" is significant issue 3. Treatment of the other significant issues will have impacts on the nature and quality of recreation opportunities available.

Dispersed Recreation: In the Maki Creek area, all roads are gated, with no motorized recreation available. The area is used by hunters on horseback or foot. However, access is through private land. The Cottonwood analysis area is used during the summer and more heavily used during the fall hunting season. North and South Cottonwood provide good areas and opportunities for dispersed camping, Off Highway Vehicle (OHV) use, fishing, hiking, picnicking, mountain biking, driving, and special use activities.

In the remainder of the Cottonwood analysis area, the impact on dispersed campsites is low to moderate, with the moderately impacted camps becoming highly impacted over time if not properly managed. Campsites are visited and monitored periodically by forest personnel to ensure they are kept clean and attractive. There are several cabins and tie hack cabins in the analysis area. The South Cottonwood tie hack village is the only village signed and somewhat preserved. The other historic sites in this area have not been preserved or signed.

Winter Sports Activities: The entire management area is open to snowmachines, except for an area in T.34N., R114W., Sec. 32, 33 & 34.

Trails: The trail system in the Cottonwood analysis area consists of 29 miles of system trails and 13.5 miles of non-system trails. The trails provide mainly for horse and foot use, but are also open for mountain biking and non-motorized uses. These trails receive more use in the fall than the summer. There is only one developed trailhead in the analysis area located at McDougal Gap. The McDougal Gap trailhead has parking and an information board.

The majority of the recreation setting is in DFC 10 and 1B areas. Recreation activities suitable for this area include dispersed, road-oriented uses such as roadside camping and day use, fishing, picnicking, mountain

biking, hunting, firewood gathering, and winter sports. Public access into the area is adequate and users are directed to the road and trail system by directional and interpretive signs and trail markers where needed.

There will be a transportation system, with some open and closed roads to meet the needs of the users. Some closed roads will be part of the trail system and provide opportunities for foot, horse, llamas, mountain bikes, and OHV's. The system trails are maintained to provide recreational opportunities and to protect resource values.

Primitive hiking and camping experiences are found at higher elevations and in DFC 12 and 2A areas.

3.42: Visual/Scenic Resources

Introduction:

Visual and scenic resources are most closely tied to significant issue 3, "Recreation Opportunities". Management and condition of vegetation (Issue 1) can impact visual resources and will be constrained by them. The following is a description of existing conditions for scenic resources of the Cottonwood area. It is divided into 3 sections: Landscape Character, Visibility of the area, and Forest Plan Direction. The first section, Landscape Character, is intended to give the reader a general description of the physical attributes, both natural and cultural. Naturally occurring features such as water, vegetation, geology, topography and other dominant land characteristics will be described first. Man-made components will then be identified. Examples include: roads, trails, buildings, recreation facilities, vegetation treatments, etc. By combining the natural and man-made attributes, a base line condition of the existing landscape will be established. This reference condition will be used in analyzing the effects of the proposed action and alternatives.

The second section, Visibility of the Area, will describe how the landscape is seen. Roads, trails, developed recreation sites, private land, popular dispersed recreation areas, destination points, etc. will be noted. These vantage points will assist in focusing the effects analysis to areas where the landscape is seen often, seen for long periods of time, and/or, where the scenic resources of the area are an important part of the recreation experience being sought.

The third section will describe Forest Plan direction relevant to managing scenic resources. The intent of this section is to disclose existing sideboards for any ground disturbing activity. It is assumed that direction contained in the plan will be applied to all alternatives, thereby, important to consider as part of the existing condition for managing scenic resources.

Landscape Character:

Natural landscape components: The Maki Creek area is part of the Overthrust Belt in the Central Rocky Mountains. Located on the east slopes of the Wyoming Range, the landscape contains sharp mountain peaks, steep cliff faces, and rock outcroppings. Triple peak, Lander Peak, and Bare Mountain reach over 10,000 feet in elevation. Due to the variation in soil types and parent material, such features as: stratified rock faces, landslides, alluvial fans and talus slopes are dispersed along sideslopes. On southeast corner area, red, stratified rock outcroppings exist. Color variations created by the diverse geology and vegetation range from shades of grey and brown to deep shades of green, orange, yellow and red.

3 Affected Environment

Vegetation varies sharply due to dramatic changes in elevation, slope, aspect and climate. North facing slopes are densely forested while south facing aspects have sparser vegetation, revealing the geology of the area. The majority of the landscape is occupied by conifer forest with Lodgepole pine being the most dominant species. Other species such as Engelmann spruce, aspen and subalpine fir also comprise the forested portions of the landscape. The remaining 30% of the area consists of grasses and sagebrush. Bands of riparian vegetation follow the alignments of creeks and lakes. Soda Lake, North and South Cottonwood Creeks and many small tributaries dissect and add to the diversity of the landscape.

Cultural (Human caused) components of the landscape: Evidence of current and past management activities in the watershed includes: transportation systems, mining, oil and gas exploration and development, various types of vegetation treatments, domestic grazing, and recreation use. Existing Recreation Opportunity Spectrum (ROS) Class (Table 3.17) inventories provide a general overview of where, and to what extent, human activities occur on the landscape. This is accomplished by locating where roads exist and what level of development is associated with them. The Cottonwood watershed includes: roaded natural, semi-primitive motorized, semi-primitive non-motorized and primitive settings.

The majority of the Cottonwood area is classified as a roaded natural setting. As such, the road system is the predominant constructed feature on these roaded natural landscapes. In addition to the road system, other man made elements include: historic cabins, fencing, and clear cuts, tie hacked areas, evidence (soil compaction and changes in vegetation) of grazing and recreation use, an abandoned coal mine, oil and gas activity, trail systems, and signs. The clear cuts occur along: Nylander, North Cottonwood, McDougal, Ole, Hardin, and Irene Creeks. Oil and Gas facilities are present on South Cottonwood Creek, west of Soda Lake and on Bare Pass.

In contrast to the roaded areas of the landscape, the western portion of the watershed is classified as a primitive ROS setting. Other than the trail system and associated signing, little man-caused alterations to the natural landscape are evident. Between the primitive and roaded natural settings, transition areas of semi-primitive, both motorized and non-motorized, occur. Areas classified as semi-primitive motorized exist along the southeastern boundary of the area and in portions of Maki and Chase Creek.

Semi-primitive non-motorized areas exist in the northeast and west corners of the area and an area east of the Wyoming Range National Recreation Trail. In addition to the trail system, portions of previous clear cuts are evident along McDougal Creek, Ole Creek, and in the northeast corner of the watershed, south of South Horse Creek.

Table 3.17 ROS Classes (Total Cottonwood Analysis Area)

ROS Classes	Acres
Motorized	26,400
Primitive	5,760
Semi Primitive Motorized	6,263
Semi Primitive Non Motorized	10,119

Visibility of the area:
Critical view points and corridors are those which offer views of and to the area. They will serve as locations from which specific effects to the scenic resources can be described and evaluated. Travel routes within the area include: the North Cottonwood-McDougal Gap Road, the South Cottonwood Road, and the Bare Mountain Road. In addition, the area surrounding Soda Lake is considered sensitive due to it's heavy concentration of recreation use. Non-motorized trails within the area include: the Wyoming Range National Recreation Trail, Old Indian Trail, Maki Creek Trail, Eagle Creek Trail, S. Fork of Cottonwood Trail, S. Cottonwood Creek Trail, and N. Piney Creek Trail. Although the number of people viewing the area from these routes is not significant, the scenic integrity is important to the recreation experience being sought.

Forest Plan Direction pertaining to Scenery Management:
Visual Quality Objectives (VQOs) (Table 3.18) for the total Cottonwood analysis area were mapped and approved during the leasing analysis in 1990. These objectives will be applied to all proposed management activities. Areas of Retention (management activities are to remain unnoticed by the average visitor) exist within foreground areas along main travel corridors and in popular dispersed recreation areas. These include North and South Cottonwood Roads, Bare Mountain Road, the Soda Lakes area, and the primitive recreation setting within the 2A management prescription, including the Wyoming Range National Recreation Trail. Areas with the VQO of Modification (human activities can be dominant but borrow from naturally occurring line, form color and textures of the natural landscape) occur within 1B and 10 Management prescriptions, specifically in the SE corner of implementation area, near Foster Meadows, and east of Sjhoberg Creek. The remainder of the area is classified as Partial Retention (human activities are to remain subordinate to the surrounding natural landscape).

Table 3.18 VQO's (Total Cottonwood Analysis Area)

VQO Classes	Acres
Modification	9,446
Partial Retention	13,699
Retention	25,262

3.43: Heritage Resources

Introduction

Heritage Resources include prehistoric sites, historic sites, and traditional cultural properties. These site types are collectively known as historic properties. The Forest's Heritage Resource Project and Site Atlas was

reviewed for the Cottonwood watershed considered in this EA. This review provides an overview of the number of acres previously surveyed as well as the number and types of historic properties that have been recorded. Prior to the year 2001, a total of 982 acres had been survey in the analysis area. Most of these surveys were in advance of timber sale projects as well as oil and gas exploration and development. During the 2001 and 2002 field seasons, an additional 1262 acres were surveyed for specific projects identified in this analysis. As a result of these surveys, a total of 19 sites have been recorded. Eighteen are classified as historic sites and one is a prehistoric site. The following discussion provides a brief overview of the cultural history of the general study area.

Prehistoric Period:

Although there has been little evidence of prehistoric activity within the study area to date, investigations conducted in the foothills just east of the study area indicate a fair amount of prehistoric presence along the eastern front of the Wyoming Mountain Range. Prehistoric sites found in these areas are typically small lithic scatters consisting of stone tools, projectile points, and chipping debris resulting from the manufacturing of stone tools. These sites represent small, temporary campsites and hunting camps. Some of the prehistoric sites also have fire pits that can provide valuable data concerning the types of food items being cooked and processed. Fire pits can also provide radiocarbon dates that provide evidence for the longevity of human occupation in these mountainous environments. These data suggest that humans have inhabited these areas for much of the last 10,000 years. These human groups were hunters and gatherers who timed their seasonal movements to coincide with the movement of big game species, such as big horn sheep, mule deer, elk and bison. The diverse environmental zones and vegetation communities also allowed these human groups to take advantage of the abundant plant foods that were available across the landscape. Springtime usually found these groups at lower elevations, and as the snows began to melt from the mountain slopes and high alpine meadows, these groups would move to progressively higher elevations throughout the year. The location of these sites is determined by such environmental factors as slopes, distance to water, and proximity to diverse vegetation communities.

One interesting feature within the watershed is the Old Indian Trail that runs north/south along the eastern edge of the analysis area. This trail shows up on the earliest maps of the area and is a good indication that Native American tribes used it at the time this area was settled by Euro Americans. It is quite possible that this trail has been used for centuries. The current condition of the trail varies from a well-worn footpath, used by cattle and big game as well as the recreating public, to two track roads. Portions of the trail, especially south of South Cottonwood, have been obliterated by improved gravel roads.

Historic Period:

Most of the historic evidence uncovered in the Cottonwood watershed relates to tie hack activities. Starting in 1919, the Standard Timber Company moved into the North and South Cottonwood drainages to cut timber for railroad ties. These ties were usually cut during the winter months, and then floated down the creeks towards the Green River, then south to the railroad at Green River City. It is estimated that some 194 million board feet of timber was cut and removed during the 10 years of operation in the Cottonwood drainages. Many of the sites found that relate to this activity are the isolated cabins used by the tie hackers. When the Standard Timber Company first moved into this area, A.G. Haugue and Carl Johnson established a large camp on the banks of

North Horse Creek. This camp became known as Johnson City and included living quarters, a blacksmith shop, a commissary, and barns. After the Standard Timber Company moved its operation north to the Horse Creek drainages in 1930, Johnson City was dismantled and the buildings were burned.

Other historic related activities in the study area include coal-mining operations in the McDougal Gap area. In 1938 a lease was issued to Herbert (Shorty) Kleinstick who owned and operated the mine. The road over Mc Dougal Pass was constructed by Shorty so that people in Greys River and Alpine could get coal. The Kleinstick Mine was in operation as late as 1963.

The National Historic Preservation Act (NHPA), as amended, mandates the Forest Service to take into account the effect an undertaking will have on historic properties. The Forest Service must also afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the effect of the undertaking (NHPA, Section 106). The procedures for implementing this process are codified at 36 CFR 800. Other legislation to be considered includes the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) and the American Indian Religious Freedom Act of 1979 (AIRFA). These laws protect American Indian access to religious sites and address treatment of Native American remains.

Goals and objectives 2.8 and 4.9 were identified in the Forest Plan that relate to the protection of heritage resources. These goals and objectives ensure the availability and display of heritage information and preservation of heritage resources.

CHAPTER 4 – Environmental Consequences

Section 4.1 Introduction

This chapter discloses the effects on the environment that would occur following implementation of the alternatives presented in Chapter 2. The direct and indirect, short and long-term, and cumulative effects are discussed by resource area. Pursuant to direction found at 40 CFR 1500.1(b) and 1500.4, the discussions presented here are summaries of the completed analysis and form the scientific and analytical basis for the alternatives comparison at the end of Chapter 2. Unless specifically stated otherwise, additional supporting information, as well as analysis assumptions and methodologies, is contained in the project planning record.

This environmental assessment (EA) is tiered to the Bridger-Teton Forest Management Plan EIS that discusses environmental effects of a wide range of anticipated activities on the Forest. The activities and projects proposed in the Maki area and discussed in this document are fully within the range of projects anticipated in the Forest Plan. The CPIS took a closer look at current and desired environmental conditions and opportunities for projects that would help meet the intent of the Forest Plan and help achieve desired resource conditions. This EA studies implementation of some of the opportunities identified in the CPIS, similar alternative actions and site-specific environmental effects from the projects.

Section 4.2 Biological Consequences

4.21 Forested Vegetation

Extensive, site specific, stand exam data, aspen community plots and field visits as well as applicable research studies are the basis of the analysis of vegetation. Forest Vegetation Simulator (FVS) modeling was performed on representative stand data for every type of harvest proposed and in each of the sub-drainages in the Cottonwood Analysis Area. FVS summary tables 4.1 to 4.12 display effects on selected forest attributes with planned treatments for the different alternatives. Additional data was gathered and analyzed for the Maki Creek area. The site-specific analysis below focuses on the Maki Creek area. The Cottonwood Analysis Area and original proposal for vegetation management, is included in the cumulative effects discussions.

Alternative 1: No Action

No direct vegetation management treatments would occur; except for occasional removal of dead trees along roads for firewood under personal use firewood permits. However, fire disturbance would continue to not be allowed to play its historic role. Vegetation manipulation using timber harvest, which began with tie hacking in the 1920's, would discontinue. Stands already changed by harvest would receive no further management or maintenance. Vegetation conditions, however, would continue to change with consequences related to the significant issues of this analysis.

Vegetation condition would remain outside desired conditions[29] in relation to the Bridger-Teton properly

[29] "Vegetative Regeneration", p 29, Schier, Jones, Winokur, in Aspen Ecology and Management in the Western U.S. GTR-RW-119

functioning conditions and as described below. Tree growth rates would continue an overall decline. Lodgepole pine mortality in older trees in the overstory will continue and increase[30]. As an example, in stands 47-34 and 55-11, a majority of lodgepole pine has either died or has crown ratios of 20% or less. Subalpine fir will continue to increase in relative density. Almost all stands in the analysis area have dense subalpine fir understories. Increased stand density and age will result in: decreased growth, increased self-thinning with episodic waves of density related mortality, and individual tree stress. As an example, in stand 47-35, 80% of measured subalpine fir in the overstory had died out. Increased tree density resulting in increased mortality, and continued succession of subalpine fir will increase live and dead fuel loading and forest ladder fuels. Existing subalpine fir understory will continue to age and exhibit suppression damage from competition.. These trees growing into overstory trees will compound ladder fuel problems. Broom rusts on subalpine fir will intensify as relative densities increase.. Comandra rust will continue to top-kill lodgepole pine. Dwarf Mistletoe will locally increase and slowly spread in unraveling lodgepole pine canopies. In many stands mountain pine beetle hazard would increase as average age, basal area and tree diameters increase.

Aspen stands will continue to decline. In stands that are currently overtopped, aspen could eventually disappear from the site, with limited potential for regeneration (FVS model for stands 55-3 and 47-35 in the project file displays overtopped aspen conditions). In stand 47-35, the average height of overstory aspen is 60 feet; and the average height of overstory conifer is 83 feet. This has the potential to adversely affect recreational use patterns and experiences, fisheries from decreased water yield and important wildlife habitat components such as transitional season forage. There may be a decrease of up to 3–7 inches in water yield when conifers replace aspen. In stands with aspen dominance where conifers are less than ½ of the overstory, conifers (particularly subalpine fir) will continue to spread and regenerate under the aspen overstory utilizing an increasing portion of the available water from the site. Aspen health and vigor will decline. Limited aspen regeneration will occur in the absence of disturbance. Conditions have changed since the time of aspen establishment to not allow the natural disturbance of periodic fire to play the same role as historically. The Cottonwood drainage is consistent with the Bridger-Teton PFC (p.10) that found aspen at high risk to be replaced with subalpine fir and other conifers. Aspen age classes across the landscape will remain outside desired conditions, with little or no seedling/sapling stands.

The risk of stand replacing wildfire, in the absence of smaller scale disturbances, particularly in older conifer forests will continue and increase. Ultimately, forests in this area will burn and be returned to an early seral stage of grass/forbs and brush. Some aspen stands will eventually burn and establish new stands. However, as disturbance is delayed further, declining aspen in many areas will be inadequate to regenerate new aspen stands[31]. Fires will be more likely to result in running crown fires. Depending on fire intensity, serotinous cones in lodgepole pine may survive and release seed providing the pathway of establishment for seral lodgepole pine. Distribution of the new cohort of lodgepole pine will be clumpy owing its establishment to randomness of cone serotiny and fire intensities. Areas of lodgepole and other regenerating species in old harvest units may be consumed due to high stem densities and crown interlock. Water quality would not likely

[30]**The CPIS found vegetation to be outside desired conditions and identified 5,044 acres of potential treatment to reach desired condition. No treatment has been done since the study nor have any wildfires burned in the analysis area. The Bridger-Teton N.F. "Properly Functioning Condition" (PFC) assessment and checklist (September 1997) found both lodgepole and subalpine fir/spruce forest types to be out of balance with desired conditions forest-wide due to an over-representation of older age classes (>60%). This holds true for the Cottonwood analysis area and Maki Creek drainage.**

meet desired sediment levels for a period of time following the fire; adversely impacting fisheries. Habitat needs for Lynx denning and hunting and other biodiversity attributes would be reduced. Old growth and hiding cover would be lost over large areas when stand replacing fires occur. Recreational use patterns and experiences would be adversely affected for those seeking a "green" forest setting for camping, hunting, backcountry or other n

Alternative 2: Proposed Action

Manipulation of vegetation is proposed on 195 treatment acres, within 8 stands encompassing 681 acres, in the Maki Creek area to help achieve desired conditions. This will include 26[32] acres clearcut harvest, 129 acres partial cut harvest and 40 acres conifer removal in aspen. On 6,885 acres in the Maki Creek area and 48,305 acres in the Cottonwood analysis area, no action would occur. On this area, effects from changing vegetation, described in Alternative 1 (No Action) would be occurring. However, by providing a more diverse vegetation mosaic on the landscape and providing some age class diversity some of the effects described in Alternative 1, particularly in conifer stands, would be ameliorated. Implementation of Alternative 2 would require some timber harvest (in stands 47-10 and 21) in areas designated as roadless. This proposal was initiated and scoped prior to implementation of the Roadless Policy. Alternatives 3 and 4 address this by not including any timber harvest in roadless.

The 195[33] acres of timber harvest would utilize timber resource values providing forest products for local and regional economies for 2 to 3 years. Potential harvest levels of .5 to 1.0 MMBF per year on the 195 acres would be consistent with objective 1.1 of the LRMP and consistent with harvest levels from the Big Piney Community Interest Area 7 (Bridger-Teton Forest Plan EIS, P. 524). Silvicultural systems are consistent with DFC's 1B and 10. Harvest would occur only in areas appropriate and suitable as determined in the Forest Plan EIS and further recognized as opportunity areas identified in the CPIS. This study identified 1,205 acres within DFC 10 in Maki Creek area as opportunity areas to achieve desired conditions.

Within the immediate vicinity of the vegetative treatment area, 486 acres will remain untreated and contain a full mixture of snag species and diameters. The treatment area of approximately 681 acres is equivalent to 1.06 sections. The LRMP snag habitat guideline recommends that 60 acres per section (640 acres) be retained for snags. Within the treatment area proposed for Alternative 2, approximately 458 acres will be retained untreated per section, almost 8 times the recommended guideline. In addition, there will be groups of snags and large trees for snag recruitment left within the harvest units. Within the whole Maki Creek area there will be 620 acres retained per section.

Vegetation condition would still remain outside desired conditions, but moving toward desired conditions.. (See footnote for Alternative 1). The FVS summary tables 4.1, based on site specific stand data, illustrate Alternative 2 vegetation effects for representative stands and harvest methods. Further examples are found in the project file.

[32] Based on GIS and field exams – aspen and conifer.
[33] Based on GIS and field exams

The 26 acres of clearcut harvest would provide age class diversity and areas of low fuel loads in stand 47-34. Due to the nature of lodgepole pine regeneration, the harvest will produce short-term homogeneity for species composition and stand structural characteristics on a small scale while contributing to age class diversity patterns on the landscape. This is not unlike fires across the landscape. To reduce the risks associated with large scale homogeneity of species, harvest units will be no larger than 20 acres. Regeneration will come from artificial planting, as well as natural regeneration from stored seed, cone serotiny, and adjacent seed walls. Initial species composition will consist primarily of lodgepole pine.

Stand Initiation Structural Stage, Grass and forbs, will dominate these sites for approximately 10-15 years. This will be characterized by conifer seedlings (approximately 200 to 1000 per acre) mixed with grasses and forbs with scattered large snags (approximately 5 to 10 per acre). Stand initiation will continue replacing grass/forbs with lodgepole pine seedling and sapling for approximately 15 to 40 years out. Young and mid-aged forests will then persist for approximately 41-120 years out, followed by mature and old forests until disturbance. Shade tolerant subalpine fir and Engelmann spruce will establish during stand initiation and under the establishing lodgepole canopy. Dwarf Mistletoe infection pockets would be reduced.

