CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter is organized by resources and presents the affected environment and the effects of the alternatives related to the purpose and need for the project (Section 1.3) and issues (Section 1.9.1). The affected environment and environmental consequences are included for selected resource areas related to issues identified by the public and the Forest Service. This chapter also presents the scientific and analytical basis for the comparison of alternatives presented in *Chapter 2, Alternatives, Including the Proposed Action.* Issues, as listed in Section 1.9.1, are referenced where relevant.

Direct, indirect, and cumulative impacts are presented in the environmental consequences discussions for issues presented in Section 1.9.1. The other resource areas also are discussed in this chapter, even though the effects of the alternatives on those resources would be minor, because disclosure of all effects must be discussed as per CEQ regulations (40 CFR 1502.16, p.475). Within a resource area, environmental consequences associated with Alternative A (No Action Alternative) are discussed first. This provides an environmental baseline or benchmark for comparison to Alternative B (Proposed Action) and Alternative C (Reduced Harvest and Temporary Roads). Table 3-1 lists the projects that were considered in the analysis of cumulative impacts. These include relevant projects that were among those listed in the July 1, 2004, to September 30, 2004, Schedule of Proposed Actions (SOPA) for the B-TNF, as well as relevant past and reasonably foreseeable future actions.

The CPIS presented existing and desired future conditions for resources in the analysis area (Forest Service 1993). The analyses presented below uses information presented in the CPIS, as well as new information collected since the CPIS was prepared.

TABLE 3-1
Projects Considered in the Cumulative Effects Analysis for the Cottonwood II Project

	Project	Location
1	Noxious weed prevention and control	Sublette County
2.	Hoback Ranches fire plan	Big Piney Ranger District and Sublette County approximately 20 miles northwest of project
3.	Lower Valley Energy Natural Gas Pipeline	Big Piney Ranger District and Sublette County approximately 20 miles north of project
4.	Maki Creek vegetation treatment	Maki Creek drainage adjacent to and north of the Cottonwood II Project
5.	Monument Ridge prescribed burn	Big Piney Ranger District and Sublette County approximately 20 miles north of project

TABLE 3-1
Projects Considered in the Cumulative Effects Analysis for the Cottonwood II Project

	Project	Location
6.	Wyoming Range (Taliaferro) Grazing Allotment Complex	Big Piney Ranger District and Sublette County
7.	Beaver Creek Timber Harvest	Beaver Creek Watershed 9 to 13 miles north of the project
8.	Road maintenance and recreation activities	Cottonwood II Analysis Area
9.	Domestic livestock grazing	Cottonwood II Analysis Area
10.	Past and potential timber harvests	Cottonwood II Analysis Area and Bridger-Teton National Forest
11.	Past and potential wild fires	Cottonwood II Analysis Area

3.1.1 Project Area Location and Management History

The analysis area encompasses the