The risk of stand replacing wildfire would be reduced, but on a small scale. Initially mountain pine beetle risk will be eliminated in the treatment area, with increased risks in 80 years[34]. Maintaining tree lower live limbs on saplings for approximately 40-60 years and controlling stand densities to reduce loss could enhance snowshoe hare habitat. However, large tree habitat attributes would be lost from harvested stands until mature growth characteristics are achieved in approximately 90 years.

Table 4.1 Stand 47-34 FVS Summary Table Clearcut with retention

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	104	5 (5%)	99 (95%)
Basal Area/ Acre (sq ft)	131	10 (8%)	121 (92%)
Merch Vol./ Acre (MBF)	11.6	.5 (4%)	11.0 (96%)

Information from Forest Vegetation Simulator output. See appendix C for more details.

The 129 acres of partial cut harvest would provide:

[34] 1987 study by Anhold and Jenkins

- Some utilization of the suitable timber resource to help meet objective 1.1 of the Forest Plan.
- Reducing stocking on 129 acres of existing stands to reduce fuel loadings and reduce insect and disease hazards.
- Leave a forested appearance in vicinity of all harvest units and forested wildlife habitat attributes. See below descriptions of harvest types for discussion of forest conditions that would be left following harvest.
- Shelterwood and group selection on 109 acres would provide favorable conditions for diverse natural regeneration.

Shelterwood harvest would provide conditions for natural regeneration favoring Engelmann spruce and Douglas fir, on 55 acres in 3 different stands while maintaining healthy trees on the site. The sites proposed are mostly diverse, mature 3-storied or multi-story conifer stands. Following harvest, 35 to 60 % of the basal area, or 35 to 90 overstory trees per acre, representing the healthiest trees, would be left. These open stand conditions would be similar to conditions historically created when lower intensity wild fires burned at more frequent intervals. Many of the smaller understory trees would be cut or knocked over during operations to provide seed establishment sites, but some individual trees and clumps would be retained to provide structural and visual diversity. Harvest unit size would be less than 20 acres and located to avoid blow-down damage. Healthy Engelmann spruce and Douglas-fir would be the majority of trees left with lodgepole pine retained where needed to maintain adequate residual stocking. Lodgepole to be left would have no or very low levels of dwarf mistletoe. Most subalpine fir would be cut. Following harvest, the growth and vigor of the residual trees would increase and mortality would tend to decrease. Conditions would be created to provide for natural regeneration from residual trees and for potential subsequent harvest of residual trees. The shelterwood treatment, along with concurrent slash treatment would reduce tree density, ladder fuels growing into the crowns of overstory trees, and tree crown continuity. This would reduce the threat of catastrophic fire in these areas and provide for easier fire control. Removal of approximately 6 to 12 MBF per acre would provide sawtimber and some other products to help meet Forest Plan objectives.

Table 4.2 Stand 47-5 FVS Summary Table Shelterwood

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	112	44 (40%)	68 (60%)
Basal Area/ Acre (sq ft)	117	61 (52%)	56 (48%)
Merch Vol./ Acre (MBF)	18.7	10.3 (55%)	8.4 (45%)

Sanitation Salvage harvest would occur on 20 acres of over mature mixed conifer stands. Under this alternative, this occurs in stand 47-3 (Table 4.3). Following harvest there would be approximately 112 overstory trees (67% of existing trees) of diverse diameters remaining, with a higher proportion of healthier trees and fewer dead and severely damaged trees. Along with reduced stocking levels, limbs and tops would be

removed during harvest and slash piled, reducing hazard from stand replacing fires. Removal of approximately 5 to 10 MBF per acre would provide sawtimber and fuel wood products. Stand structure would be retained with overstory and understory trees remaining after harvest, as well as some snags. The trees that are retained would provide a recruitment source of future snags and down woody material. However, fuel ladders would be reduced with removal of more sub-dominant and understory trees that are growing into crowns of overstory trees.

Table 4.3 Stand 47-3 FVS Summary Table Salvage

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	167	112 (67%)	55 (33%)
Basal Area/ Acre (sq ft)	120	70 (58%)	50 (42%)
Merch Vol./ Acre (MBF)	14.7	8.2 (56%)	6.5 (44%)

Group Selection harvest would occur on 54 acres of mature or over mature mixed conifer stands in stands 47-3, 47-21, 47-30 and 47-43. The harvests would result in openings of 2 acres or less, with a few older healthy trees as well as some snags retained in the units. All trees, including all snags, structure and vegetative diversity, outside of cutting units would be retained.

Table 4.4 Stand 47-30 FVS Summary Table Group Selection Harvest
Note: 69% of the total stand would be retained outside of group harvest units.

Attribute	Prior to Harvest	Retained within group units	Removed in group units
Overstory Trees/acre	133	5 (4%)	128(96%)
Basal Area/ Acre (sq ft)	120	6 (5%)	114 (95%)
Merch Vol./ Acre (MBF)	14.8	1.0 (7%)	13.8 (93%)

Trees cut would be mostly older lodgepole pine and subalpine fir, while trees left would favor healthy Engelmann spruce and Douglas fir. Limbs and tops would be removed during harvest in the openings and slash concentrations piled. Breaks in forest fuel continuity would be provided by having openings with little slash scattered in forest areas with heavier slash, reducing hazard from stand replacing fires. Naturally regenerating seedlings along with grasses and forbs would persist in the openings for 10 to 15 years. Seedling establishment would be facilitated with scarification during harvesting and slash piling and close proximity to seed wall throughout the openings. Removal of approximately 10 to 15 MBF per acre would provide sawtimber and fuel wood products.

Conifer removal in aspen stands would occur on 40 acres in stand 47-10. This treatment would leave most aspen standing. Slash would be treated by removing tops with merchantable logs and piling concentrations only. Aspen in this stand is just beginning to be overtopped by subalpine fir and is still relatively healthy with good crown ratios. Conifer densities are low in this stand and as a result slash created in logging operations would not pose a significant fuel loading if treated as specified. Following logging small clumps of sub-merchantable subalpine fir would be left also.

Table 4.5 Stand 47-10 FVS Summary Table Conifer removal in aspen

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	84	57 (68%) (mostly aspen)	27(32%)
Basal Area/ Acre (sq ft)	25	10 (40%) (mostly aspen)	15 (60%)
Merch Vol./ Acre (MBF)	2.0	0	2.0 (100%)

Alternative 3: Issue Driven Action

Manipulation of vegetation is proposed on 2,450 acres to help achieve desired conditions and respond to project issues. Use of timber harvest on 273 acres within 11 stands encompassing an area of 600 acres will include 150 acres of partial cut harvest and 123 acres of conifer removal in aspen. There will also be 2,177 acres of treatment in sagebrush and aspen areas, primarily with prescribed burning. On 4,630 acres in the Maki Creek area and 46,050 acres in the Cottonwood analysis area, no action would occur and the effects described in Alternative 1 (No Action) related to changing vegetation, would apply on that area. Alternative 3 would provide more of a mosaic of vegetation on the landscape and provide increased age class diversity. Treated stands would serve as fuel breaks where fire behavior would be moderated. In aspen stands, at highest risk for deterioration and loss (BTNF PFC), a higher proportion are treated in this alternative. This significantly reduces the effects associated with aspen decline under the no action alternative. In Alternative 3, no timber harvest or road work would occur in areas designated as roadless.

On the 2,177 acres of sagebrush and aspen treatments, a vegetative mosaic would remain following treatment. In the 1,169 acres of sagebrush type, the mosaic would be comprised of 40 to 60% of the area burned to quickly regenerate grasses and forbs and the remainder of the area either unburned or partially burned with sagebrush overstory remaining. In the 1,008 acres of aspen 80 to 100% of the area would be burned or mechanically treated (without timber removal) with aspen root suckering initiating within the first year after treatment. Snags would remain following treatment, as well as some islands of untreated vegetation.

The 273 acres of timber harvest would utilize timber resource values providing forest products for local and regional economies for 2 to 3 years. Harvest would occur only in areas appropriate and suitable as determined in the Forest Plan EIS. Potential harvest levels of .5 to 1.0 MMBF per year on the 273 acres would be consistent with objective 1.1 of the LRMP and consistent with harvest levels from the Big Piney Community Interest Area 7 (Bridger-Teton Forest Plan EIS, P. 524). Harvest acres would be significantly less than the

1,205 acres of opportunity areas identified in the CPIS due to other constraints. Silvicultural systems are consistent with Forest Plan DFC's 1B and 10. Opportunity areas identified in the CPIS, as well as nearby suitable stands were closely evaluated to determine the best treatment areas to meet project objectives and issues.

Within the immediate vicinity of the vegetative treatment area, 327 acres will remain untreated and contain a full mixture of snag species and diameters. The Forest Plan snag habitat guideline recommends that 60 acres per section (640 acres) be retained for snags. Within the treatment area proposed for Alternative 3, approximately 307 acres will be retained untreated per section, almost 5 times the recommended guideline. In addition, there will be groups of snags and large trees for snag recruitment retained within the harvest and burn units as discussed below. Within the whole Maki Creek area over 400 acres will be retained per section.

Vegetation condition in conifer stands would still remain outside desired conditions, but moving towards a desired condition (See Footnote for Alternative. 1). The FVS summary tables 4.6 -11 below illustrate effects on vegetation for Alternative 3, using representative stands and harvest methods. Further examples are found in the project file. No clearcuts are planned with this alternative. This is 26 acres less than Alternative 2 and the same as Alternatives 1 and 4.

There are 150 acres of partial cuts planned in Alternative 3. This is 21 acres more than Alternative 2 and 75 acres more than Alternative 4. This harvest would provide:

Some utilization of the suitable timber resource to help meet objective 1.1 of the Forest Plan.

Reducing overstocked conditions on 150 acres of existing stands to reduce fuel loadings and reduce insect and disease hazards.

Leave a forested appearance in the area of all harvest units and forested wildlife habitat attributes. See below descriptions of harvest types for discussion of forest conditions that would be left following harvest.

Shelterwood and group selection on 80 acres would provide favorable conditions for diverse natural regeneration.

Commercial Thinning on 25 suitable acres is 25 more acres than Alternative 2 and the same area as Alternative 4. Commercial Thinning would reduce the basal area of the proposed stand to 40 to 50% of existing stocking, depending on the site. There would be from 250 to 300 pole to sawtimber size trees, representing the healthiest trees, remaining on the site. This is relatively high residual tree stocking, due to high number of existing trees on the site. The residual trees would provide a forested appearance, cover, habitat, sustained growth, and a seed source for regeneration and a recruitment source for snags and down woody material. The residual trees would provide: cover and tree structure habitat; a forested appearance; and healthy trees to sustain forest growth on the site and provide seed source for regeneration as well as future recruitment of snags and down woody material. The thinning operation along with slash treatment would reduce forest fuels, ladder fuels and crown continuity, thereby reducing the threat of catastrophic fire and providing for easier fire control. The thinning would also reduce bark beetle risk by reducing stand basal area below 120 (to 79) and reducing average diameter below 8.0 inches DBH (to 7.2)[1]. Trees left would be mostly lodgepole pine, with some Douglas fir and Engelmann

spruce also left. These trees would be generally of the same age class, reflecting the stand that was present before harvest. Most subalpine fir would be removed. A few would be retained to maintain a forested appearance and for wildlife value. Growth and vigor of existing trees would be enhanced and mortality would be reduced. Removal of 743 trees and approximately 2 to 3 MBF per acre would provide post and pole and small sawtimber products. Some natural regeneration would begin to occur following harvest and eventually lead to establishment of a 2- storied stand in the absence of further disturbance[35].

Table 4.6 - Stand 55-10, FVS Summary Table Thinning

Note: The residual DBH of overstory trees is 7.2 inches DBH, to reduce bark beetle risk.

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	1021	278 (27%)	743 (73%)
Basal Area/ Acre (sq ft)	202	79 (40%)	123 (60%)
Merch Vol./ Acre (MBF)	6.8	4.2 (62%)	2.6 (38%)

Shelterwood harvest would provide for conditions favoring natural regeneration of Engelmann spruce and Douglas fir on 20 acres in stand 47-5 while maintaining healthy trees on the site. There are 35 less acres proposed for shelterwood than Alternative 2 and 20 more acres than Alternative 4. The descriptions of effects are similar. Trees retained would be a range of diameters, mostly larger size classes, and would be a recruitment source for snags and down woody material.

Table 4.7 Stand 47-5 FVS Summary Table Shelterwood

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	112	44 (40%)	68 (60%
Basal Area/ Acre (sq ft)	117	61 (52%)	56 (48%
Merch Vol./ Acre (MBF)	18.7	10.3 (55%)	8.4 (45%)

Sanitation Salvage harvest would occur on 45 acres of mature or over mature mixed conifer stands. In this alternative this occurs in stands 47-34, 55-11, and 55-12. Following harvest there would be 80 to 140 overstory trees of diverse size and species remaining, with a higher proportion of healthier trees and fewer dead and

[35]See Samman and Logan, "Assessment and response to bark beetle outbreaks in the Rocky Mountain Area", in RMRS-GTR-62, p.9, September 2000

severely damaged trees. Within harvest units some snags would be retained as well as all snags adjacent to harvest units. Use of the contract designation, "leave dead standing" would be used adjacent to harvest units. Reduced stocking levels, limb and top removal during harvest, and slash concentrations piled, would reduce hazard from stand replacing fires. Removal of approximately 5 to 10 MBF per acre would provide sawtimber and fuel wood products. In units 55-11 and 55-12 greater number of trees would be retained adjacent to existing clearcuts.

Table 4.8 Stand 55-11 FVS Summary Table Salvage

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	257	132 (51%)	125 (49%)
Basal Area/ Acre (sq ft)	180	112 (62%)	68 (38%)
Merch Vol./ Acre (MBF)	19.3	13.6 (70%)	5.7 (30%)

Group Selection harvest of 60 acres proposed for Alternative 3 is 6 acres more than Alternative 2 and 60 acres more than Alternative 4. The area proposed is similar to Alternative 2 except no treatment in stand 47-21. Effects are similar to Alternative 2.

Table 4.9 Stand 47-30, FVS Summary Table Group Selection Harvest
Note: 69% of the total stand would be retained outside of group harvests.

Attribute	Prior to Harvest	Retained in groups	Removed in groups
Overstory Trees/acre	133	5 (4%)	128(96%)
Basal Area/ Acre (sq ft)	120	6 (5%)	114 (95%)
Merch Vol./ Acre (MBF)	14.8	1.0 (7%)	13.8 (93%)

Removal of commercial conifer from aspen stands would occur on 123 acres in 5 different stands. This is 83 more acres than Alternative 2 and 20 acres more than Alternative 4.

In stand 47-4 commercial conifer would be removed, except for a few larger Douglas-fir and Engelmann spruce in clumps. (Up to 20 trees per acre would be retained). All aspen would be felled to encourage suckering. Aspen regeneration from root suckering will occur post harvest. It may be patchy, reflecting pre-harvest patchy condition of aspen but should meet objectives of 1,000 stems per acre at 10 years following burning.

In stand 55-3, all commercial conifer would be removed in harvest operations. Following harvest, most aspen would be left standing, as well as clumps of sub-merchantable subalpine fir. Broadcast burning of slash would kill most aspen and also burn through most clumps of fir. These would provide snags for forest structure. Dense aspen regeneration can be expected throughout the unit to meet objectives, reflecting existing widespread aspen occurrence in the stand. Some natural conifer regeneration will also be occurring to add diversity, but will take longer to establish than aspen, giving early competitive advantage to re-establishing aspen.

In stands 47-34, 47-35 and 46-17, large diameter Douglas-fir would remain following harvest, as well as most aspen. Broadcast burning of slash following harvest would kill most aspen while most Douglas-fir should survive. Aspen regeneration may be in dense patches, reflecting pre-harvest patchy occurrence of aspen. Natural regeneration of conifer will also be occurring. The residual Douglas-fir trees will provide a seed source as well as shade for eventual Douglas-fir re-establishment. They would also provide stand structure and diversity that mimic historical conditions that likely included more frequent under-burns through these stands.

Table 4.10 Stand 55-3 FVS Summary Table Conifer Removal in Aspen
Note: Most aspen would also be retained after harvest, and exist as snags following burning.

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre (conifer)	170 (90% subalpine fir)	12 (7%)	158 (93%)
Basal Area/ Acre (sq ft) (conifer)	104 (169 including aspen)	9 (9%)	95 (91%)
Merch Vol./ Acre (MBF) (conifer)	7.4 MBF (9.6 including aspen)	.6 MBF (8%)	6.8 MBF (92%)

Table 4.11 Stand 47-35 FVS Summary Table Conifer Removal in Aspen
Note: Most aspen would also be retained after harvest, and exist as snags following burning. Most DF >18 inches DBH would be retained after harvest, and survive burning.

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre (conifer)	84 (58% DF, 42%AF)	20 (DF) (24%)	64 (76%)
Basal Area/Acre (sq ft) (conifer)	112 (166 including aspen)	50 (45%)	62 (55%)
Merch Vol./ Acre (MBF) (conifer)	14.5 (17.8 including aspen)	7.6 (52%)	6.9 (48%)

Alternative 4: Additional Snag and Lynx Habitat Action

Manipulation of vegetation is proposed on 2,340 acres to help achieve desired conditions and respond to project issues. This will include use of timber harvest on 163 acres within 5 stands encompassing an area of 247 acres. Timber harvest will include 60 acres of partial cut harvest and 103 acres of conifer removal in aspen. There will also be 2,177 acres of prescribed burning of sagebrush and aspen areas. On 4,740 acres within the Maki Creek area as well as the remainder of the Cottonwood analysis area, no action would occur. Thus, some of the effects described in Alternative 1 (No Action) would be occurring with implementation of this alternative as well. However, by providing a better vegetation mosaic on the landscape and providing better age class diversity some of the effects described above, especially in aspen stands, would be ameliorated. Treated stands would serve as fuel breaks or areas where fire behavior would be moderated.

The 163 acres of timber harvest would utilize timber resource values providing forest products for local and regional economies for 2 to 3 years. Harvest volumes would be 40–50% of Alternative 3 and 60% of Alternative 2. Harvest would occur only in areas appropriate and suitable as determined in the Forest Plan EIS. Potential harvest levels of .3 to .5 MMBF per year on the 163 acres would be consistent with objective 1.1 of the LRMP and within harvest levels from the Big Piney Community Interest Area 7 (Bridger-Teton Forest Plan EIS, P. 524). Harvest would occur in up to 2 separate sales to allow some opportunities for small business purchasers. Silvicultural systems are consistent with Forest Plan DFC's 1B and 10.

Vegetation condition in conifer stands would still remain outside desired conditions, but moving towards desired conditions. Refer to footnote for Alternative 1. The FVS summary table 4.21.12 below illustrates Alternative 4 vegetation effects for representative stands and harvest methods. See the Alternative 3 section, tables 4.6, 4.10, for examples of thinning and conifer removal in aspen.

No clearcuts are planned with this alternative. This is 26 acres less than Alternative 2 and the same as Alternatives 1 and 3.

There are 60 acres of partial cuts planned in Alternative 4. This is 69 acres less than Alternative 2 and 90 acres less than Alternative 3. This harvest would provide:

- Some utilization of the suitable timber resource to help meet objective 1.1 of the Forest Plan.
- Reducing overstocked conditions on 60 acres of existing stands to reduce fuel loadings and reduce insect and disease hazards.
- Leave a forested appearance in the area of all harvest units and forested wildlife habitat attributes. See below descriptions of harvest types for discussion of forest conditions that would be left following harvest.

Commercial Thinning on 25 suitable acres is 25 more acres than Alternative 2 and the same area and similar treatment as Alternative 3. Refer to Alternative 3 description and table 4.6 for information and attributes for this treatment. The only difference in this treatment for Alternative 4 is that many subalpine fir would be retained to maintain a forested appearance and for wildlife values.

Individual Tree Marking would occur on 35 acres in stand 47-34. This combines the 35 acres of sanitation salvage and group selection treatment proposed in Alternative 3 for the same stand. By leaving all Douglas-fir >8 inches DBH as well as many understory trees, the resulting stand would retain this structure and diversity. There would be fewer small openings than the group selection harvests of Alternative 3. However, Douglas-fir is not evenly distributed through the stand and some small openings would occur where Douglas-fir is absent from the stand. Approximately 60 to 70% less timber volume would be removed in this stand compared to Alternative 3 treatments. If broadcast burning occurs following harvest, a majority of smaller diameter trees (<16 inches) left would not survive.

Table 4.12 Stand 47-34 FVS Summary Table Individual tree marking

Note: Most understory trees would also be retained, unless damaged in operations.

Attribute	Prior to Harvest	Retained	Removed
Overstory Trees/acre	114 (conifer)	70(conifer) (61%)	44 (39%)
Basal Area/ Acre (sq ft)	95 (conifer)	67 (71%)	28 (29%)
Merch Vol./ Acre (MBF)	11.6	8.5 (73%)	3.1 (27%)

Removal of commercial conifer from aspen stands would occur on 103 acres in 4 different stands (55-3, 47-34, 47-35 and 46-17). This is 20 acres less than Alternative 3 and 63 more acres than Alternative 2. In stands 47-34, 47-35 and 46-17, large diameter Douglas-fir would also be left. Consequences are similar to Alternative 3 for these stands. (EA, p 12)

Cumulative Effects: Vegetation

Past: Vegetation in the Maki and Cottonwood watersheds, as well as adjacent Forest areas, has been affected by past timber harvest and fires. In the Maki Creek area, there have been 163 acres of past clearcut harvest that has re-vegetated: all occurred from 1979 to 1981, except 18 acres in 1989. In the rest of the Cottonwood Creek drainage, there has been 2064 acres of clearcuts, most in the 1960's and 1970's and most of which have regenerated sufficiently to provide cover. Past harvests also included partial cutting for railroad ties in the 1920's and 30's. This area is considered excellent lynx habitat. More recently in the 1990's harvest on the Big Piney district focused in the Beaver Creek drainage, 10 miles north of the analysis area and was approximately 50% of Forest Plan allowed levels.

Present: There are no active timber sales in the Maki or Cottonwood Creek drainages. There are 5 active timber sales in the Beaver Creek watershed, 9 to 13 miles north of the Maki Creek area, with approximately 130 acres remaining to harvest. These sales include 114 acres of partial cuts and 16 acres of clearcuts. Personal use and small firewood and post and pole sales also occur but are rare in the Maki Creek area due to gated access.

Reasonably Foreseeable: Cumulative effects may be associated with the planned harvest of timber in the North and South Cottonwood Creeks that was scoped as an initial part of this analysis but will be analyzed separately. This planned harvest was within opportunity areas identified as part of the interdisciplinary CPIS and within areas identified in the Forest Plan as suitable. No planned harvests would exceed created opening standards and would comply with silvicultural and reforestation standards.

Forest Plan Discussion: Timber volumes and treated acres for all past, present and reasonably foreseeable harvests are well below levels allowed in the Forest Plan. The Bridger-Teton Forest Plan was approved in 1990 and analyzed cumulative effects for a planned forest program of activities. This analysis considered all past timber harvest and other disturbances to vegetation that had occurred up to that point. One of these activities analyzed was allowable timber sale quantity (ASQ), a level that could be achieved (after site specific analysis) and still meet standards and guidelines, as well as public expectations. The Forest Plan also took into consideration that, outside of Greys River, timber harvest would primarily occur in DFC 10 areas (P317, FEIS for Bridger-Teton Forest Plan). Maki Creek area planned harvest is primarily in DFC 10. ASQ for the first decade (1990 to 2000) under the forest plan for the Big Piney Community Interest Area (CIA 7) was 23 MMBF over an estimated 3,300 acres (P 524, FEIS for Bridger-Teton Forest Plan). In the 1990's, actual harvest in CIA 7 was approximately 50% of allowed levels. For the second decade (2000 to 2010) under the Forest Plan, allowable sale quantity for CIA 7 jumps to 68 MMBF on an estimated 8,050 acres. One of the reasons for this jump is that past harvest areas of the 1960's and 70's will no longer be in created opening status. Looking at all sales that have occurred thus far in the second decade, planned harvest with this analysis, as well as all reasonably foreseeable sales, timber harvest will be 14 to 15.5 MMBF on 1325 to 1445 acres. This is 23% of the allowable sale volume on 17 % of the acres estimated to achieve that volume. Even if you extend the lower first decade quantity into the second decade, the reasonably foreseeable volume is 66% of allowed on 42% of allowed acres.

4.22: Rangeland Vegetation

The improvements to the understory vegetation from aspen and sagebrush treatments, long-term (5-30 years), could greatly improve both the quantity and quality of forage for both domestic livestock and wildlife. This is a total of 40 acres for Alternative 2, 1715 acres in Alternative 3 and 1695 acres in alternative 4.

The potential to spread and establish new populations of noxious weeds exists for any projects that involve ground disturbing activities. All projects that result in ground disturbance will include preventative and control actions for noxious weeds. Timber sale activities will include standard contract clauses to prevent and control noxious weeds. Knutson-Vandeberg (KV) funds will be collected to control any noxious weed infestations within the sale area boundaries. The existing cooperative action plan with Sublette County Weed and Pest has been and will continue to be used as the tool to control any new noxious weed infestations.

4 Environmental Consequences

4.23: Wildlife Habitat

Terrestrial Wildlife Species and Habitats

This section assesses the direct, indirect, and cumulative impacts to wildlife species. Direct effects are those effects to wildlife or their habitats that occur within the project area and at the same time as the proposed action. Direct effects are usually short in duration, and often include changes in behavior, physiological stress, or mortality (Youmans, 1999). Indirect effects are those that are removed in space or time from the action. These effects may be long-term in nature. Cumulative effects are the incremental impacts of the proposed action in the context of past, present, and reasonably foreseeable future actions. For the purposes of this analysis, site-specific effects on key habitat components (described in existing condition) were considered in evaluating impacts to wildlife species.

Wildlife use, primarily big game of this area is significant. Removal of live, dead and dying trees will affect the structural complexity of the existing habitats and the future stands that will develop. There will be less security cover, but more forage enhancement. Subsequent wildlife responses to conditions and characteristics will be affected if it occurs on a large scale (>30%) within the watershed.

Alternative 1: No Action

This alternative is required under NEPA regulations and also serves as a baseline of information for comparison of other alternatives. Though this alternative does not respond to the entire purpose and need for action, it does address some issues.

In general, periodic disturbances, such as fire, insects, disease, and weather related disturbances (wind, flooding, drought, etc) naturally maintain a mosaic of structural conditions for a variety of wildlife. Periodic disturbances often result in early seral communities. Because post disturbance landscape is typically patchy rather than homogenous, it still provides suitable habitat for species dependent on late seral and climax communities. Native wildlife species have evolved with these disturbances.

In addition, there have been 2,413 acres of past vegetative treatment within the Cottonwood watershed that have not reforested sufficiently (225 stems per/acre and >12 feet high) to be suitable Canada lynx habitat. The lynx will be used as a generalist and as a species that is sensitive to vegetative treatment and disturbance. The combination of past fires (69 ac.) and previous timber harvest (2,413 ac.) have disturbed the timber component (31,616 ac.) within the watershed by 7.8 %.

Wildfire constitutes the single most prevalent landscape disturbance type in the Rocky Mountains (Gruell 1983). Having evolved over time to incorporate such disturbances as wildfires into their life-history strategies (Hansen et al. 1991), species' traits and behavior allow wildlife populations to persist in the face of large-scale; stand replacement fires (Freeman and Karr 1985, Weaver et al. 1996). Resilience of wildlife species at the metapopulation (Hanski et al. 1991, Harrison 1994, Wiens et al. 1996), population, or individual level vary according to the scale, intensity, and duration of a fire, and the extent and frequency of similar fire events within

an animals home range or habitat over time. However, fire suppression activities would still occur under no action. Suppression and appropriate management response will occur under each alternative.

There would be no habitat improvement of big game range. There would be no change in the seral stages of shrubs (sagebrush, willows) because there would not be any prescribed burning. Aspen would not be treated but would continue to become more decadent and be replaced by encroaching conifers. Conifers would continue to close canopy, reducing ground understory that is valuable for foraging and birthing for big game.

There would be no increased disturbance which could cause wildlife displacement during the life of the project. The closed roads and trails would continue to erode and cause sediment into the watershed.

Therefore, the no action alternative could have a neutral, adverse or beneficial effect to wildlife, Management Indicator Species (MIS) and Threatened, Endangered and Proposed (TEP) species.

Alternative 2: Proposed Action

Direct and indirect effects

Alternative 2 would harvest approximately 195 acres of timber. Even though the harvest proposal would affect a very small percentage (0.6%) of the total acreage, existing past management activities (2,413 ac.) and wildland fires (post 1977-69 ac.) have previously "disturbed" (7.8%) of the suitable lynx habitat (timber type) within the Cottonwood watershed and Lynx Analysis Unit (LAU-1404010120) not including any of the proposed vegetation treatments. An additional 195 acres of timber harvest, as proposed would result in an additional 0.6% of the suitable lynx habitat within the Maki Creek area (a portion of the Cottonwood watershed) being in a short term unsuitable condition for snowshoe hare and subsequently lynx. Overall disturbance in the LAU would increase slightly, and would be 8.4% (Table 3). Forest Plan standards for "created openings" would be within guidelines for the Maki Creek area.

The primary habitat elements that will be affected and their relationship to wildlife species are as follows:

1. Compliance with the Canada Lynx Conservation Assessment Strategy, (CLCAS). Alternative 2 as proposed would be in compliance with standards and guidelines in the CLCAS. Specifically, existing lynx habitat would not be moved significantly into a unsuitable condition. Block size of unsuitable habitat would not be significantly increased. See Comparison of Alternatives below for further discussion.

2. Cover and habitat security. A small portion <1%) of the analysis area is crucial wildlife range and DFC 10. Groups of species are emphasized, such as early or late successional dependent species, in order to increase species richness or diversity. Habitat is managed to achieve game and fish populations, harvest levels, success, and recreation objectives identified by the Wyoming Game and Fish Department and agreed to by the Forest Service (p.235-LRMP). In general, management direction in these areas should have beneficial or neutral impacts to wildlife. Cover and security habitat would be reduced minimally for short-term with Alternative 2.

3. Forest Plan direction for snag retention will be met with implementation of Alternative 2. Moose habitat will not be treated and there is not any habitat within the project area for antelope and bighorn sheep. Mule deer and elk will lose minimal security and parturition cover, and additional forage will be created or enhanced. There will be some displacement of big game animals during the life of the project.

4. Dead and dying trees. Snags provide important habitat components for a wide range of wildlife species including: nesting, denning and roosting sites in cavities (woodpeckers, forest owls, pine marten, squirrels), on branches or broken tops (owls, goshawks), under bark and in crevices (bats, brown creeper), and foraging substrate (woodpeckers and nuthatches) and hunting perches (hawks, eagles, and owls).

5. Removal of some snags would result in reduced availability of perch and roost trees, potential nest sites (for both primary and secondary cavity nesters), and insect foraging opportunities as compared to the no action alternative. Snag removal has a long-term effect on wildlife habitat by reducing the availability of important habitat components, not only in the current forest stand, but also in the future stand. Removal of snags would also result in reduced availability of coarse woody debris in the future stand. The forest plan snag guideline recommends reserving from timber harvesting (and firewood cutting) an area of 60 acres per section (640 acres), that contains dead, or down and green trees. This guideline will be far exceeded as explained here. In Alternative 2, the total area to be harvested is 195 acres with only 26 acres clearcut. No area will be subject to firewood cutting, due to restricted access on the gated road. This will leave at least 4,882 acres in the Maki Creek area (considering sagebrush areas, previous harvest and planned harvest) that contains dead, and down and green trees. This can be compared to the snag guideline which would only require 660 acres of snags in the Maki Creek area.

6. Downed logs. Coarse woody debris provides cover and sites for feeding, resting, and denning for a wide range of species including many small mammals and birds that are prey for lynx, goshawks, and forest owls. Downed logs also provide cover for traveling animals. Timber harvest has the potential to decrease prey populations and create a barrier to movement if created openings are greater than 300 feet in width. Alternative 2 proposes to leave an average of 10–12 tons of down woody material per acre. This is within the range recommended for maintenance of prey populations for goshawks (Reynolds et al. 1992) and by Evans and Martens (1995) in unburned or low intensity burned areas.

Brewer's sparrow will not be affected by this alternative.

Direct and indirect effects due to road use and management as well as motorized trails

Alternative 2 includes re-opening and reconstructing existing roads as well as creation of 3.5 miles of temporary roads, all of which would be closed to public traffic during and after harvest. No new permanent roads would be constructed so direct habitat loss is not expected, but there is still some potential for direct mortality during reconstruction and hauling. All roads would be closed to the public, therefore the potential for increased mortality or disturbance due to traffic is limited to the period of harvest. Highly mobile organisms such as wide-ranging carnivores, ungulates, and birds are unlikely to be directly impacted by road reconstruction and hauling. However, smaller, slow-moving species like amphibians could be affected.

Disturbance impacts to some wildlife, in particular deer and elk, would be limited to the immediate project area. Harvest activities will temporarily displace animals away from the project area during implementation, but they should return once the disturbance ends. Nesting songbirds would also be affected, with higher nest failure rates as a likely consequence of adult birds repeatedly flushing off the nest and leaving eggs or chicks exposed (Baicich and Harrison 1997). These effects would be short-term and limited to the project area.

Disturbance to other wildlife species such as lynx and other old growth dependent species will most likely be longer term. Lynx, if they currently exist in the Big Piney Front are in exceedingly low numbers. There will not be sufficient activities to remove them from the area, but post treatment vegetative composition will make the area (though small) unsuitable for foraging and most likely denning. Travel corridors north and south through the Wyoming Range will not be significantly affected.

Weber's Saw-wort, Wyoming Tansymustard and Shultz's milkvetch will not be affected by any alternative. They all are found in alpine talus, gravel fields, steep rocky limestone and sandstone slopes. There is not any proposed treatment (prescribed burning) or management activities (road building, skidding, landings, etc.) associated with this habitat type.

Alternative 3: Issue Driven Action

Alternative 3 proposes to harvest 150 acres of conifer with partial cut treatments and 123 acres of aspen encroached conifers and to burn or mechanically treat an additional 1108 acres of aspen and 1,169 acres of sagebrush/grass.

Direct and indirect effects

The harvest proposal would affect a very small percentage (4.3 %) of the total forested acreage. Existing past management activities (Table 4.23.1) and wildland fires have previously disturbed 7.8 percent of the suitable lynx habitat (Timber type) within the Cottonwood watershed/LAU. The additional 1281 acres of timber harvest and aspen treatment would result in approximately 12.1% of the suitable lynx habitat (timber type) within the Maki Creek area (a portion of the Cottonwood watershed). Forest Plan standards for "created openings" would be within guidelines for the Maki Creek area.

The primary habitat elements that will be affected and their relationship to wildlife species are as follows:

1. Compliance with the CLCAS. Alternative 3 would be in compliance with the CLCAS. Specifically, existing lynx habitat would not be moved significantly into a unsuitable condition. Block size of unsuitable habitat would not be significantly increased. See Comparison of Alternatives below for further discussion on Canada lynx.

2. Cover and habitat security. A small portion (<1%) of the analysis area is crucial wildlife range. Groups of species are emphasized, such as early or late successional dependent species, in order to increase species richness or diversity. Habitat is managed to achieve game and fish populations, harvest levels, success, and recreation objectives identified by the Wyoming Game and Fish Department and agreed to

by the Forest Service (p.235-LRMP). In general, management direction in these areas should have beneficial or neutral impacts to wildlife. Cover and security habitat would be reduced minimally for short-term with Alternative 3. There is minimal habitat within the project area for antelope and bighorn sheep. Mule deer and elk will lose minimal security and parturition cover, and additional forage will be created or enhanced. There will be some displacement of big game animals during the life of the project. A portion of moose habitat will be treated with the proposed 1,169 acres of prescribed burns. Aspen treatment, prescribed burning and removal of encroaching conifers will increase forage and birthing component of the stands in the long term. Big game, especially elk, will remain on the Forest longer before going to their winter feedgrounds. There will be some displacement of big game animals during the life of the project.

3. Snags provide important habitat components for a wide range of wildlife species including: nesting, denning and roosting sites in cavities (for woodpeckers, forest owls, pine marten, squirrels), on branches or broken tops (for owls, goshawks), under bark and in crevices (for bats, brown creeper), and foraging substrate (woodpeckers and nuthatches) and hunting perches (hawks, eagles, and owls). Dead and dying trees provide habitat for a number of sensitive and MIS species.

4. Forest Plan direction for snag retention will be met with implementation of Alternative 3. Removal of snags will minimally result in reduced availability of perch and roost trees, potential nest sites (for both primary and secondary cavity nesters), and insect foraging opportunities as compared to the no action alternative. Snag removal in a specific area has a long-term effect on wildlife snag habitat because it reduces the availability of important habitat components, not only in the current forest stand, but also in the future stand. The standing material in the residual stand will become the material that will become coarse woody debris over time. Removal of some snags will result in reduced availability of coarse woody debris in harvested stands. Snag retention will include a range of diameters (including large trees) that benefit the greatest number of species. Large diameter trees are also used by species such as forest owls, pine marten, and fishers. The forest plan snag guideline recommends reserving from timber harvesting (and firewood cutting), an area of 60 acres per section (640 acres) that contains dead or down and green trees. This guideline will be far exceeded as explained here. In Alternative 3, the total area to be harvested is 273 acres with no clearcut acres. No area will be subject to firewood cutting. This will leave at least 4804 acres in the Maki Creek area (considering sagebrush areas, previous harvest and planned harvest) that will contain dead, and down and green trees. In addition, all areas proposed for harvest will contain significant numbers of residual, large dead, down and green trees. This can be compared to the snag guideline which would require only 660 acres in the Maki Creek area.

5. Downed logs. Coarse woody debris provides cover and sites for feeding, resting, and denning for a wide range of species including many small mammals and birds that are prey for lynx, goshawks, and forest owls. Downed logs also provide cover for traveling animals. Timber harvest has the potential to decrease prey populations and create a barrier to movement if created openings are greater than 300 feet in width.

Alternative 3 proposes to leave an average of 10–12 tons of down woody material per acre. This is within the range recommended for maintenance of prey populations for goshawks (Reynolds et al. 1992) and by Evans and Martens (1995) in unburned or low intensity burned areas. The diet of other TES species, such as fishers, lynx,

etc. overlap with the goshawk, so this amount of slash should meet many of their needs as well.

Brewer's sparrow will be affected if the sagebrush treatment is during the nesting season. There will be some short-term displacement during the prescribed burn and post treatment. Long term, habitat will be improved as seral stages and vegetation composition will be enhanced.

Direct and indirect effects due to road use and management as well as motorized trails

Alternative 3 includes re-opening and reconstructing existing roads (repairing culverts and erosion work) as well as construction of 3 miles of temporary roads, all of which would be closed to public traffic during and after harvest. Thus, direct and indirect road effects are similar to those described above for Alternative 2. Effects would be short-term and limited to the project area.

Disturbance impacts to some wildlife, in particular moose, deer and elk, would be limited to the immediate project area. Harvest activities will temporarily displace animals away from the project area during implementation, but they should return once the disturbance ends. Nesting songbirds would also be affected, with higher nest failure rates as a likely consequence of adult birds repeatedly flushing off the nest and leaving eggs or chicks exposed (Baicich and Harrison 1997). These effects would be short-term and limited to the project area.

Alternative 4: Additional Snag and Lynx Habitat Action

This alternative was developed from Alternative 3. Specifically, the Canada lynx has been listed as a threatened species since the Plan Implementation Study. Alternative 4 was designed to have less impact on suitable lynx habitat, with special focus on maintaining and/or improving foraging habitat.

Alternative 4 proposes to harvest 60 acres of conifer and 103 acres of aspen/conifer with various treatments and to burn or mechanically treat 2,177 acres of aspen and sagebrush. Conifer treatments are concentrated at lower elevations on the aspen/conifer interface. Douglas-fir types are the dominant stands treated and are less desirable as lynx habitat than the fir and lodgepole habitat types. Existing past management activities (2,413 a) and wildland fires (post 1977-69 a) have previously "disturbed" (7.8%) of the suitable lynx habitat (timber type) within the Cottonwood watershed and Lynx Analysis Unit. This alternative would increase the disturbance by 4.2% (163a mixed + 1,000a aspen). Overall disturbance in the LAU would increase slightly, to 12%.

Changes specific to Alternative 4 include:

1. Minimal harvest in existing lynx/hare habitat. Any proposed harvest unit in Alternative 3 that contains mixed fir, multi-storied stands have been reduced. The intent is to enhance existing lynx habitat. Harvest/treatment is proposed in conifer stands currently not providing excellent hare habitat. Treatment is also proposed for aspen, Douglas fir and sagebrush areas. Aspen is included as suitable lynx habitat under the CLCAS mapping criteria. However, local research indicates, "…the male and female lynx tended to avoid non- forested clearcuts and mature slow seral aspen stands with little

understory; most use was concentrated in higher elevation conifer forests." (Squires et al. 2001). Aspen and sagebrush treatments are proposed to move these vegetative types closer to their historic disturbance regime and with less of an impact on lynx and hare habitats. Rejuvenated, younger age class aspen and sage will provide benefits to a variety of other wildlife species discussed earlier. There will be some disturbance to possible lynx travel pathways.

2. Existing past harvest units currently providing minimal lynx/hare habitat are not enlarged with additional harvest. This will avoid additional fragmentation and maintain more of the existing habitat and travel corridors.

3. Retention groups. Alternative 4 will retain a bit more live and dead standing trees and down material in a range of diameter classes (8-20"+) in patches distributed throughout the project area ranging from 1 to 5 acres in size. Retention groups would consist of roughly 8 to 25 trees (both live and dead) of the species preferred by cavity-dependent species. A minimum of 8 to 12 dead trees will be retained in each group in the 9 to 20"+ diameter (DBH) range. There are numerous areas within the Section (640 a) and scattered throughout the watershed to fully meet the snag requirement in the Regional Guide and Forest Plan. This is similar to Alternatives 2 and 3. Retention groups, composed of the tree sizes and status as described above, would provide several benefits for wildlife. First, groups of trees are more resistant to windthrow than those left as lone individuals (Bull et al. 1997). Therefore clumping snags would increase their longevity and facilitate longer-term use by woodpeckers and other snag-dependent species. It also incorporates habitat features necessary for nesting by a wide range of cavity nesting species, provides patches of cover throughout the burn for big game, and does not create openings that can be barriers to movements of some wide-ranging carnivores. Snags retained in the middle of clearcuts are used by open habitat species such as northern flicker, bluebirds, or kestrels for nesting, but most other woodpeckers avoid open areas for nesting (Bull et al. 1997, Saab and Dudley 1998). The greater number of snags retained under this alternative will also benefit long-term recruitment of coarse woody debris. Large diameter snags typically stand longer and can accommodate a wider range of nesting species than smaller trees (Bull et al. 1997).

4. Timing. Under Alternative 4, fire activity would/could occur August through December (weather and fire season permitting). In comparison, some Alternative 3 fire activities could occur in the spring, from April through June. Thus, operations will conclude prior to use of the area by transitioning elk and wintering moose. Fire activities will avoid disturbance activities during the sensitive breeding periods of most TES and MI species. By August most young birds (goshawks, woodpeckers, and forest owls) have fledged and young mammals are capable of traveling with adults, therefore they should be much less vulnerable to disturbance. Wild fires however can occur from June 15 through October requiring the appropriate response and full suppression methods. Harvest and fire activity will minimally conflict with big game hunting.

Direct and indirect effects due to road use and management

Alternative 4 includes re-opening and reconstructing existing roads and construction of about 2.8 miles of temporary roads, all of which would be closed to public traffic during and after salvage. Thus, direct and indirect road effects are similar to those described above for Alternatives 2 and 3. No motorized trails are

proposed.

Table 4.13 Comparison of effects to wildlife habitat components by alternative.

Habitat component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Compliance with CLCAS	Yes	Yes	Yes	Yes
Habitat security and cover; all alternatives largely impacted by natural disturbances long term	Stable trend long-term, omitting natural disturbances	Short-term reduction due to timber harvest and aspen treatments	Short-term reduction due to timber harvest and aspen treatments	Short-term reduction due to timber harvest and aspen treatments
Created opening acres; all alternatives within guidelines	2,413 acres past harvest in Cottonwood analysis area-regeneration and cover variable	Approximately 60 acres additional openings plus 135 acres partial cut	Approximately 123 acres additional openings in Aspen plus 150 acres partial cut	Approximately 103 acres additional openings in Aspen plus 60 acres partial cut
"disturbed" acres of suitable lynx habitat; see cumulative effect discussion	Existing level is 7.8% 2,413 a CC's and PC's 69 a Burns < 25 yrs old	Increases disturbed level to 8.4% Proposed disturbance: 195 a conifers harvest 2,413 a CC's and PC's 69 a Burns < 25 yrs old	Increases disturbed level to 12.1% Proposed disturbance: 273 a conifer and aspen harvest 1,008 a aspen burn 1,169 a sagebrush burn 2,413 a CC's and PC's 69 a Burns < 25 yrs old	Increases disturbed level to 11.5 % Proposed disturbance: 163 a conifer and aspen harvest 1008 a aspen burn 1,169 a sagebrush burn 2,413 a CC's and PC's 69 a Burns < 25 yrs old
Snag density	No change	Reduction meets FP standards and guidelines	Reduction, but more trees retained in comparison to alt. 2, meets FP standards and guidelines	Reduction, but more trees retained in comparison to alts 2 and 3; meets FP standards and guidelines
Downed woody debris	No change	Reduction to 10-12 tons/ac	Reduction to 10-12 tons/ac; Greater number of standing snags left as a long-term supply of DWD than alt 2	Reduction to 10-12 tons/ac; Greater number of standing snags left as a long-term supply of DWD than alts 2 and 3
Multi-layered older forests	No change	Reduction across all timber species	Reduction across all timber species	Reduction in Douglas-fir and aspen types only
Open road density; all alternatives meet guidelines	No change	3.5 miles of temporary roads constructed, but no long-term change in open road density	3.0 miles of temporary roads constructed, but no long-term change in open road density	2.8 miles of temporary roads constructed, but no long-term change in open road density

Canada lynx –Discussion and Canada Lynx Conservation Assessment and Strategy (CLCAS) Compliance

General discussion of lynx and habitat in the project area is covered in Chapter 3 and within the BA, as well as initial discussions of CLCAS guidelines such as habitat mapping and Lynx Analysis Units (LAU's). As mentioned above, because of the sensitivity of this particular lynx population, a more detailed analysis is

provided.

In addition, the Lynx Conservation Agreement (2000) states: "If the evaluation indicates an activity is likely to adversely affect the lynx, the agency will not authorize the activity until plans are revised or amended as indicated in Part 2…" In other words, until the Bridger-Teton Forest Plan is amended to incorporate lynx guidelines, no activity can be authorized which has an "adverse" impact on lynx. The BTNF Plan has not been amended to date although the US Fish and Wildlife Service has prepared a Biological Opinion on the current Forest Plans (FS) within regions 1, 2 and 4. One of the basic tenants of the LCAS is to take a conservative approach and retain future options, but also allow project proposals and evaluation(s) on a case by case basis. See Conservation Measures (Mitigations) Table 7.

There is some local lynx research available, although sample sizes are small (2 collared animals which are now both dead-starved). BTNF information and data has been accumulated on past lynx movement on the Piney Front and this information has been used in the analysis.

Key guidelines considered in this analysis are described below. A separate and more detailed Biological Assessment covering all Threatened and Endangered species as well as lynx, will be prepared and submitted to U.S. Fish and Wildlife Service. Additional information is also in the project record.

CLCAS Direction
The Lynx Conservation Agreement (Lynx CA; USFS 2000) between the USFWS and the USFS specifies that recommendations found in the CLCAS (Ruediger et al. 2000) will be reviewed and considered prior to making any new decision to undertake actions in lynx habitat. Conservation measures outlined in the CLCAS (Ruediger et al. 1999) apply only to lynx habitat on federal lands within LAUs.

Project Planning - Standards
Within each LAU, map lynx habitat. Identify potential denning habitat and foraging habitat (primarily snowshoe hare habitat, but also habitat for important alternate prey such as red squirrels), and topographic features that may be important for lynx movement (primary ridge systems, prominent saddles, and riparian corridors (CLCAS p. 7-4).

Potentially suitable lynx habitat has been mapped per criteria in the CLCAS and the August 2002 memo (USFS 2000). The amount of potential habitat is summarized in Chapter 3.

Within an LAU, maintain denning habitat in patches generally larger than 5 acres, on at least 10 percent of the area capable of producing stands with these characteristics. Where less than 10 percent of the forested lynx habitat within a LAU provides denning habitat, defer those management actions that would delay achievement of denning habitat structure.

A total of 61,797 acres of denning habitat occurs throughout the three LAUs considered under cumulative effects (below). This figure is based on conifer cover types with greater than 30% canopy cover, which may be an overestimate of suitable denning habitat. Field verification of denning habitat suitability has not occurred. Denning habitat comprises about 85% of the potentially suitable habitat within each of the three LAUs, and thus does not appear to be limiting. Based on visual inspection of mapped denning habitat, habitat appears to be well distributed throughout the LAUs.

Maintain habitat connectivity within and between LAUs (CLCAS p. 7-4).

No new roads are proposed that might create barriers to lynx movement. Based on visual inspection of the distribution of suitable lynx habitat, connectivity within and between LAUs would be maintained with Alternatives 1, 2, 3 and 4.

Conservation Measures Applicable to Address Risk Factors Affecting Lynx Productivity

Timber Management in Lynx Habitat: Project Planning – Standards

Management actions shall not change more than 15 percent of lynx habitat within an LAU to an unsuitable condition within a 10-year period (CLCAS p. 7-5).

No alternative changes more than 15 % to unsuitable.

1. In lynx habitat, pre-commercial thinning will be allowed only when stands no longer provide snowshoe hare habitat (CLCAS p.7-6)

   The proposed project does not involve any pre-commercial thinning. Stem density would be reduced as described for various alternatives, however patches of dense seedling/sapling conifers will be maintained in project areas where they are available (primarily past harvest units).

In aspen stands within lynx habitat in the Cascade Mountains, Northern Rocky Mountains, and Southern Rocky Mountains Geographic Areas, apply harvest prescriptions that favor regeneration of aspen (CLCAS p. 7-6).

Aspen treatments are planned to promote vigorous regeneration.

Cumulative Effects

Impacts to wildlife species due to management activities or landscape changes are scale and organism dependent. Consequently, to be meaningful, cumulative effects analyses should be conducted at a scale relevant to each organism. For purposes of this analysis, the Cottonwood, Horse Creek and Piney Creek watersheds shown above will serve as the cumulative effects analysis area. Horse Creek and Piney Creeks are the adjacent watersheds to Cottonwood. This area is roughly 168,421 acres (FS) in size. The watershed boundaries are used because topographic features and drainages tend to determine movements of many wildlife species and often correspond to seasonal home ranges. This area relates more to species' actual use of a landscape than a non-geographic boundary. These watersheds also encompass a portion of the known ranges of resident lynx. Cumulative impacts are evaluated in terms of the extent to which they have the potential to affect important source habitats and key habitat components. Past, present and reasonably foreseeable future activities are summarized in Table 4.2.

Table 4.14 Past, present, and future activities: Cottonwood, Horse Creek, and Piney Creek watersheds

Project/Activity	Year	Location and Affected Area
Timber harvest	historic	Tie hack areas, various locations throughout the cumulative effects analysis area.
Timber harvest	1970's	Past harvest, 5995 acres (conservative estimate, not all past harvest data were available)
Timber harvest	Ongoing and planned	Cottonwood II proposed sales (Scoped)
Prescribed and wildland fire	Ongoing	Wildland fire: 4021 acres post 1977. Other fires in past have reforested to cover.
Prescribed and wildland fire	planned	Cottonwood II aspen/sage treatments
Fire suppression	Ongoing	Entire area
Firewood gathering	Ongoing	Entire area (Maki Creek area gated to public motorized access)
Christmas tree cutting	Ongoing	Entire area (Maki Creek area gated to public motorized access)
Livestock grazing	Ongoing	Entire area; both cattle and sheep
Livestock improvements	Ongoing	Entire area; fences, water developments, cattle guards, etc.
Predator control	Ongoing	Entire area, limited
Noxious weed control	Ongoing	Various locations throughout analysis area; both biological and chemical
Recreation, dispersed	Ongoing	Entire watershed; both summer and winter
Hunting, outfitting, black bear baiting	Ongoing	Entire area
Oil and Gas development	Ongoing	Currently being considered. Most off-forest.

Total disturbed acres (Table 4.15), existing is 7,714 which is 4.5 % of the total watershed acres and 9.7 % of the suitable lynx habitat in these 3 watersheds. This is a conservative estimate as not all past timber harvest acres were counted as reforested. Past timber sale stand exams were reviewed and stands that had less than 225 stems per acre and were not reforested to at least 12 feet in height were considered as non-forested for lynx (year round range). Wild fires prior to 1977 were counted as reforested and suitable.

Table 4.15 Disturbance by Watershed

DISTURBANCE	COTTONWOOD	HORSE CREEK	PINEY CREEK	Totals
Partial and Clear Cuts	**2,413 a**	**287 a**	**993 a**	**3,693 a**
Fires < 25 years old, not forested	**69 a**	**3,911 a**	**41.3 a**	**4,021 a**
Acres in HUC	**48,500 a**	**93,394 a**	**26,527 a**	**168,421 a**
Forested Acres in HUC	**31,616**	**30,725 a**	**16,656 a**	**78,997 a**
Percent of Disturb. Acres of Disturb.	**5.1 % &7.8%** **2,482 a**	**13.6 %** **4,198 a**	**6.2%** **1,034 a**	**4.5 and 9.7 %** **7,714 a**
Lynx Habitat Suitable Acres Percent in HUC	**29,134 a** **92.1 %**	**26,527 a** **86.4 %**	**15,622 a** **93.8 %**	

Wildfire constitutes the single most prevalent landscape disturbance type in the Rocky Mountains (Gruell 1983). Having evolved over time to incorporate such disturbances as wildfires into their life-history strategies (Hansen et al. 1991), species' traits and behavior allow wildlife populations to persist in the face of large-scale, stand replacement fires (Freeman and Karr 1985, Weaver et al. 1996). Resilience of wildlife species at the meta-population (Hanski et al. 1991, Harrison 1994, Wiens et al. 1996), population, or individual level vary according to the scale, intensity, and duration of a fire, and the extent and frequency of similar fire events within an animals home range or habitat over time. Human-induced changes in suitable habitats via timber harvest, roads, or related recreational and grazing activities may also affect wildlife response to disturbance. The cumulative effect of human-induced, and natural environmental effects upon wildlife should not exceed any species ability to accommodate the scale and rate of environmental change, and still persist (Goodman 1987, Weaver et al. 1996).

Wide-ranging carnivores – The major issues facing the long-term persistence of wide ranging carnivores (grizzly bear, gray wolf, lynx, wolverine, fisher, and pine marten) include the need for large tracts of remote country away from humans, maintenance of adequate prey base, and conservation of mosaic of appropriate seral stages (Witmer et al. 1998, Wisdom et al. 2000).

Human disturbance – Wide-ranging carnivores need large tracts of remote country away from humans because mortality for many of these species is directly related to human interactions. Mortalities resulting from trapping, poaching, and vehicle collisions all increase with increasing road density because roads facilitate access. Large portions of the watersheds are within roadless areas. Overall road density at the watershed scale is low; hence the risk of road-related mortalities is low. The proposed project will not result in a net increase in open road density and thus should not change the long-term human use patterns in the area. Human activity in the immediate area of activity will increase over 3-5 years as a consequence of timber harvest and fire activity during early spring until fall, but will decline thereafter. Thus, no habitat loss as a consequence of added road use and associated activity outside of the vegetative treatment area would occur. Potential for increased wildlife mortality or disturbance due to traffic is limited solely to the period of harvest while timber is being hauled. Changes in activity levels, and related wildlife effects within the harvest area will not exceed 5 years and all roads will be closed to the public thereafter. There are no

anticipated changes in the amount or type of recreational activity in the area, or grazing effects as a consequence of salvage harvest under Alternatives 2, 3, or 4. Post treatment could however, move big game animals into the harvested and burn units, thus causing a redistribution of hunting pressure within the watershed.

Bear and wolves occasionally come into conflict with humans over livestock. In Wyoming, most wolf mortalities since the reintroduction have been attributable to humans (USFWS et al. 2001). Six grazing allotments overlap portions of the watersheds; three are cattle allotments and three are sheep allotments. To date, no wolf packs have territories that overlap the analysis area and no wolf or grizzly bear depredations have been reported in this area. Grizzly depredation has occurred a short distance to the northwest, however.

The grizzly bear, wolf, and wolverine all depend to varying degrees on healthy ungulate populations. The watersheds provide transition and summer habitat for elk, moose and mule deer, and winter range for moose. Elk, moose, deer, and large carnivores are highly mobile and respond quickly to large scale disturbances such as fire, or smaller scale disturbances such as timber harvest, by moving to adjacent areas (Singer et al. 1988, Lyon et al. 2000) or expanding their range to encompass burned, unburned, harvested, and pristine areas.

Availability of winter range is often the limiting factor for ungulate populations. The project area is not considered winter range for elk or mule deer, but it does provide important winter habitat for moose. In compliance with the Forest Plan (USFS 1990) grazing utilization standards would be implemented, thus grazing should not contribute additional impacts to important ungulate ranges if Forest Plan guidelines and "rest" criteria are followed. Most of the proposed vegetation treatments are targeted to improve elk and deer spring, summer, and fall range. Treatment areas in aspen and sagebrush will need to be rested from domestic livestock grazing as outlined by the IDT in order to achieve the targeted improvements.

Maintenance of suitable habitat – Fire suppression, timber harvest, and natural disturbances have and will continue to alter the amount and distribution of suitable habitat. Depending on the key habitat features required by a species, these activities have had both beneficial and negative impacts. There are 3,693 acres of past harvest (GIS past harvest layer) and 4,021 acres of wildland fire.,

Snag and post-fire-dependent bird communities – The major issues facing the long-term persistence of three-toed woodpeckers (sensitive species) and other post-fire-dependent bird communities include: altered fire regimes, and decline in the availability of mature and old forests with evidence of decadence and medium to large diameter snags and live trees infected with insects or disease (Hejl 1994, Hutto 1995, Wisdom 2000).

Altered fire regimes – Intense, stand-replacement fires in mid- to high elevation forested areas are likely to be under represented across these landscapes due to suppression efforts (Gruell 1980, Hutto 1995, Bradley et al. 1992**).** A review of fires in the Cottonwood, Maki, Horse Creek and Piney Creek drainages during the past 60 years shows 161 fires burned 6,090 acres. This is approximately 3.6 % of the area. The fires, therefore, represent an important landscape level disturbance that contributes an important ecological attribute for species that use and depend on early post-burn environments to persist (Heijl 1994, Hutto 1995, Hoffman 1997). Most of the watersheds are not within the historic range of fire frequency. Based on literature, fire personnel and limited field observations, it appears that lodgepole, spruce, sage and aspen types are out of their historic disturbance regimes.

Though information is lacking to assess the status of other sensitive primary cavity-nesters at a metapopulation or population level, three-toed woodpeckers are present and likely have a dynamically functioning population.

Maintenance of key habitat components – Firewood cutting has the potential to affect post-burn and post timber harvest wildlife species specifically tied to snags because the dead trees that they use for nesting, roosting, and foraging are specifically targeted. However, firewood harvest levels are not expected to change as a result of this project because haul roads would be closed to the public and access for firewood cutting would not be permitted. Existing firewood harvest is concentrated around the open road corridors. Given the low road density in the watersheds and the fact that some snags would be unavailable for harvest, this activity is unlikely to contribute significant additional affect to snag-dependent bird communities.

Mature forest bird communities – The issues facing the long-term persistence of goshawks, boreal, great gray and flammulated owls include: reduction in mature and old forests and altered fire regimes (Wisdom 2000).

Altered fire regimes and maintenance of key habitat components – In the aftermath of timber harvest and large-scale stand-replacement fires, including areas of moderate burn intensity, species that prefer late-successional forest interior habitats will likely be reduced or absent. Species that prefer late successional forests, for nesting, or hunting, such as goshawks, and forest owls are likely to be reduced until such time as forest canopies again mature, and these species recolonize the project area. Periodic disturbance (such as timber harvest and stand- replacement fire) is necessary to sustain the forest conditions used by these species in the long-term. It appears as mentioned earlier that conifer types within the area are outside their historic range of fire frequency. Most of the vegetative types have experienced moderate to high fire frequency during the past five years. The area is currently under drought conditions and many fires have escaped control on the Forest because of this condition.

4 Environmental Consequences

Canada Lynx

Table 4.16 Summary of past disturbances by LAU acres – Cumulative Effects

Disturbance Type	LAU			Total
	Piney	Horse Creek	Cottonwood	
Past timber harvest	993 a	287 a	2,413 a	3,693 acres
Large Fire (not reforested-pre-1977)	41 a	3,911 a	69 a	4,021 acres
Total FS Acres in LAU	26,527 a	93,394 a	48,500 a	168,421 acres
Suitable lynx habitat (CLCAS -all timber types)	16,656 a	30,725 a	31,616 a	78,997 acres
Total disturbance (% suitable habitat-timber types)	1,034 a (6.2 %)	4,198 a (13.6 %)	2,482 a (7.8 %)	7,714
Suitable Lynx acres (Percent in LAU)	15,622 a (93.8 %)	26,527 a (86.4 %)	29,134 a (92.2 %)	

Further reduction of suitable lynx/hare habitat in any of the above LAU's, will not have an adverse impact on the local lynx population for the following reasons (Table 4.17):

Table 4.17 Description of Risk Factors (Conservation Measures) and Proposed Treatment

Conservation Measure	Description of Measure	Percentage Needed For the Measure	Percent change of the Measure in Cottonwood LAU
Denning Habitat	-Coarse woody debris -Patch size of 5+ acres	>10% of LAU	No Change-Existing
Foraging Habitat	-Dense horizontal cover of conifers -Just Above Snow level -Young seral stages	≤ 30% of LAU	Change from 7.8 to 12.1%
Habitat Conversions	-Vegetative conversion -Do not limit or change hare habitat to larch, etc.	≤ 30% of LAU	No Change-Existing
Thinning	-Will reduce foraging habitat -Thinning allowed IF hare habitat is gone	≤ 30% of LAU	No Change-Existing
Fire Management	-Lo-mod intensity fires stimulate understory -Burn in mosaic	≤ 30% of LAU	No Change-Existing

Conservation Measure	*Description of Measure*	*Percentage Needed For the Measure*	*Percent change of the Measure in Cottonwood LAU*
Livestock Grazing	*-Do not graze aspen, riparian/willow carrs or recently cut areas*	*No Standard*	*Not Applicable*
Trapping, Predator Control, Shooting	*-Incidental, illegal mortality*	*No Control, WY G&F*	*Not Applicable*
Landscape Patterns	*-Use a variety of Forest age and structure* *-Late seral = denning and red squirrels* *-Earl seral = hare habitat*	*≤ 30% of LAU*	*Change to 12.1 %*
Forest Roads	*-No increase in over snow or groomed* *-Minimize roads on ridges*	*No Standard*	*No Change-Existing*
Developed Recreation	*-Do not alter behavior except while denning* *-New ski areas may fragment landscape*	*Identify den sites, closures*	*Not Applicable*
Non-winter Dispersed Recreation	*-Disturbance near dens* *-Concentrate activities* *-Connectivity*	*No Standard*	*Not Applicable*
Winter Dispersed Recreation	*-Compaction of snow* *-Increase competition*	*No Standard*	*Not Applicable*
Minerals and Energy	*-Minimize impacts* *-Regulate timing of entry* *-Abandoned, reclaim*	*No Standard*	*Not Applicable*
Land Adjustment	*-Contiguous tracts maintain connectivity*	*No Standard*	*Not Applicable*
Connectivity	*-Habitat is naturally fragmented* *-Protect linkages*	*No Standard*	*No Change-Existing*
Coordination	*-Coordinate with adjacent admin. Units*	*Adjacent is Private*	*No Change-Existing*
Monitoring	*-Lack of monitoring difficult to assess adverse effects*	*No Standard*	*On Going*
Non-native Invasive Plant Species	*-Maintain natural succession* *-Time spraying*	*No Standard*	*Not Applicable*

Threatened, Endangered, and Sensitive Species - Summary of Findings

Threatened, Endangered and proposed Species

A separate Biological Assessment will be prepared for TEP species.

Sensitive Species
A separate Biological Evaluation will be prepared for TEP species

4.24: Fisheries

Introduction

The National Forest Management Act (NFMA) regulations require National Forests to provide habitat in order "to maintain viable populations of existing native and desired non-native vertebrate species in the planning area." (36CFR219.19) The regulations further direct that "habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area." Identification of those populations levels and the habitat quantity and quality required to maintain those population levels on Federal lands is a shared responsibility to be accomplished through the cooperative efforts of State and Federal managers.

Threatened and Endangered Species

Kendall Warm Springs dace: The only known location of Kendall Warm Springs dace is within Kendall Warm Springs that is located approximately 32 mi north of Pinedale, Wyoming. Cottonwood projects area is about 29 mi west of Pinedale, Wyoming and about 35 miles straight-line distance between Kendall Warm Springs and the Cottonwood projects area, it is unlikely that there would be any direct, indirect, or cumulative effects from Cottonwood Project proposed actions.

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker: Water depletion from the Colorado River basin as discussed below is considered to jeopardize the continued existence or adversely modify the critical habitat of these four Colorado River endangered fish species (Table 4.19).

A negligible amount of water (less than 1 acre foot) would be required for road maintenance and controlled fire activities (). Approximate water usage was estimated at less than 1,000 gallons per acre of disturbance (BLM 1999)36, or approximately 2,000 gallons per mile of road. Maximum length of road for Maki Creek area requiring water during maintenance was estimated at 7.8 miles over a three-year period. No new road construction is planned in this project area. Fire suppression activities water use was estimated at 1,000 gallons per acre.

Table 4.18 Maximum water depletion estimates (ac-ft) for project activities

Water Depletion Activities	Acre Feet
Road Maintenance	0.14
Fire Suppression 2,300 acres	0.71
Maximum Water Depletion Estimate	**0.75**

[36] USDI, Bureau of Land Management. 1999. Draft Environmental Impact Statement South Baggs Area Natural Gas Development Project Carbon County, Wyoming. Rawlins Field Office, BLM. May 1999.

Any of the three action alternatives would be considered to be new depletions but are not likely to deplete more than 100 ac-ft per year. According to a USFWS Biological Opinion on 'Elimination of Fees for Water Depletions of 100 acre-feet or Less from the Upper Colorado River Basin' (USFWS 1997, amended May 2000), impacts on endangered fish due to project depletions of less than 100 ac-ft/year are offset by recovery actions accomplished by the Upper Colorado River Basin Endangered Fish Recovery Implementation Program and do not require the project proponents to pay a depletion charge. [37]

Summary of Findings
The proposed project will have no effect on Kendall Warm Springs dace. The proposed project, at less than 1 acre foot maximum depletion is not likely to jeopardize the continued existence of the Colorado River fishes: bonytail, Colorado pikeminnow, humpback chub, and razorback sucker.

Table 4.19 Threatened and Endangered fish species that may occur or are potentially affected by Cottonwood Project actions

COMMON NAME	STATUS	EFFECT
Kendall Warm Springs dace (*Rhinichthys osculus thermalis*)	Endangered	No Effect
humpback chub (*Gila cypha*)	Endangered	Jeopardy
bonytail (*Gila elegans*)	Endangered	Jeopardy
Colorado pikeminnow (*Ptychocheilus lucius*)	Endangered	Jeopardy
razorback sucker (*Xyrauchen texanus*)	Endangered	Jeopardy

Fisheries Environmental Consequences
To compare the environmental effects by alternative, assumptions and generalizations were made to quantify effects upon fisheries. The following effects analysis also assumes recommended mitigation in this and other sections are implemented for Alternatives 2, 3, and 4.

A key assumption is that applicable LRMP Standards and Guidelines will be incorporated into project plans to meet Forest Plan goals and objectives to protect aquatic species and habitats. Two LRMP Standards and Guidelines that have the most applicability to this analysis are the Fish Passage Standard and the Streamside Roads Standard. Further definition for these Standards follows.

1. **Fish Passage Standard**: All new or reconstructed stream crossings will be designed and built such that passage is assured for all identified aquatic dependent species known or potentially to occur in that drainage and their respective life stages. Exceptions to this standard are those crossings that are designed

[37] The USFWS has the responsibility to review biological assessment(s) and inform the Deciding Official as to the necessary requirements that will offset depletion impacts. If new depletions were to exceed 100 ac-ft, then a one-time depletion charge would be assessed to project proponent ($14.36/ac-ft for FY2000) to offset depletion impacts.

to prevent non-native trout species migration into streams containing conservation populations of Colorado River cutthroat trout.

2. **Streamside Roads Standard**: Approved road management plan or a Transportation Management Plan is required for each existing and planned road included with each timber sale contract. Minimum requirements are those set forth in the Standards and Guidelines for Roads Management in Inland Native Fish Strategy Environmental Assessment (1995) (See mitigation listed above).

Magnitude of Effects				
Alternative	**2**	**3**	**4**	**1**
Effects	**Highest** →			**Least**

Alternative 1: No Action

No additional, direct adverse effects upon fish and fish habitat would occur in the North and South Cottonwood Creeks, as no development would take place.

Alternative 2: Proposed Action

Disrupting hydrologic function of watersheds and sub-watersheds, increased sediment delivery to streams, and loss of connectivity of fish populations from road construction, road maintenance and increased road traffic will cause the primary negative effects upon fish and fish habitat. Road building and maintenance activities to a service level required for industrial use can also have positive effects upon aquatic resources.

Direct negative effects to Maki and Little Maki Creeks from re-construction of roads and trails including loss of riparian and fish habitats, increased sediment delivery to streams. Eighteen trails and road stream crossings were identified within the project area, 10 of which were identified as sources of sediment delivery to streams (Figure 3). Little Maki Creek road crossing was identified as a barrier to fish and other aquatic organisms, and a chronic source of sediment delivery. Additional direct effects, which cannot be quantified due to a lack of site-specific project information, include altering channel morphology, and changing runoff characteristics of sub-watersheds and watersheds. These processes interact to cause secondary changes in channel morphology. These indirect negative effects include stream bank destabilization, widening of the stream channel, and loss of the formative features that direct flow and promote habitat complexity. These negative direct and indirect effects upon fish habitat reduce the likelihood of sustaining viable Colorado River cutthroat trout populations.

Direct positive effects are the opportunity to restore damaged stream segments by eliminating existing stream crossings and restoring riparian areas, or replacing the existing road stream crossing on Little Maki Creek. Eliminating or reducing sediment delivery to stream channels, and restoration of runoff characteristics and channel morphology could realize additional positive effects. Indirect positive effects could result from obliterating existing roads, and improvements to channel stability and habitat complexity from the aforementioned.

An isolated Colorado River cutthroat trout population is present in Maki Creek area. Existing habitat condition information indicates some elevated sediment levels and degraded stream segments have been identified in the drainage. Analysis indicates that there is potential for both negative and positive impacts from implementing proposed action and recommended mitigations. Assuming the mitigations are implemented, and watershed restorations reducing chronic sediment delivery to streams are completed, there is a moderate likelihood that project implementation will reduce sediment delivery and improve aquatic habitat conditions in the long term (20 years). Therefore, it is determined that selection of Alternative 2 **may impact individuals and habitat in Maki Creek area, but will not likely contribute to a trend towards Federal listing or a loss of viability** to the subbasin population or species.

Alternative 3: Issue Driven Action

Negative and positive effects upon fish and fish habitat from roads, trails, and timber harvest and associated watershed restorations, as compared to existing conditions are the same as identified in Alternative 2.

There are potential positive and negative effects from the additional 2,177 acres aspen and sagebrush treatment that is primarily prescribed fire on fish and fish habitat in the Maki Creek area. It is possible that short-term rates of erosion and sediment delivery after a fire may be larger than the effects of roads and timber harvest. Fire effects occur relatively quickly following fire events as compared to other more chronic disturbances associated with roads and timber harvest. After fire, effects to vegetation and watersheds influencing hydrologic and temperature regimes and erosion may persist for years, perhaps decades. Some of the long-term beneficial effects include increased water storage and delayed release, increased recruitment of large wood to channels, and reduced upland erosion rates due to increased ground cover.

Large, intensely hot fires can result in abrupt changes in stream conditions and extinctions of small, isolated fish populations. However, spatially connected populations in complex habitats may still have the ecological diversity necessary to persist. An isolated Colorado River cutthroat trout population such is present in Maki Creek area is not considered resilient because it is not connected to a larger population, local population is relatively small, and habitat is relatively low complexity. Therefore, streamside areas require protection measures necessary to reduce the risk of post-burn conditions that would lead to local populations extinction. In addition, fire prescriptions should include fuel and weather conditions that would result in light to moderate intense burn. Streamside buffers, roads and trails mitigations listed above is expected to provide the protection measures necessary to prevent effects that could be harmful to local fish populations. Therefore, it is determined that selection of Alternative 3 **may impact individuals and habitat in Maki Creek area, but will not likely contribute to a trend towards Federal listing or a loss of viability** to the subbasin population or species.

Alternative 4: Additional Snag and Lynx Habitat Action

Reduced timber harvest would result in fewer log truck trips on existing roads, and less potential sediment delivery to area streams. Description of negative and positive effects upon fish and fish habitat from roads, trails, timber harvest, prescribe fire, and associated watershed restorations, as compared to existing conditions

are similar to those identified in Alternative 3. Therefore, it is determined that selection of Alternative 4 may impact individuals and habitat in Maki Creek area, but will not likely contribute to a trend towards Federal listing or a loss of viability to the subbasin population or species.

Cumulative Effects

The cumulative effect issue associated with the proposed action is the viability of native Colorado River cutthroat trout populations. The indirect and direct effects to trout populations from cumulative effects of the proposed action is loss of stream habitat complexity from increased sediment delivery to streams, reduced survival of juvenile trout, and increased fragmentation of trout populations. The geographic scope for detailed cumulative effects analysis is the North and South Cottonwood Creek drainages, and the upper Green River subbasin for determining viability. Timeframe for viability analysis is two generations of Colorado River cutthroat trout (5 to 10 years).

Past and current actions that have influenced aquatic habitats and native fish populations within the Cottonwood analysis area are:

- Domestic livestock grazing - 5 Federal permits and private lands agriculture;
- Historic timber harvest for railroad ties;
- Commercial timber harvest since 1960's on approximately 2,059 acres;
- Oil and gas development with 1 operating well and associated infrastructure;
- Fifty four miles of existing roads, and 33 miles of trails; and
- Non-native fish introductions.

These past actions have resulted in reduced Colorado River cutthroat trout (CRC) distribution and population sizes within the analysis area. Although CRC are reported present throughout the analysis area, pure populations are only found in headwater streams. CRC in the main North and South Cottonwood Creek are mixed with either rainbow trout, or finespotted Snake River cutthroat trout; both non-native species that interbreed with CRC. Brook trout, a competitor with CRC for available habitat, are found throughout the areas streams.

Links between aquatic habitat quality and fish population size and distributions are not clearly defined. However, stream inventory data indicates lowered habitat quality (See fisheries habitat descriptions in Chapter 3). Higher than expected silt and sand mixed with stream gravels indicates a lowered capability for reproductive success (smothering of incubating trout eggs).

Colorado River cutthroat trout populations within the analysis area are at moderate to extreme risk of extinction because of population characteristics and past and current habitat and population modifications (Table 4.20). Moderate extinction risk ratings were assigned due to population size, and current growth and survival based upon current habitat conditions. High risk of extinctions is due to the variability in recruitment and survival; a linkage to habitat complexity and populations expected response to annual environmental events. The extreme extinction risk rating is due to the isolation of small populations in the North and South Cottonwood Creek drainages.

Reasonably foreseeable future actions include:

- Continued domestic livestock grazing on 5 Federal permits;
- Timber harvest approximately 900 acres;
- Prescribed and natural fires;
- Construction of four trailheads;
- Bridge and culvert replacements;
- System road upgrades; and
- Watershed restoration projects.

All of the reasonably foreseeable actions listed above have potential to impact fish habitat and fish populations. Additional direct effects, which cannot be quantified due to a lack of site-specific project information, include altering channel morphology, and changing runoff characteristics of sub-watersheds and watersheds. These processes interact to cause secondary changes in channel morphology. These indirect negative effects include stream bank destabilization, widening of the stream channel, and loss of the formative features that direct flow and promote habitat complexity. These potential negative effects upon fish habitat could reduce the likelihood of sustaining viable Colorado River cutthroat trout populations. However, changes in extinction risks to CRC population from foreseeable actions could result in increased or decreased risk, depending upon project design and future population restoration efforts. Stream and watershed restoration projects, non-native fish population control, road and trail management to reduce chronic erosion and sediment delivery, and management of domestic livestock to limit degraded stream segments could cumulatively result in increased numbers and more resilient CRC population. It is important that foreseeable projects follow similar design measures and mitigation that will be part of the Maki Creek area projects or there could be a trend toward extreme risk of extinction for local CRC populations.

Direct, Indirect and Cumulative Effects to Amphibians: Potential habitat for amphibians within the Maki Creek area was surveyed on July 2, 2002. Surveyed habitats and techniques focused on habitats for Columbia spotted frog (*Rana luteiventris*), a Region 4 sensitive species, and Western toad (*Bufo boreas*), although all reptiles and amphibians encountered were identified and recorded. Surveyors did not observe any amphibians or reptiles in the surveyed areas. However, lack of observations does not preclude the presence of these species. Stream side and wetland buffer mitigations proposed should provide for amphibian protection. This no disturbance buffer protection is consistent with Maxell's recommendations (2000).

Table 4.20 (Relative Risk Rating for local CCT population extinction adapted from Rieman et al 1993)

Population Characteristic	Nature of Risk Primary and (Secondary)	Risk of Local Population Extinction
Variability in recruitment of survival	Stochastic (Genetic)	HIGH Frequent flood or drought producing highly variable flows, scour events, debris torrents, or high probability of catastrophic fire through a major part of the watershed. Channel simplified providing little hydraulic complexity Population survival and recruitment respond sharply to annual environmental events. Year class failures common.
Population Size	Stochastic (Genetic)	**MODERATE** **Adult population fewer than 500. Periodic year class failures.**
Growth, Survival	Deterministic (Stochastic) (Genetic)	MODERATE Fine sediments, stream temperature, or the availability of suitable habitats have been disrupted and will not recover to pre-disturbance conditions within one generation (5 years). Survival and growth rates have been reduced from those in undisturbed habitats. The population is reduced in size but no long term in abundance exists.
Isolation	Stochastic (Genetic) (Deterministic)	**EXTREME** Migratory Form is absent and population is isolated to the local stream or a small watershed not likely to support more than 2,000 fish.

4.25: Livestock Grazing Management

Alternative 1: No Action

This is the no action alternative of continuing with the current management. Livestock and rangeland vegetation management would continue as outlined in the current allotment management plans. This alternative doesn't provide for the reconstruction of the upper South Cottonwood road, which is presently washing out and is used to access the domestic sheep loading area. There would be a direct effect to the present sheep permittee if and when the, access to the loading area become impassable.

Alternative 2: Proposed Action, Alternative 3: Issue Driven Action, Alternative 4: Additional Snag and Lynx Habitat Action

The direct effects of aspen and sagebrush treatment in Alternatives 2 (40 acres - aspen), 3 (1,131 acres aspen and 1,169 acres sagebrush) and 4 (1,111 acres aspen and 1,169 acres sagebrush) could result in a short-term (2-5 years) reduction in the current livestock carrying capacity to provide for the establishment of the new aspen stands. On the other hand, improvements to the under story vegetation long-term (5-30 years) could greatly

improve both the quantity and quality of forage for both domestic livestock and wildlife. . Prescribed fire aspen treatment will need to be coordinated with the existing grazing permittees to insure rest objectives can be met.

Timber harvest activities and haul routes adjacent to suitable grazing areas could have a short-term effect on livestock distribution. Poor livestock distribution can result in uneven grazing patterns with some areas having heavy vegetative use while other area only have light or no use. To minimize the effects on livestock distribution, timber treatment activities should be limited to a few areas each year and the treatments should be scheduled out over a number of years.

Vegetative treatments originally proposed in Alternatives 2 and 3 on the east side of Sjhoberg creek in timber stands 49-16, 49-33 and 49-35 and on the ridge between North and South Cottonwood creeks, and stand numbers 56-1, 56-4, 56-5, 70-9, 70-13 and 70-15 could open up the natural boundary currently being used to control livestock movements. These timber treatments are reasonably foreseeable actions (a possible cumulative effect) that will now be a separate analysis. None of the treatments are in the Maki Creek area. Treatments should be designed to minimize the effects on the natural boundary. In treatment areas where natural boundaries are removed, Knutson-Vandeberg (KV) funds should be collected to replace the natural boundaries with fence. Any new fence will place an additional burden on the livestock permit holders for long- term fence maintenance.

Recreational use has, and is anticipated to continue to increase in the project area. Possible cumulative effects could also come from the recreational facility improvements on trails, trailheads, dispersed camping areas and additional OHV routes originally proposed in Alternative 2 and 3 that could promote and encourage additional recreational use. As recreational use increases, proper livestock distribution in some areas will become harder or impossible to achieve. The direct result will be a loss of forage production for livestock use in these areas with an overall reduction in the livestock carrying capacity in the analysis area.

4.26: Forest Fuels and Fire

Alternative 1: No Action

Alternative 1 does not meet the purpose and need outlined in the Landscape analysis completed for the project area. No action will result in continued increase in fuel loading within timbered stands, loss of fire resistant aspen communities to succession and decadence, and increase potential impacts to air quality with no manipulation of fuels. Suppression of wildfires under 90th percentile conditions will continue to get more difficult and financially costly, and fire will continue to be excluded from playing its historical role in the analysis area.

Alternative 2: Proposed Action

Alternative 2 does not meet the purpose and need for the project. Alternative 2 does propose to harvest and thin a small part of the analysis area. Thinning overstocked stands and harvesting timber (with an effective activity fuel treatment) will modify fuel characteristics over 195 acres within the analysis area. Future expected fire behavior in treatment areas would be significantly reduced. However, the overall impact to fuel conditions in

the analysis area will not be significant. Fuel loads will continue to increase in timbered stands, fire resistant aspen communities will continue to decline due to succession and decadence, potential impacts to air quality will increase with no manipulation of fuels, suppression of wildfires under 90th percentile conditions will continue to get more difficult and financially costly, and fire will continue to be excluded from playing its historical role in the analysis area.

Alternative 3: Issue Driven Action

Alternative 3 proposes vegetation treatments utilizing commercial harvest and thinning on 273 acres and sagebrush and aspen treatments using primarily prescribed fire on up to 2177 acres (includes up to 100 acres mechanical fuel treatments). The CPIS identified the need to restore aspen communities within the analysis area. The use of prescribed fire is proposed as a cost effective and historically beneficial means of achieving the desired outcome for identified treatment units. A concern for creating a mosaic when conducting prescribed burning is easily addressed. The arrangement of fuels within the burn units combined with ignition patterns, time of year, and site-specific weather conditions will create a mosaic on the landscape when we get to the point of project implementation. Out of the approximately 2177 acres proposed, approximately 20 to 50% or 435 to 1090 acres would remain unburned. Planned commercial harvest units have been strategically placed to complement and assist the implementation of the prescribed burn units.

Secondary benefits of proposed treatments include the modification of fuels (and effects to future fire behavior), and the reintroduction of fire in its historical role on the landscape. Alternative 3 proposes the most modification and reduction of fuels, therefore, reduces future fire behavior within the analysis area the most. We can expect commercially harvested units with post-activity fuels treatment to reduce future expected fire behavior. Thinning regenerating stands promotes stand resiliency by reducing crown densities and promoting health of the stand. The reduction of crown densities decreases the chance of stand replacing crown fire. Prescribed burning of conifer encroached aspen stands will eliminate the conifer component, reduce surface fuel loadings, and enhance the regeneration of the aspen clone. Pure aspen clones are very fire resistant and resilient to future fire disturbance. Expected fire behavior post-treatment will be dramatically reduced. The Mule Fire of 2002 is a recent example of the resiliency and reduction of fire behavior that can be expected when a wildland fire enters into fire resistant aspen and regenerated stands. Fire growth, behavior, and severity moderated considerably, and in many cases stopped, when entering aspen and regenerated stands (see photos of Mule fire).

Alternative 4: Additional Snag and Lynx Habitat Action

Alternative 4 differs from Alternative 3 in that it removes the harvest and reduction of fuels in mixed conifer stands within the analysis area. From a fuels/fire perspective, breaking up the fuel continuity of these large multistoried timbered stands is beneficial by reducing the potential future fire behavior and promoting stand resiliency. Without addressing the fuels conditions in these mixed conifer stands, we can expect ignitions under drought conditions to burn with high intensity and be difficult to suppress. This alternative does not provide for strategically placed harvest units to compliment and assist with implementation of the prescribed burn units to the extent that Alternative 3 does. This will make it more difficult and expensive to achieve burn objectives and

increase the risk of the burns exceeding planned boundaries.

Section 4.3 Physical Environmental Consequences

4.31: Watershed Resources

Introduction

This section discloses the effects of each alternative on the watershed resources. The assessment discusses direct, indirect, and cumulative effects on the Soils, Hillslope Stability, Hydrologic Function (Watershed Runoff Processes), and Water Quality. Again, riparian areas, wetlands, and floodplains were not analyzed because the proposed actions are not expected to occur in or adjacent to these areas (see mitigation measures).

Direct and Indirect effects were evaluated for four areas: Little Maki Creek, Maki Creek, the Maki Creek area, and the upper North Cottonwood Creek watershed. Direct effects occur at the same time and place as the triggering action. Indirect effects are caused by the action but occur at a later time or place than the triggering action.

Cumulative effects result from the incremental effect of the proposed action plus other past, present, or reasonably foreseeable future actions, regardless of who is taking the action. The cumulative effects boundary encompasses the upper North Cottonwood Creek down to where the last tributary from the Maki Creek area enters North Cottonwood Creek. This boundary delineates the area where upstream activities are likely to impact. Several reasons why the cumulative effects boundary was delineated to this location are as follows:

1. No equipment or harvest activities will occur within or adjacent to riparian areas, wetlands, or floodplains. This will retain the necessary structure and function of the riparian areas and will significantly reduce the risk of sediment being delivered to stream channels via overland flow.

2. Anticipated ECA increases from all proposed action alternatives are expected to be at or below levels found to make measurable differences in downstream water yield or peak flow measurements. This will reduce the risk of stream channel erosion or bank instability occurring during high flow events.

3. The proposed prescribed fire activities will recover relatively fast thereby limiting the risk of downstream effects from occurring.

Soils

There will be some soil displacement from the endlining process of bringing the trees to the skid trail before skidding them to the landing. The amount of compaction from the skid trails will depend on the number of trips and amount of slash left on the skid trail for surface protection. Excess slash, (>10-15 tons per acre), will be piled and burned on landings or where heavier accumulations are along roadsides. Landings, skid trails, and non-system roads will be temporarily removed from the productive land base, during the time they are open and

maintained. There may be no irreversible effects since these lands can be reclaimed and productivity returned if precautions are taken to ensure the soils are protected during removal and restoration.

Alternative 1: No Action

Implementation of this alternative will not improve watershed conditions and could, if stand replacement fire occurs, cause a reduction in soil productivity. Fire is a natural disturbance in these watersheds but the existing fuel loadings are not consistent with fuel loadings expected for these vegetation types, consequently fires tend to be hotter and larger when they occur. Hotter fires can cause soil sterilization, alter revegetation processes and contribute to accelerated soil erosion. For example, the sage/grass community is dominated by older age sagebrush, so in general the grasses and forbs are not as productive. This leads to a loss of ground cover and can lead to increased sediment runoff with poor livestock management. This alternative would continue this trend, but returning fire to this community could improve the ungulate habitat. If Alternative 1 is implemented, no prescribed burning will occur and the landscape will remain the same in the short term. This alternative would have no measurable direct, indirect, or cumulative effects on soil displacement, compaction, puddling, soil erosion, or ground cover (vegetation, moss, litter and rock). There would be no adverse effects to the soil resource except if a large fire occurred.

Alternative 2: Proposed Action

Implementing this alternative will impact soil conditions as pre-commercial and commercial timber harvest occurs to reduce fuel loading on 155 acres of conifer stands and aspen regeneration of 40 acres. Reduction of fuel loadings contributes to watershed stability by modifying fire intensity and dampening the size of wildfires when and where they occur. However, soil conditions in these areas will lose productivity in the short term. The vegetation treatments will reduce the possibility of a larger hotter fire degrading the soils in the area, so in the long-term soil productivity should be maintained.

Water runoff would decrease and soil water storage would increase. Litter and soil organic matter would increase over time, leading to the development of a more productive topsoil layer. Soil productivity would increase in areas currently below their potential. Soil erosion would continue to decline over much of the area as vegetation continues to recover on disturbed sites.

Alternative 3: Issue Driven Action

Implementing this alternative will result in 2,177 acres of prescribed fire treatments for fuel reduction and aspen and sagebrush/grass regeneration, and timber harvesting of 150 acres of conifer and 123 acres of mixed aspen/conifer forest. Aspen regeneration will be accomplished by commercial harvest (123 acres) and prescribed fire (1008 acres). Because more acres of vegetation are treated in this alternative, overall watershed stability should improve due to the abatement of stand replacement fires. However, soil conditions in the harvest areas will lose productivity in the short term. Soil conditions should improve in the prescribed fire areas where foraging occurs by both domestic livestock and wildlife. Improvements will occur as nutrients from the burns enter the soils and denser forage is produced.

Alternative 4: Additional Snag and Lynx Habitat Action

Implementing this alternative will include timber harvest using "partial cutting" on 60 acres of conifer forest and 103 acres of aspen/conifer forest. Prescribed burning for regeneration and fuels reduction will occur on 1,008 acres of aspen and 1,169 acres of sage/grass communities. More acres of vegetation are treated in this alternative so overall watershed stability should improve from the reduction of stand replacement fires. However, soil conditions in the harvest areas will lose productivity in the short term. Over the long term, soil conditions should improve in the prescribed fire areas where foraging occurs by both domestic livestock and wildlife. Improvements will occur as nutrients from the burns enter the soils and denser forage is produced.

The proposed activities will have minimal effects on soils within the analysis area if the Forest Plan Standards and Guidelines, the Wyoming Best Management Practices (WDEQ 1997), and the Regional Soil Quality Guidelines are applied and monitored.

Table 4.21 Vegetation Harvest Treatments by Alternatives for Soils

Soil	Alternative 1	Alternative 2	Alternative 3	Alternative 4
202	No treatment	30 ac. SW, 26 ac. CC, 34 ac. GS	40 ac GS, 35 ac aspen, 15 ac S, 20 ac SW	35 ac ITM, 35 ac aspen
303	No treatment	20 ac aspen, 20ac GS	20 ac GS, 70 ac aspen, 25 ac TH, 30 ac S	50 ac aspen, 25 ac TH
205	No treatment	10 ac SW	18 ac aspen	18 ac aspen
345	No treatment	40 ac. Aspen, 15 ac. SW, 10 ac. GS	No treatment	No treatment

Hillslope Stability

None of the alternatives would have any effect on slope stability outside of the project area. Past activities, mostly related to road construction and maintenance, have affected slope stability within the project area. There are no large management-induced landslides within the project area. Known sites are limited to small cut and fill failures (slumps) along the road prisms and surface erosion associated with road related run-off. Decommissioning of new temporary roads would reduce the potential effect to slope stability in the long-term. Geotechnical field surveys will identify and avoid unstable areas.

Prescribed fire to reduce fuel loads, regenerate aspen, and improve range habitat would occur at low to moderate intensities and is not expected to increase or initiate landslide activity.

Alternative 1: No Action

Road-stream crossings with undersized culverts may be at risk during high precipitation events or during high spring runoff events and may lead to debris torrents. This alternative may increase the likelihood of a plugged culvert occurring within the analysis area, since the roads are not regularly maintained or obliterated. This alternative should have no new direct, indirect, short term or long-term effect on hillslope stability because no management related activities are planned. However, if fuel loading increases and a large fire burns through, it

is quite possible that hillslope stability could be compromised. Given the terrain there would likely be numerous slumps and some debris slides. This no action alternative should have little affect on hillslope stability within the project area, therefore no cumulative effects are anticipated.

Alternative 2: Proposed Action

The proposed 195 acres of harvest are on low slope areas (< 30%). Even though several of the harvest units are proposed on marginally unstable or unstable soils it is unlikely there will be landslides, because the slope is low. An additional 3.5 miles of temporary road construction are on areas predicted to have low landslide hazard (i.e. low slope). This alternative will open roads and increase truck traffic on roads. The roads will receive increased maintenance so it is less likely that a culvert failure will occur. The roads will lose any vegetation cover they have grown so the water runoff patterns will change increasing the amount of surface material entering the streams. Eventual road decommissioning will reduce the potential failure of the roads.

Alternative 3: Issue Driven Action

The proposed 273 acres of harvest are on low slope areas (< 30%). Even though several of the harvest units are proposed on marginally unstable or unstable soils it is unlikely there will be landslides, because the slope is low. This alternative proposes less temporary road construction than Alternative 2 (0.5 miles). If the proposed 2,177 acres of prescribed fire treatments and harvest activities follow the Forest Plan standards and guidelines, the Wyoming BMPs, and the Regional Soil Quality Guidelines it is unlikely that landsliding will occur in these areas. However, it is expected that there will be minor slumps associated with the roads system since it will be reopened to truck traffic. As the vehicle traffic, compaction, rutting, and vegetation removal occur the water runoff patterns will change increasing the possibility of slumps occurring.

Alternative 4: Additional Snag and Lynx Habitat Action

As in Alternative 3 it is unlikely that the harvest or fuels treatments will increase hillslope instability. It is more likely that the road system will slump in places or there will be hillslope slumping along cut or fill slopes.

Hydrologic Function (Watershed Runoff Processes) Road Density and Hydrologically Connected Roads

Table 4.22 Road Densities

Road Density and Road Mileages	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Drainage Area (sq. miles)
Little Maki Creek **---Density**/(Mileage)	**2.3/(2.8)**	**2.9/(3.5)**	**2.9(3.5)**	**2.8(3.3)**	1.2
Maki Creek **--- Density**/(Mileage)	**1.2(5.3)**	**1.9(8.0)**	**1.3(5.8)**	**1.2(5.3)**	4.3
Maki PA (FS lands) **--- Density**/(Mileage)	**1.8/(20.0)**	**2.1(23.5)**	**2.1(23.0)**	**2.1(22.8)**	11.1
North Cottonwood	**2.1(97.0)**	**2.1(100.5)**	**2.1(100.0)**	**2.1(99.8)**	46.9

PA -----**Density**/(Mileage)					

For this assessment we assumed that all roads were equal in their effects to the water runoff processes. Even though closed roads that partially revegetate do not disrupt the system as much as open roads with no vegetation. The road density estimates are primarily for comparing the Alternatives and not detailed sediment modeling calculations. Alternative 1, no action, represents the existing condition. The changes in road densities from the alternatives do not substantially change the existing condition (Table 4.31.2).

The Maki Creek area road-sediment inventory did not locate many road segments that connect to the stream system. However, there are several road and trail stream crossings that are contributing water and sediment runoff. All the basic visual indicators such as flow paths (little stream channels) and sediment plumes were seen at most crossings (see the fisheries section). Overall the road system is in relatively good shape, but there are several places that need work. See the fisheries section and the watershed section in Chapter 3.

The road system in the Maki Creek area is currently closed except for administrative use (e.g. fire suppression) Road construction and reconstruction under Alternatives 2, 3, and 4 would be obliterated or closed following implementation of the projects. The additional road segments proposed in Alternatives 2, 3, and 4 do not present adverse effects to the watersheds for several reasons: where they will be located (e.g. relatively flat areas), their short lengths, and that they will be closed after their use. This does not mean that they will not change the landscape. For example they will detrimentally disturb the soils and changes water infiltration capabilities. The cumulative effects from these additional proposed road segments will not greatly alter the North Cottonwood watershed.

Water Runoff Processes
The amount of water runoff change associated with the various proposed activities will not likely induce a measurable change in annual water yield or stream flow. This is based on the numerous experimental forest studies that show that about 20-30% of a watershed needs to be in ECA before a measurable change occurs (Troendle, 1983). There is the possibility that there could be a change in stream flow in Little Maki Creek or the Maki Creek area if prescribed fires burn more than 50% of the sagebrush vegetation cover.

Table 4.23 Equivalent Clearcut Percentages by Alternative.

Percent Drainage in ECA:	**Maki PA (FS lands)**	**Maki Drainage Includes Off-forest**	**Upper North Cottonwood (Includes Off-Forest)**	**Alternative actions**
Alternative 1 (existing)	1.9	1.3	3.6	Existing condition – no action
Alternative 2	3.3	2.1	4.0	Timber harvest and road building
Alternative 3 (without	2.9	1.9	3.9	Timber harvest and roads.

prescribed fire)				
Alternative 3	24.6	15.5	9.0	Prescribed fire, Timber harvest and roads.
Alternative 4 (without prescribed fire)	2.3	1.5	3.7	Timber harvest and roads.
Alternative 4	24.0	15.2	8.8	Prescribed fire, Timber harvest and roads.

All the assessed watersheds are under the recommended Forest Plan threshold, < 30% of the watershed in 10 yr old harvest and ECA within any 30-year period. This threshold was designed to examine cumulative effects of timber harvesting on second order or larger watersheds and assumed that by meeting the threshold, there should not be any cumulative effects to the watershed or the downstream channels. See the watershed section in Chapter 3 or the Watershed report (Project File) for more on this subject.

Stream Channels

Current conditions are a reflection of multiple uses such as livestock grazing, recreation (developed and dispersed), timber harvest, roads, and possibly fire suppression. These factors have resulted in localized areas of stream channel instability. Natural bank instability occurs on the outside of meander bends and where obstructions (e.g. logs) deflect flow. This is important to maintain so a stream channel like lower Maki Creek or North Cottonwood Creek can properly function. This was understood when the Forest Plan was written. It states that, "at least 90 percent of natural bank stability of streams… should be maintained."

There is a possibility of a large rainstorm event following project implementation. The risk is low for such an event but not impossible. The following example illustrates the possible risk associated with the possibility of a large rain storm occurring. We will assume that the burned vegetation and clearcuts will adequately recover in about five years to the point where the landscape can absorb large rainstorm and that a 25-year event is necessary to cause watershed disturbance such as mass surface erosion or a small flood. Then the probability that this storm will be equaled or exceeded during the next five-year period is 18% (Schmidt, 1998).

Alternative 1: No Action

If Alternative 1 is implemented natural processes will continue to function except for fire related processes, and no immediate human-caused changes will occur. The current hydrologic function will show little change except that the existing clearcuts will continue to recover and the aspen and sage/grass vegetation communities will continue to by replaced with conifers or older age sage. This may lead to some loss of late summer groundwater flow that returns to the streams.

If fuels continue to accumulate and wildland fire occurs and burns at high severity and intensity levels, water yields could increase for up to 5 years if a high proportion of stands are burned in the watershed. Overland flow could occur if soil becomes hydrophobic and forest floor organic matter is removed. If a high severity fire occurs and a high intensity rainstorm follows, overland flow could quickly deliver water and sediment to the stream channels increasing water yields, peak flows and in channel erosion.

Alternative 2: Proposed Action

By implementing this alternative the four assessment areas would remain below the Forest Plan % ECA threshold. The channel stability would not likely be affected except where the stream is already degraded.

Alternative 3: Issue Driven Action

Implementing this alternative would result in an increase in % ECA in the Maki Creek area (Table 4.23). These increases would not exceed the Forest Plan standard but could exceed 20% for short durations due to the prescribed fire. Several hydrologists use this range (20-30%) as a yellow flag to further investigate the proposed actions. However, moderate to low intensity burn areas will create a nice mosaic pattern that should recover extremely fast. Assuming the fires are implemented like planned, it can be expected that the aspen and sage/grass areas will recover quickly and the risk for changes in the amount of water runoff leading to additional channel instability will be low. Also, burning will take place over several seasons allowing opportunities for recovery and adaptive management. Areas that are in a degraded condition such as livestock damaged streambanks could be affected by slight changes in the streamflow. These areas should be managed through livestock permit administration. Downstream effects to North Cottonwood Creek are not expected to occur if mitigation measures are followed and care is taken to implement the projects**.**

Alternative 4: Additional Snag and Lynx Habitat Action

This alternative is similar to Alternative 3 except there is less harvest planned. This lowers the ECA levels somewhat. Implementing this alternative is not expected to result in a detectable change in water runoff or stream channel stability.

Water Quality

Water Quality Criteria – Percent Fines

The pertinent water quality parameter for evaluating if we are meeting the LRMP, Wyoming State beneficial uses, and the Clean Water Act is the level of fines in the CRCT spawning gravels.

The geology, soils, and vegetation determine the chemical composition of the streams. Sediment influx to the stream system is determined by the upland, riparian, and streambank conditions, and the prominent geomorphic disturbances. The majority of the proposed harvest areas are located in areas where the risk of sheet erosion is generally low. In addition riparian buffers (mitigation measures) to stream channels, riparian areas, and wetlands are excluded from management activities.

The desired fine sediment levels are not being met under current conditions in the North Cottonwood Creek mainstem, Little Maki Creek, and Maki Creek. Fine sediment levels in the spawning gravels are higher than the desired ranges, 10-20% fine sediment (<6.4 mm) in the trout spawning gravels. This adds to other problems such as strong competition by invasive species (i.e. brook trout), and problems with habitat conductivity (e.g. impassable culverts). Implementation and monitoring of the Forest Service's soil and water conservation practices and the Wyoming BMPs will help ensure that we do not increase the levels of fine sediment in the

streambeds. BMP monitoring is essential to ensure that their implementation is done correctly. On-site contract administration will be needed to address small areas of concern that might arise during project implementation.

There is the possibility that if Alternatives 3 and 4 are implemented that there could be a short-term increase in the fine sediment levels if the prescribed fires burn more than planned or a large rain storm event occurs before the vegetation recovers. This risk is relatively low however it does exist. See Chapter 3 for an example of the calculated risk. If the fire does burn hotter or more area than planned, the site will be examined to determine if short-term treatment measures are needed to prevent excessive water and/or sediment runoff from entering the stream system. This is standard procedure for most fires on the Forest.

There may be an increase in the fine sediment quantities flowing to the stream channels from the opening of the road system (truck traffic, maintenance, and storm runoff). However, the long-term watershed benefits from returning fire to the ecosystem and changes in the vegetation out-weigh these short-term increases. The primary benefit is a small increase in late season stream flow from the changes in aspen and sage/grass vegetation types.

Table 4.24 Evaluation criteria assessment summary

Evaluation Criteria	Desired Ranges	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Detrimentally disturbed soils	Less than 15% detrimentally disturbed soils	No change expected	There will be an increase linked to the % ECA increase	There will be slightly larger increase over Alt 2. (Due to fire)	There will be less of an increase than Alt 3
Unstable Areas	No projects located on marginally unstable and unstable soils, and/or landslides	No change expected	There will be an increase – mitigation measures should minimize the amount	There will be an increase – mitigation measures should minimize the amount	There will be an increase – mitigation measures should minimize the amount
Road Density	Maintain road densities below 2.5 miles per square mile	No change expected.	Road density will increase by a small amount	Road density will increase by a small amount	Road density will increase by a small amount
Hydrologically connected roads	The road drainage system is disconnected from the stream system	No change expected – stream crossings contributing fine sediment	There will be a small increase – mostly from opening the roads	There will be a small increase – mostly from opening the roads	There will be a small increase – mostly from opening the roads
Equivalent Clearcut Area	Forest Plan: < 30% in 2nd or higher order watersheds	No change expected – currently the ECA %s are low	There will be a minor increase in the % ECA	The % ECA will increase, but prescribed fire will occur over several years.	The % ECA will increase, but prescribed fire will occur over several years.
Stream channel disturbance	Management related activities do not increase stream channel instability	No change expected – currently there is livestock damaged stream banks	Not likely to increase stream channel instability Moderate confidence	There is potential to increase stream channel instability in Little Maki Creek Low confidence	Not likely to increase stream channel instability Moderate confidence

Percent Fine Material	10-20% fine sediment in trout spawning gravels (< 6.4 mm in dia.)	No change expected – the current levels are high (>35%)	There will be a minor increase resulting from opening the roads	There will be a minor increase resulting from opening the roads	There will be a minor increase resulting from opening the roads

4.32: Roads and Transportation

Under Alternative 1, no action, road work would not occur. Deteriorated road conditions and creek crossings as identified in the Cottonwood PI would remain and continue to decline. Under Alternatives 2, 3 and 4, only roads in the Maki Creek area would be affected. Some culvert replacement and restoration work at creek crossings in the Maki Creek area would occur, as well as other work on road alignment and surfacing to improve watershed conditions. The Maki Creek road system (10120 and 10120A) would be open for timber harvest and administrative uses but remain closed to most public motorized travel. Detailed analysis or decision on original proposals to improve road conditions in the remainder of the Cottonwood analysis area would be deferred. ID team members conducted some analysis and initial design work of culvert replacement and restoration work, which should aid in easier implementation of projects under a separate analysis or decision.

Section 4.4 - Social Consequences

4.41: Recreation Consequences

Recreational use of the Cottonwood Creek area is part of both the project purpose and need, and significant issues. Scoping for this project, as well as initial alternatives, included improvement in recreation facilities and opportunities to meet desired conditions from the CPIS. In the process of focusing detailed analysis on vegetation treatments in the Maki Creek area, implementation and detailed analysis of recreational improvement projects was deferred. No recreational facilities will be improved and no recreational opportunities improved under any of the alternatives including no action. However, the ID team members conducted some analysis and initial design work of trailheads, trail reconstruction and recreation improvements at Soda Lake, which should aid in easier implementation of projects under a separate analysis or decision. The project file contains information on original recreation proposals and recommendations of the ID team for proceeding with these.

With implementation of any of the action Alternatives 2, 3, or 4 there may be some short-term disruption of summer and fall recreation opportunities and use in the Maki Creek area. Most use occurring in the Maki Creek area is for big game hunting. Alternatives 2, 3 and 4 propose differing levels of timber harvest during a 2 to 3 year period, which may cause recreational users to avoid the area. Harvest activities are usually confined to the June through October time period and are seldom active on weekends when most recreational use would occur. Activities are also restricted from taking place on opening weekends of big game hunting season. The Maki Creek area roads are gated during this time with recreational access limited to foot and horse travel. Under normal operations, Alternative 2 activities would take place during approximately 4 to 6 months total; Alternative 3: 6 to 9 months and Alternative 4: 3 to 5 months. None of the alternatives would change the spectrum of recreation opportunities available in the Maki Creek area.

Alternatives 3 and 4 also include prescribed fire activities on 2,177 acres that may disrupt some recreation

activities. Burning would take place during short timeframes in the fall or spring in 1 to 3 seasons. The objective of prescribed fire activities is to enhance big game habitat. Aspen and sagebrush vegetation targeted for treatment typically recovers quickly from burning. The long-term effect on recreation should be an enhancement of big game hunting opportunities and a reduction in potential for large-scale wildfire in the area.

4.42: Visual Scenic Consequences

A majority of the Maki Creek area is in partial retention. The areas roads are closed to public travel, so the primary concern is the view from the North Cottonwood road as the visitor approaches the Forest from the east. Most of the proposed harvesting is partial cutting which would blend with existing landscape pattern. Alternative 2 proposes 26 acres of clearcutting which may detract from scenic integrity. Unit layout and placement would need to be reviewed with a landscape architect to assess visual effects. The aspen harvests and prescribed burning in Alternatives 3 and 4 will have a short term impact for the Forest visitor, but would borrow from the character of naturally occurring disturbance. The aspen areas should recover quickly with aspen re-growth and long term effects will be positive.

4.43: Heritage Resources

Direct effects to heritage resources generally occur at the same time and place as a project or improvement is implemented. Examples of direct effects could include destruction of a historic property by road construction, timber harvest, or during a prescribed fire. Direct effects can usually be avoided. Heritage resource surveys conducted in the analysis area have identified the location of significant historic properties, and relocating projects or adjusting project boundaries can avoid these properties. Indirect effects usually occur subsequent to project development and may occur later in time. Examples of indirect effects could include increased vandalism or damage to historic properties as a result of increased public use of an area. Construction of new roads or OHV trails could lead to increased visitation to areas that were previously closed. Increased artifact collections could occur in area subjected to prescribed fire because the removal of vegetation would facilitate in the discovery of artifacts. Mitigation of indirect effects is difficult because it may not be possible to predict where these indirect effects may occur.

Alternative 1: No Action

Implementation of this alternative will have no direct or indirect effect to heritage resources. Management of heritage resources would continue as it has in the past.

Alternative 2: Proposed Action

Under this alternative, there would be no direct effects to heritage resources as a result of timber harvest activities. Heritage resource inventories have been conducted within the analysis area and significant historic properties have been identified. These properties will be avoided by project activities.

If construction of an OHV trail on the Old Indian Trail occurs, as originally scoped, there will be an adverse

effect to this significant site, and possibly indirect effects to other resources located along the trail. An OHV trail would result in increased erosion of the trail and would alter the visual and historic integrity of the trail. Increased human use in this area, which in the past has received little use, could result in damage to other sites that may be located along the trail. These impacts cannot be mitigated.

All other projects proposed under this alternative will have no direct effect to heritage resources. Heritage resource surveys conducted in the analysis area have identified significant historic properties, and these properties will be avoided by project implementation.

It is anticipated that there will be no indirect effects to heritage resources as a result of other projects implemented under this alternative. Monitoring of site conditions in the analysis area over the past few years has indicated that historic properties are not being effected by the recreating public, and this trend is expected to continue.

Alternative 3: Issue Driven Action

There would be no direct or indirect effect to the Old Indian Trail under this alternative because the OHV trail would not be developed. The direct and indirect effects of all other proposed projects would be the same as in Alternative 2.

Alternative 4: Additional Snag and Lynx Habitat Action

There will be no direct or indirect effects to heritage resources under this alternative.

4.44 Economic Effects

Economics is not a critical issue for this analysis. It is, however, useful in displaying a comparative value for the alternatives. Beside market costs and benefits related to timber removal, there are many other non-market benefits from the project. The primary benefit is proposed treatment of aspen and sagebrush areas. The comparison table displays number of acres that would be treated for each alternative. In the comparison table the NEPA cost is assessed wholly to the economic benefit of timber removed. In reality the NEPA cost will help accomplish the other non-market benefits, such as aspen and sagebrush treatment

Table 4.25 Economic Comparison

	Alternative 1	Alternative **2**	Alternative 3	Alternative 4
Net Volume (CCF)	0	3600	4800	2000
Gross Revenue (Sawlog Standard Rate Value)	0	$241,800	$322,400	$134,000
Gross Revenue (Sawlog Appraised Value)	0	$270,864	$361,152	$150,480
Gross Revenue (Sawlog Bid Value)	0	$276,912	$169,216	$144,070

Gross Revenue (Average of bid value and standard rate value)	**0**	**$259,356**	**$345,808**	**$144,070**
Projected NEPA Costs	-$114,000	-$114,000	-$114,000	-$114,000
Projected sale preparation and harvest administration costs	0	-$118,800	-$158,400	-$66,000
Returns to County	0			
Returns to Rds. and Trails Fund	0			
Net Revenue (Gross Revenue – Costs)	**-$114,000**	**+$26,556**	**+$73,408**	**-$35,390**
Aspen Treated	0	40	1,030	1,010
Sagebrush Treated	0	0	585	585

Alternative 3 aspen acres based on 90% treatment over 1008 acres plus 123 acres harvest.
Alternative 4 aspen acres based on 90% treatment over 1008 acres plus 103 acres harvest.
Sagebrush acres based on 50% treatment over 1169 acres.

Revenues:
Standard Rates for 2000 and 2001 ranged from $44.00 to $82.00/CCF ($88.00 to $164.00/MBF) for live mixed conifer sawlogs. The average value of $67.17/CCF ($134.34/MBF) is used as expected price in the analysis. For purposes of this analysis, dead sawtimber is not analyzed separate from live sawtimber. Comparable sale analysis of 16, 1999-2001, timber sales on the Bridger-Teton National Forest resulted in a range of *advertised rates* for mixed conifer live sawlogs from $20.00 to $101.52/CCF. The weighted average was: $75.24/CCF. *Actual sale bid rates* were determined from the bid rates of the high bidder on 16, 1999-2001, timber sales on the Bridger-Teton National Forest. The rates for mixed conifer live sawtimber ranged from $35.61 to $125.00. The weighted average was: $76.92/CCF.

Costs:
Estimates are based on Bridger-Teton National Forest 3-year historical average costs (FY 99-FY02).
Sale Preparation Cost: The costs of implementing harvest activities in Alternatives 2, 3 and 4 is estimated at $18.00 per CCF This includes other resource support, sale planning and layout, tree marking, cruising, contract preparation, and Forest Service associated costs for brush disposal, road work, and road maintenance.
Sale Administration Cost: The cost of administering timber sale contracts and ensuring compliance with contract provisions is estimated at $15.00 per CCF. This is based on 3 year Forest averages for 1999-2002.
Reforestation Cost: These costs would include tree planting, plantation protection and regeneration surveys to ensure adequate stocking levels. Not all areas harvested will require planting. Many are aspen regeneration sites, which rely on natural root suckering for regenerating aspen on the site. Many areas are partial cut areas which will rely on natural regeneration where needed.

Economic Effects of Alternatives on Local Communities:
Table 4.26 summarizes the number of employment years, value to community, and taxes generated from the proposed harvest of timber. Each employment year is an estimated person-year of employment and associated

income. Estimates do not necessarily represent new jobs and income but jobs and income that could possibly be sustained by harvesting timber at the level proposed in each alternative. The figure was calculated by multiplying the anticipated harvest volume in MMBF by 10.4 person years (TSPIRS). The economic value to the community was calculated by multiplying the anticipated timber volume harvested in MMBF by $519,000 (TSPIRS). Taxes generated were calculated by multiplying the economic value to the community by 15% (TSPIRS). These numbers are for planning purposes only and to display a fair comparison between alternatives.

Table: 4.26: Economic effects on local communities

Effect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Employment Years	0	18.7	25.0	10.4
Value to Community	0	$934,200	$1,245,600	$519,000
Taxes Generated	0	$140,130	$186,840	$77,850

Section 4.5 Cumulative Effects and Required Disclosures

Cumulative effects are discussed separately under each of the resource areas in this chapter. Listed below are the past, current and reasonably foreseeable actions that could lead to cumulative effects.

Cumulative Effects:

Timber Sales: Past harvest in the Cottonwood Creek analysis area is discussed in the CPIS as well as in Chapter 3 of this document. The Beaver Creek (9 to 10 miles north of Maki Creek area) plan implementation study and EA (1991) also analyzed past harvest levels and identified additional harvest opportunities. These studies found past and projected harvest levels to be in compliance with Forest Plan created opening standards.

The only active sales on the Big Piney Ranger District are in the Beaver Creek drainage, 9 to 11 miles to the north of the analysis area. There are 5 active sales with approximately 130 acres to harvest, all partial cuts, except for 16 acres. There are 2 thinning sales of approximately 50 acres that have been prepared and plan to be sold in FY 2003, pending lynx consultation. There is also on-going personal use and limited small firewood and post and pole offerings. On the Greys River Ranger District approximately 10 miles to the west and on the other side of the Wyoming Range, there are 2 sales on the 5-year schedule, in 2005 and 2006, for 200 acres.

The Cottonwood analysis originally scoped timber sale treatments in all of North and South Cottonwood Creeks. They will be analyzed further in a separate document. These projects, along with these proposed in the Maki Creek area, are reasonably foreseeable and are listed on the Bridger-Teton 5 year schedule as follows:

Table 4.27 Cottonwood Area Planned Timber Sales

Sale Name	Year	CC acres	PC acres	Aspen acres	Total acres
(Maki –proposal)	2004	0-20	60-150	40-123	163-273
South Cottonwood	2005	256	296	11	563
Halverson	2006	49	115	21	185
McDougal	2007	65	63		128
Sjhoberg	2008	16	38	28	82
Nylander	2009	0	50	8	58
There would be approximately 3 to 6 miles of temporary road needed to access the units. No new permanent road will be required. Some reconstruction on existing roads would occur, mainly to correct existing channel crossings. Planting of trees would occur on up to 450 acres.					

Grazing: Grazing is occurring in the analysis area and adjacent forest lands within levels allowed in the Forest Plan, in accordance with allotment management plans. Grazing also occurs on adjacent BLM and private lands. No increase in grazing levels or type of use is forecast in the reasonably foreseeable future.

Oil and Gas Activities*:* Forest lands in the analysis area and adjacent drainages have been leased for oil and gas development, and some development has taken place in the South Cottonwood drainage approximately 5 miles to the south of the Maki Creek area . No additional development is planned in the reasonably foreseeable future. Active exploration and development of natural gas resources is occurring on BLM and private lands to the east of the analysis area. This activity is primarily in sagebrush/grass vegetation types. The closest activity is approximately 5 miles away.

Recreation: The Maki Creek area is gated which limits recreational activity in this area to the occasional hunter. Recreational use of the remainder of the Cottonwood drainages occurs year-round. The trend in recreation use is upward and some new low-impact facilities will likely be built to accommodate the use, though there is no firm timetable.

Activities on adjacent BLM lands: Oil and gas leasing and grazing are the primary activities on adjacent BLM lands. No timber harvest has occurred.

Adaptive Management: There will be numerous opportunities for adaptive management based on new conditions or monitoring results for any future activities. For the planned timber harvests outside of the Maki Creek area over the next 5 years, further analysis will occur under NEPA. This analysis process will provide further opportunities for public involvement, modification of proposals and further mitigation as needed to conserve or protect critical resources. For timber harvest activities planned in the Maki Creek area, there will be opportunities to modify proposals during timber sale layout and contract preparation and following contract award through modification, suspension or termination of the contract. As an example, existing timber sale contracts on the Bridger-Teton N.F. have twice had operations delayed to complete analysis for lynx

conservation and one sale had modifications to operations to conserve habitat.

Prescribed burn proposals can be modified as burn plans are developed. Burning will likely take place over 2 or more seasons. Later burns can be modified, based on results of first efforts.

Other Required Disclosures:
This section contains disclosures or effects that are specifically required by Federal law, regulation or policy.

Endangered Species Act*:* The direct, indirect and cumulative effects upon listed species are described in Chapter 4 of this EA.

Clean Air Act*:* Prescribed burning on up to 2,177 acres of aspen and sagebrush is planned for Alternatives 3 and 4. This burning will take place in fire-dependent ecosystems in which periodic fires burned on an average of every 50 to 150 years. It has been more than 100 years since fire has occurred in these areas. Burning of fuels from slash associated with timber harvest (mostly slash pile burning) will take place on an additional 110 to 225 acres, depending on alternative. Any prescribed burning undertaken as part of this project will be managed to comply with State and Federal air quality regulations and control.

National Historic Preservation Act: See section 4, Heritage Resources for discussion.

Clean Water Act: Section 313 of the act as well as executive order 12088 requires Federal Agencies to comply with all Federal, state and local requirements for control and abatement of water pollution. Timber sale and prescribed burning activities proposed for this project will comply. Timber sale contract provisions regarding prevention and containment of oil and fuel spills will be included. No harvesting operations will be occurring within 300 feet of streams.

Prime Farmland, Rangeland and Forest Land: All alternatives to this project are in accordance with the Secretary of Agriculture Memorandum 1827 for prime farmland, rangeland and forestland. The definition of prime forestland does not apply to National Forest land. National Forest lands will be managed in accordance with Forest Plan Standards and Guidelines and best management practices. Any timber sale or burning operations conducted on National Forest land will be conducted with coordination and sensitivity to adjacent private and public lands.

Energy Requirement and Conservation Potential: Alternative 1, No Action, will require no energy directly to implement. The energy required to implement the action Alternatives 2 – 4, in terms of petroleum products, is negligible when compared to national and worldwide petroleum reserves. Prescribed burning on up to 2,177 acres as proposed in Alternatives 3 and 4 would require far less petroleum products compared to mechanical treatment of these same areas.

Equal Employment Opportunity and civil rights: The USDA prohibits discrimination in all its programs and activities, including this proposal, on the basis of race, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. Persons with disabilities who require alternative means for communication of program information (Braille, large print, audio tape, etc) should contact USDA's TARGET center at 202-720-2600 (voice and TDD). The civil rights or civil liberties of any American citizen

including women and minorities, are not differentially affected by the implementation of any alternatives, including the no action alternative.

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Bldg, 1400 Independence Ave, SW Washington D.C. 20250-9410, or call 202-720-5964.

Wetlands and Floodplains: Use of existing stream crossings of Maki, Little Maki and N. Cottonwood Creeks under the action alternatives may cause minor, mitigatable effects to riparian, wetlands and floodplains. No new crossings of streams are planned. Mitigation work to improve existing crossings will be implemented as needed for each alternative. No timber harvest activities or lighting of prescribed burns will take place within 300 feet of streams. No net loss of wetlands is anticipated.

Unavoidable adverse environmental effects and maintenance of long-term productivity: Some minor adverse effects on components of the ecosystem cannot be avoided even with selection of the no action alternative. The action Alternatives (2 – 4) are designed to bring forest conditions closer to properly functioning conditions based on naturally occurring disturbance regimes. The range of alternatives, mitigation measures and management requirements are designed to avoid or reduce environmental effects and insure that long-term productivity is not impaired by short-term uses and management practices. Short-term adverse disturbance impacts to wildlife and watershed condition would not be completely avoided. The various resource sections in Chapter 4 provide more information on the type, duration and scope of impacts, as well as resource benefits.

Conflicts with other agency goals and objectives: Consultation with other agencies indicates that there are no major conflicts between this proposed action and the goals and objectives of other government entities. Consultation has been ongoing with the Wyoming Game and Fish Department personnel to achieve conditions beneficial to big game populations and management in the area. Coordination with the Bureau of Land Management and adjacent private landowners will be required during proposed prescribed burning planning and operations. Coordination will also take place for use of project access roads crossing private and BLM lands.

Chapter 5 Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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U.S. Fish and Wildlife Service
Wyoming Game and Fish Department
Wyoming State Historic Preservation Office
Wyoming Office of State Lands and Investments – Forestry Division
Wyoming Department of Agriculture
Wyoming State Planning Office
Wyoming Department of Environmental Quality – Water Quality Division
Wyoming State Trails Program
Wyoming State Forestry
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5 Consultation and Coordination

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Distribution of the Environmental Assessment

This environmental assessment or summary has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views.

The EA or summary was sent to the following agencies, organizations, and individuals:

Congressional Delegation

U.S. Representative
Barbara Cubin

U.S. Senator
Craig Thomas
Michael Enzi

Federal Government

USDI, U.S. Fish and Wildlife Service

State, County and City Agencies

See above.

A Appendix A - Maps

Appendix A - Maps

Appendix B - Biological Evaluation

INTRODUCTION

The Bridger-Teton Forest Land and Resource Management Plan establish programmatic Direction for various resource activities including goals, objectives, standards and guidelines. Portions of the Forest have been identified where activities can occur. Even though lands may be suitable for these activities to occur, depending on the location, other resource objectives may take precedence. The decision on what projects will be implemented, where and under what management system will be made based on this environmental analysis.

Resource activities on National Forest System Lands is conducted in accordance with applicable Agency regulations, policies, and federal laws including Endangered Species Act (ESA), National Forests Management Act (NFMA), Clean Water Act, National Historic Preservation Act and Treaties with American Indian Tribes. Planning and decision making is done at the Forest Plan level and site-specific implementation is done at the project level. Compliance with the National Environmental Policy Act (NEPA) is necessary at each of these two stages.

This Biological Evaluation was prepared to display the possible effects to Intermountain Region Sensitive Species known to occur, that may occur, or may be affected by activities authorized by the selected alternative for the Maki Creek area projects.

PROPOSED ACTION

The proposed action is the preparation of an Environmental Assessment for vegetative treatment projects (prescribed burning, partial cuts, clear cuts and thinning) occurring in the Maki Creek area. The Maki Creek area is part of the Cottonwood Management Area (MA 25) which is a 5th level HUC. This corresponds to the Cottonwood Creek Lynx Analysis Unit (LAU). The evaluation will consider implementing different activities to best meet the Desired Future Condition as defined by the Bridger-Teton Land and Resource Management Plan and the specific results of those actions on Sensitive Species.

The decisions to be made are what projects will be selected and implemented. Location of the projects is located approximately 35 miles north east of the town of Big Piney in the Wyoming Mountain Range. All projects fall entirely within Management area 25, Community Interest area 7 (Big Piney), and include Desired Future Condition area 1B, 10 and 12 as defined by Bridger-Teton Land and Resource Management Plan.

Specifically, Alternative 3 proposes:

- Timber harvesting to achieve desired conditions on 150 acres of conifer forest. This is all accomplished with “partial cutting”. Harvest on 55 of these acres is planned to facilitate prescribed burning on adjacent aspen and sagebrush areas.

- Aspen regeneration, rejuvenation of sagebrush/grass communities and fuels reduction treatments on 2,300 acres using primarily prescribed fire with some mechanical methods. Within this treatment area

there are 1,131 acres of aspen with over 90 percent with conifer intrusion and 1,169 acres of sagebrush/grass community types. Removal of commercial conifer trees on 123 [38] acres of mixed aspen/conifer forest types will be allowed to facilitate aspen regeneration. The harvest operation will provide fuels to facilitate post-harvest prescribed burning. Burning operations will be conducted during conditions that will favor a mosaic burn across the treatment area. A major objective of this treatment is improved spring dispersal of elk from the nearby Jewett winter feedground.

There are currently 1,749 acres of partial, clear cuts and 69 acres of wildfires that have not reforested to 225 stems per acre and have a vegetative height (dbh) of 12 feet. This criterion was used solely for lynx and snowshoe hare habitat and is very conservative when doing assessments for Sensitive Species within the watershed. All of the "disturbed" acres have reforested to Forest Plan Standards and Guidelines, but do not meet the Lynx Conservation Assessment and Strategy (LCAS). The Lynx narrative is covered within the Biological Assessment for Threatened, Endangered and Proposes Species.

SENSITIVE SPECIES- "Other Than Plants"

There are a total of 5 mammal, 1 reptile/amphibian, 13 bird, 5 fish, and species on the Region 4 Sensitive Species List. Of these, there are 5 mammal, 1 reptile/amphibian, 9 bird, and 3 fish species that are known or suspected to occur on the Bridger-Teton National Forest. Habitat requirements for each of these eighteen species are described in the Species Narrative(s).

Sensitive species are those species for which population viability is a concern as evidenced by a significant existing or predicted downward trend in population number or density, or, a similar downward trend in habitat capability that would reduce a species existing distribution. Sensitive species are managed under authority of the National Forest Management Act and are administratively designated by authority of the Regional Forester. U.S. Department of Agriculture regulations and Forest Service Manual direction provide for habitat protection in an attempt to prevent species population or habitat declines to the point of need for listing as threatened or endangered.

A sensitive species is defined as those plants and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:

1) Significant current or predicted downward trends in population numbers or density or
2) Significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670.5).

The Forest Service objective for sensitive species management is to "develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions" (FSM 2670.22). There are numerous sensitive species that do or could occur within the analysis area.

The following species designated as sensitive by the Intermountain Regional Forester may occur or be impacted by activities in the Cottonwood watershed

[38] These are the areas from the plots made in GIS and maps.

B Biological Evaluation

Table 1 Forest Service, Region 4 Sensitive Species and their habitats.

Common Name *Scientific Name*	Habitat Requirements Presence or Absence
Spotted Frog *Rana pretiosa*	Fish-free, spring fed creeks and ponds; **Habitat is present in the project area**
Peregrine falcon *Falco peregrinus*	Far ranging flier, lives, roosts in /on cliffs; **Habitat is not present within the area.**
Common Loon *Gavia immer*	Breeds in lakes greater than 9 acres; **Habitat is not present**
Trumpeter Swan *Cygnus buccinator*	Breeds in remote marshes, lakes, and ponds 5-10 acres or larger; **Habitat not present within project area**
Harelequin Duck *Histrionicus histrionicus*	Undisturbed, low gradient, meandering mountain streams; **Habitat not present within project area**
Boreal Owl *Aegolius funereus*	High elevation spruce-fir forests; **Habitat is present within project area**.
Flammulated Owl *Otus flammeolus*	Breeds in mature open canopied aspen and Douglas-fir or mixed coniferous/deciduous forests; **Habitat is present in project area**
Great Gray Owl *Strix nebulosa*	Mature coniferous and mixed coniferous forests interspersed with small clearings; **Foraging habitat is present within the project area**
Northern Goshawk *Accipiter gentilis*	Mature coniferous and mixed coniferous forests interspersed with small clearings; **Foraging habitat is present within the project area**, no observations during two year survey.
Greater Sage Grouse *Centrocercus urophasianus*	Mixed seral stands of sagebrush; **Habitat is present but is not targeted for treatment.**
Three-Toed Woodpecker *Picoides tridactylus*	Mature conifer and mixed conifer forests; capitalizes on dead standing timber left by stand replacing fires; **Habitat is present**
Spotted Bat *Euderma maculatum*	Caves, roosts in rock crevices on steep cliff faces; **Habitat is not present in project area**
Pygmy Rabbit *Brachylagus idiahoensis*	Mature heavy old growth Great Basin Sagebrush;**Habitat is not present within the project area.**
Western Big-Eared Bat *Plecotus townsendii*	Hibernates in caves, rock outcrops, and mine shafts; roosts in hollow trees and snags; **Potential roosting habitat not present; no known hibernacula present**; no observations
Wolverine *Gulo gulo*	Generalist, utilizes a variety of habitats spanning all elevations; needs large roadless areas (36-250 mi2); **Habitat is present in project area**. Species not present in project area.
Fisher *Martes pennanti*	Mature and old growth forest, closed canopy coniferous forests at mid- to lower elevations; may be limited by snow depth; **habitat is not present in project area**. Species not present in project area.
Fine Spotted Cutthroat Trout *Oncorhynchus clarki spp.*	Lakes and Streams, cool, clear, well oxygenated streams; gravel for spawning; **Spawning habitat is not present in project area**
Colorad River Cutthroat Trout	Lakes and streams, cool, clear, well oxygenated streams; gravel for spawning;

Oncorhynchus clarki pleuriticus	**Spawning habitat is present in project area**

None of the following species have been documented or are expected within the project area and will not be discussed further:

- Common loon and trumpeter swan require lake habitat, which is not present in the project area. The closest trumpeter swans have been confirmed breeding on lakes in the Upper Green area and Gros Ventre area.

- Harlequin duck require low gradient streams with woody debris and dense, shrubby riparian areas. Existing streams would provide marginal harlequin duck habitat. The closest breeding harlequins are found in Pine Creek which empties into Fremont Lake, Pinedale Ranger District.

- Townsend's big-eared and spotted bats will forage in a variety of habitats, but require cliffs, caves, abandon buildings or mine shafts for roosting. This type of roosting habitat is not found in the project area. They may also roost under loose bark of trees. In Wyoming, known distribution of Townsend's big-eared bat averages 7000 feet elevation and known distribution of spotted bats averages less than 4000 feet elevation. The project area elevation ranges from 7975 to 9075 feet. Additionally, in Wyoming, spotted bats are only known to use juniper shrublands and sage-brush grasslands, whereas Townsend's big-eared bats use a variety of habitat types including dry coniferous forests (Luce et al. 1999).

- The Greater Sage Grouse is commonly found from central Colorado to Wyoming. It prefers mixed seral stages of sagebrush. There are not sufficient acres of habitat to sustain a viable population of sage grouse within the area and it is not targeted for treatment.

- Pygmy rabbit(s) are found in Giant Great Basin Sagebrush. There is not any of this habitat in the analysis area.

- Peregrine falcon will forage in a variety of habitats, but require large cliffs for nesting. Peregrines most commonly nest on large cliffs under 9500 feet in elevation, and closely associated with open water, wetlands, and riparian habitat. No cliffs are found in or near the project area.

- The Snake River fine spotted trout inhabits the Snake River from above Jackson Lake in Idaho and Wyoming. It also inhabits tributaries of the Snake River from the Gros Ventre to Salt Rivers. The project area is outside the Snake River drainage so there will be no impact to the Snake River fine-spotted cutthroat trout

The following is documentation of effects and conclusions for determining effects.

Suitable habitat exists for spotted frog, boreal owl, flammulated owl, three-toed woodpecker, wolverine, fisher, northern goshawk, great gray owl and Colorado River Cutthroat Trout. Potential impacts to these species and their habitats are discussed below.

Colorado River cutthroat trout

Colorado River cutthroat trout are found in relatively silt free cool mountain streams. The cutthroat has a tendency to interbreed and be out competed for favorable habitat. They require cobble, pebble and relatively moderate stream gradients to spawn. Though habitat is present within Maki Creek, none of these fish have been inventoried within the stream reach. The proposed vegetative treatment and associated activities "**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".**

Spotted frog

Potential habitat exists within the analysis area, though the spotted frog has never been documented within the analysis area.

Spotted frog habitat primarily includes oxbow ponds (without fish) with emergent sedges (Carex sp.) located in wet meadows at the edge of lodgepole pine (Pinus contorta) forest. Frogs move considerable distances from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and shrub lands of sagebrush and rabbit brush.

Riparian areas often provide critical breeding, foraging, and over wintering habitats for amphibians such as spotted frogs. These areas also provide migratory or dispersal corridors. Because riparian areas are usually preferred by livestock, grazing is likely to have a number of direct and indirect impacts to amphibians. Impacts include direct mortality from trampling, habitat alteration by removal or reduction of herbaceous and shrub cover, stream bank collapse, soil compaction, and water contamination and eutrophication (Maxell 2000). Timber harvest or fire can impact habitat through direct destruction and/or fragmentation.

If watersheds and the riparian/wetland areas within watersheds are in properly functioning condition, spotted frog habitat should be protected. Therefore, those watersheds currently not functioning, or functioning at risk, are probably not providing suitable habitat for spotted frogs should they occur. Wetlands, ephemeral ponds, and intermittent streams and a minimum 300' buffer should be protected from management impacts. Larger buffers maybe necessary depending on adjacent habitat and the magnitude of threats (Patla 2000).

Amphibians in general are very susceptible to chemical contamination. The effects range from direct mortality to sublethal effects such as depressed disease resistance, inhibition of growth and development, decreased reproductive ability, inhibition of predator avoidance behaviors, and morphological abnormalities. If chemicals such as herbicides or road treatments are utilized, they should not be applied within 100 meters of water bodies or wetlands (Maxell 2000). Accidental spills are also a potential threat.

In addition to spotted frogs, boreal toads and leopard frogs maybe present in the project area. Both species are "species of special concern" in Wyoming. Protection of wetlands, ephemeral ponds, intermittent streams, and a minimum 300' buffer from management impacts should also protect boreal toads and leopard frogs and their habitat.

The proposed activities will not be conducted within riparian or wetland areas. There will **be "no impact"** on the spotted frog or habitat.

Flammulated owl

Flammulated owls have not been documented on the Big Piney Ranger District. This owl prefers old growth ponderosa pine (>150 years) habitat, but will also utilize Douglas-fir, aspen, and/or limber pine. Douglas-fir, aspen, and limber pine are present within the project area. Flammulated owls are secondary cavity nesters that primarily feed on nocturnal lepidopteron moths, which they glean from the foliage. The two key habitat features that may limit flammulated owl populations are availability of nest cavities and sufficient prey, particularly beetle, grasshoppers, and moths (McCallum 1994). In the Intermountain west, suitable habitat is characterized by open stands of mature Douglas fir maintained by frequent, low intensity fires. Aspen habitats may also be used for nesting and foraging. These owls appear to prefer older, fairly open forests. Management recommendations (Verner 1994) includes: implement uneven-age management and provide snags for meeting nesting requirements. Live trees must also be preserved in harvest areas to provide for future snags.

Threats to this specie are mostly from habitat modifications such as timber or fuelwood removal and fire suppression (Groves et al 1997). Snag and other dead timber removal as sawtimber and fuelwood will reduce available habitat. Clear cutting in old growth will eliminate any use by these owls. Forest Plan snag management guidelines will be followed to minimize potential impacts to this specie. Douglas-fir and aspen stands in the project area are proposed for treatment. There will be minimally impact to this species due to the location of the proposed activities and the abundance of older stands within the watershed.

Flammulated owls occur in old-growth (>200 years) and mature (>150 years) ponderosa pine and ponderosa-douglas fir forests, often mixed with mature aspens (Richmond et al., 1980). Their preferred habitat includes mixed conifer-ponderosa forest with some undergrowth and near the edges of open grassland areas. They area normally found between 4,500 feet to 7,800 feet and nest in snags, usually in old woodpecker cavities. This species is considered a summer resident in Sublette County, possibly migrating through the lowlands in the spring and through the mountains in the fall. The project area does not contain any ponderosa pine. Suitable habitat for this species is not found in the project area and there will be **"no impact"** to this species.

Boreal owl, three-toed woodpecker, great gray owl, goshawk

These species inhabit montage stands of coniferous, deciduous and mixed trees. No survey work has been done for boreal or great gray owls within the analysis area, but suitable habitat exists, and lack of documented

sightings is probably the result of lack of survey efforts. Minimal survey work has occurred for three-toed woodpeckers (present) and goshawk (two years of inventory).

Boreal owls

These owls have been documented to the west along the Grey's River. All breeding sites were above 2100 meters or approximately 6900 feet (Clark 1994). According to the Wyoming Game and Fish Department Wildlife Observation System database (WGFD WOS), boreal owls were also located at the southern end of the Big Piney District near La Barge Guard Station (Kemmerer Ranger District). The boreal owl prefers high elevation spruce-fir forests or aspen for foraging and nesting. Nesting habitat structure consists of forest with a relatively high density of large trees, open understory, and multi-layered canopy. The boreal owl is a secondary cavity nester that is generally associated with mature and old spruce-fir forests. As a secondary cavity nester, boreal owls rely on woodpeckers (mainly northern flickers in this area) to excavate snags and decaying trees, which they subsequently use for nesting and roosting. Clark (1994) conducted extensive owl surveys within the Greys River drainage and found that boreal owls were mainly found in spruce fir habitat between 2100 – 2600 m (6800 – 8500 ft). Owls were detected in multi-layered stands with high structural complexity, usually close to small wet meadows with complex perimeters (Clark 1994). Boreal owls primarily prey on small mammals, particular red-backed voles.

This species begins nesting in late March, prior to any proposed activity within the project area; there will be **"no impact"** to this species.

Three-toed woodpeckers

Three toed woodpeckers have been documented in the Maki Creek area. These woodpeckers require snags in coniferous forests for nesting, feeding, perching, and roosting. In Wyoming forests, the three-toed woodpecker is found in only large, unbroken stands of mature spruce-fir and lodgepole pine. Snags with DBH of 12-16 inches and heights of 19.6 to 39.4 feet are preferred (USFS 1991). This woodpecker forages on insects, mainly in dead trees, but will also feed in live trees. The three-toed woodpecker is primarily associated with recent coniferous forest burns and bark beetle infestations in lodgepole pine and spruce-fir habitats (Hoffman 1997, Hutto and Young 1999). They excavate a new cavity annually for nesting. In the GYA, Hoffman (1997) found that three-toed woodpeckers preferred to nest in moist, coniferous forests in relatively gentle terrain.

Three-toed woodpeckers forage primarily on bark beetles, which they secure by scaling the bark from trees. They prefer to forage on scaly barked trees, which in this area include lodgepole pine and spruce. Murphy and Lehnhausen (1998), observed that woodpecker species differed in the burn severity of the trees they selected for foraging, with three-toed woodpeckers selecting lightly to moderately burned trees, black-backed woodpeckers selecting moderately to heavily burned trees, and hairy woodpeckers selecting heavily burned trees.

Threats to these species are mostly from habitat modifications. Any removal of timber reduces potential nesting sites and foraging habitat for these species. The proposed activities with regards to vegetation removal could have an effect on some individuals of Northern three-toed woodpecker. Of the 18,171 acres of suitable habitat (Forest Plan designated old growth, Spruce Fir 3, Lodgepole 3 and Douglas Fir 3), 273 acres will be treated. With over 75 percent of the project's timbered vegetation 100 years or older, recruitment into the old, mature age classes over the next 20 – 30 years will offset the acres harvested. Therefore the proposed activities from

timber harvesting "**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".**

Great gray owl

No documented sightings of great gray owls exist for the Big Piney District. In the adjacent Greys River drainage, great gray owls were mainly found between 2000 to 2400 m (6500 to 7800 ft) in lodgepole pine stands close to wet meadow complexes (Clark 1994). The great gray owl uses mixed coniferous forests usually bordering small openings or meadows. Semi-open areas, where small rodents are abundant, near dense coniferous forests, for roosting and nesting, is optimum habitat for the great gray owls. Broken top snags, stumps, dwarf-mistletoe platforms, or old hawk and raven nests are utilized for nesting. We expect these birds are present.

The great Gray Owl is found in coniferous forests and muskeg. It creates a hugh nest of sticks in dense conifer trees. Like other owls of the far north, this species hunts during the day, often watching its prey from a low branch. It spends much of it's time in dense conifer timbered stands, its often overlooked and not easily seen. It is an extremely elusive species.

Threats to these species are mostly from habitat modifications. Any removal of timber reduces potential nesting sites and foraging habitat for these species. The proposed activities with regards to vegetation removal could have an effect on some individuals of Northern goshawk, Great gray owl and Northern three-toed woodpecker. Of the 19, 018 acres (40 percent of project area) of suitable habitat (Forest Plan designated old growth, Spruce Fir 3, Lodgepole 3 and Douglas Fir 3), 273 acres will be treated. With over 75 percent of the project's timbered vegetation 100 years or older, recruitment into the old, mature age classes over the next 20 – 30 years will offset the acres harvested. Therefore the proposed activities from timber harvesting **"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".**

Northern goshawk.

Goshawks tend to select stands with relatively large diameter trees and high canopy closure for nesting (Siders and Kennedy, Daw et al.1998). In south-central Wyoming and northeastern Utah, nest tree species were mainly lodgepole pine and aspen, but Douglas fir, Engelmann spruce, and subalpine fir are also used (Squires and Ruggiero 1996, USFS unpublished data). Goshawks selected moderate slopes (range 1-34%) for nesting, but showed no preference for aspect (Squires and Ruggiero 1996). On the Targhee Forest in southeast Idaho, goshawks also used Douglas fir and lodgepole pine for nesting and again selected moderate slopes (0-47%) on northerly and westerly aspects for nest sites (Patla 1997). Nest sites are often close to a perennial water source.

Goshawks exhibit high nest site fidelity and may maintain several alternative nest sites within a territory. They typically return to their breeding territories in late-March or April and lay eggs in May. The chicks hatch by mid-June, fledge by late-July and are generally independent by early September. Goshawks prey upon a variety of small and medium sized mammals (e.g. red squirrels, snowshoe hares) and birds (e.g. woodpeckers, grouse, jays, etc.), which they hunt from perches. Stands with pole size diameter trees and larger tend to be suitable for

hunting (Hayward et al. 1990).

All habitat needs for goshawk are present within the project area. Threats to these species are mostly from habitat modifications such as timber or fuelwood removal and roading. Snag and other timber removal as fuelwood and sawtimber will also reduce available habitat for these species.

The northern goshawk is a forest hawk showing a strong preference in this portion of Wyoming for nesting in mature aspen stands near the bottom of stream courses. Shuster (1980) found nest sites to have an affinity for gentle slopes on north and east aspects. Goshawks are primarily a bird of dense, mature timbered stands although they occasionally hunt in open meadows near mature forest. Out lying area to the south and southwest does contain mature aspen and mixed conifer forest. This species begin nesting in late March. A two year survey was completed for Northern goshawk with no observations. Suitable habitat for all four species exists within or adjacent to the project area.

Threats to this species are mostly from habitat modifications. Any removal of timber reduces potential nesting sites and foraging habitat for these species. The proposed activities with regards to vegetation removal could have an effect on some individuals of Northern goshawk. Of the 19, 018 acres (40 percent of project area) of suitable habitat (Forest Plan designated old growth, Spruce Fir 3, Lodgepole 3 and Douglas Fir 3), 273 acres will be treated. With over 75 percent of the project's timbered vegetation 100 years or older, recruitment into the old, mature age classes over the next 20 – 30 years will offset the acres harvested. Therefore the proposed activities from timber harvesting **"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".**

Wolverine and Fisher

The wolverine is the largest terrestrial member of the weasel family. Its range extends from the arctic islands southward to the central Rockies, but its present status in the southern part of its range is uncertain (it may be extinct in Colorado). Wolverines are mammals of heavy forest but they may range past treeline into alpine tundra or inhabit subalpine rock piles. They are solitary animals, using 56 to 73 square miles of territory (females-males). Lack of human disturbance is an important component for wolverine habitat. Wolverines inhabit high mountain forests of dense conifers; primarily in true fir (Abies) cover types as well as subarctic-alpine tundra. They are widespread, but occur in low densities. They are difficult to observe so frequency of sightings may not reflect population size. Maintenance of wolverine populations is dependent on large areas free from land-use activities that permanently alter their habitat (Ruggiero et. al. 1994). They seasonally move between higher and lower elevations in search of food. In the winter, a large part of their diet includes big game carrion (Banci 1994), but they also feed on a variety of small mammals and birds (Hash 1987). In central Idaho, Copeland and Hudak (1995) reported that wolverines preferred mature montane forest in association with subalpine rock and screen habitats. Home range sizes of wolverines in central Idaho ranged from 80 to 700 square kilometers for females to maternal and natal dens and are an important feature of fisher habitat. Fisher primarily preys upon small mammals such as red-backed voles, red squirrels, and snowshoe hares, but larger species such as beaver are also taken occasionally (Witmer et al. 1999).

Fishers are boreal weasels closely associated with conifer forests, especially those dominated by spruce-fir and

containing complex physical structure near the ground (Buskirk and Powell 1994). Due to their denning and foraging needs, they prefer old growth or late successional forests but may also inhabit talus fields above treeline. They tend to avoid open spaces, as a result of predation pressures, and are rarely found below the lower elevational limit of trees.

There are no documented sightings on the Bridger-Teton National Forest, either historic or recent. In addition, the WYNDD does not contain any observations of fishers. However, no formal surveys have been conducted. Potential habitat exists.

Threats to these species are mostly from habitat modification such as timber removal and road building. Both species require secure areas relatively free of human activity. Timber harvest can lead to habitat destruction, modification or fragmentation for these species.

No known occurrence of wolverine or fisher has been documented in the analysis area. The proposed action will likely have **"no impact"** on habitat, individuals, a population, or these species.

Table 2. Determinations of Fish and Wildlife Species

Common Name *Scientific Name*	Habitat Requirements Presence or Absence	Determination
Spotted Frog *Rana pretiosa*	Fish-free, spring fed creeks and ponds; **Habitat is present in the project area**	**"No Impact"**
Peregrine falcon *Falco peregrinus*	Far ranging flier, lives, roosts in /on cliffs; **Habitat is not present within the area.**	**"No Impact"**
Common Loon *Gavia immer*	Breeds in lakes greater than 9 acres; Habitat is not present	**"No Impact"**
Trumpeter Swan *Cygnus buccinator*	Breeds in remote marshes, lakes, and ponds 5-10 acres or larger; Habitat not present within project area	**"No Impact"**
Harelequin Duck *Histrionicus histrionicus*	Undisturbed, low gradient, meandering mountain streams; Habitat not present within project area	**"No Impact"**
Boreal Owl *Aegolius funereus*	High elevation spruce-fir forests; **Habitat is present within project area**.	**"No Impact"**
Greater Sage Grouse *Centrocercus urophasianus*	Mixed seral Stages of Great Basin Sagebrush; Habitat is present in the project area.	**"No Impact"**
Flammulated Owl *Otus flammeolus*	Breeds in mature open canopied aspen and Douglas-fir or mixed coniferous/deciduous forests; Habitat is present in project area	**"No Impact"**
Great Gray Owl *Strix nebulosa*	Mature coniferous and mixed coniferous forests interspersed with small clearings; Foraging habitat is present within the project area	**"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".**
Northern Goshawk *Accipiter gentilis*	Mature coniferous and mixed coniferous forests interspersed with small clearings; Foraging habitat is present within the project area, no observations during two year survey.	**"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".**
Three-Toed Woodpecker *Picoides tridactylus*	Mature conifer and mixed conifer forests; capitalizes on dead standing timber left by stand replacing fires; Habitat is present	**"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".**
Spotted Bat *Euderma maculatum*	Caves, roosts in rock crevices on steep cliff faces; Habitat is not present in project area	**"No Impact"**
West. Big-Eared Bat *Plecotus townsendii*	Hibernates in caves, rock outcrops, and mine shafts; roosts in hollow trees and snags; Potential roosting habitat not present; no known hibernacula present; no observations	**"No Impact"**
Pygmy Rabbit *Brachylagus idahoensis*	Commonly found in Giant Sagebrush in the Great Basin; Habitat is not present in the project area.	**"No Impact"**
Wolverine *Gulo gulo*	Generalist, utilizes a variety of habitats spanning all elevations; needs large roadless areas (36-250 mi2); Habitat is present in project area. Species not present in project area.	**"No Impact"**
Fisher *Martes pennanti*	Mature and old growth forest, closed canopy coniferous forests at mid- to lower elevations; may be limited by snow depth; habitat is not present in project area. Species not present in project area.	**"No Impact"**
Fine Spotted Cutthroat Trout *Oncorhynchus clarki spp.*	Lakes and Streams, cool, clear, well oxygenated streams; gravel for spawning; Spawning habitat is not present in project area	**"No Impact"**
Colorado River Cutthroat Trout *Oncorhynchus clarki pleuriticus*	Lakes and streams, cool, clear, well oxygenated streams; gravel for spawning; Spawning habitat is present in project area	**"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".**

SENSITIVE SPECIES - Plants

There are a total of 200 plants on the Region 4 Sensitive Plant List. Of these, there are 11 that are known or expected to occur on the Big Piney Ranger District, Bridger-Teton National Forest (Table 3).

Table 3. Sensitive Plant Species and their habitats.

SPECIES *Scientific Name* *Common Name*	HABITAT/COMMUNITY	ELEVATION	SUCCESSION	PHENOLOGY
Agoseris lackschewitzii Pink agoseris	Subalpine wet meadow, saturated soils	8500-10600	Mid to late	Flowering/Fruiting July-August
Androsace chamaejasme ssp. *carinata* Sweet-flowered rock jasmine	Montane rock crevices in rocky limestone or domolite soils	8500-10800	Mid to late	Flowering/Fruiting May-July
Aster mollis Soft aster	Sagebrush grasslands and mountain meadows in calcareous soils	6400-8500	Early to mid	Flowering/Fruiting July-September
***Astragalus paysonii* Payson's milkvetch**	Disturbed areas and recovering burns on sandy soil	6700-9600	Early	Flowering/Fruiting Jun-Aug/Jul-Oct
Descuraania torulosa Wyoming tansymustard	Sparely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone	8300-10000	Early to mid	Flowering/fruiting July-September
Draba borealis Boreal draba	Moist north-facing limestone slopes and cliffs and shady stream sides	6200-8600	Mid	Flowering/Fruiting Jun-Aug/Jul-Sep
Haplopappus macronema var. *linearis* Narrowleaf goldenweed	Semi-barren, whitish clay flats and slopes, gravel bars, and sandy lake shores	7700-10300	Mid to late	Flowering/Fruiting July-September
Lesquerella paysonii Payson's bladderpod	Rocky, sparcely-vegetated slopes, often calcareous substrates	6000-10300	Mid to late	Flowering/Fruiting May-August
Physaria integrifolia var. monticola *Creeping twinpod*	Barren, rocky, calcareous hills and slopes	6500-8600	Mid	Flowering/Fruiting Jun-Jul/Jun-Aug
Primula egaliksensis *Greenland primrose*	Wet meadows along streams and calcareous montane bogs	6600-8000	Mid	Flowering/Fruiting May-Jul/Jun-Aug

***Astragalus paysonii*, Payson's milkvetch, has been located within the project area within the Maki Creek drainage. It typically occurs on disturbed areas and in recovering burns on sandy soils. It has low palatability for grazing, requires disturbance to become established, and moderate to high vulnerability to fire suppression or competition with exotics. Other plant species that are designated as Sensitive, but are not known to occur in the project area include: Slickspot peppergrass.

Vegetation management can have both beneficial and adverse effects on Threatened, Endangered or Sensitive Species within the analysis area. The degree to which species are impacted depends on the management implemented and degree of overlap between these species habitats and management activities. A number of the above sensitive plants occupy unique microsites. Soft aster, Wyoming tansymustard, narrowleaf goldenweed, and creeping twinpod occupy more generalized habitats and are the most likely of the above species to be present.

Soft aster (Aster mollis), **Meadow milkvetch** (Astragalus diversifolius var. diversifolius), **Payson's milkvetch** (Astragalus paysonii), **Payson's bladderpod** (Lesquerella paysonii), **Creeping twinpod** (Physaria integrifolia var. monticola)

Payson's milkvetch is an early successional stage plant requiring disturbance to persist. Surveys by the Nature Conservancy have located populations of Payson's milkvetch in the project area. Areas where populations are located have been intensively managed for timber since the 1960's providing the required disturbance. There is a potential for loss of habitat, individuals, and populations due to advancing succession.

The proposed activities with regards to timber harvesting will provide the disturbance needed for the plant to persist. Therefore, the proposed activities will not likely result in a trend toward federal listing or cause a loss of viability to the population or species of Payson's milkvetch.

There are no historical records of the remaining sensitive plant species nor have they been located in the analysis area during survey work by the Nature Conservancy and Forest Service. However, other sensitive plants or their habitat could be present in the analysis area.

Based on available data, there will be no impact to Sensitive Plants other than Payson's milkvetch, which will be a **"positive or beneficial impact".**

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Appendix C - Summary stand exam data and Forest Vegetation Simulator information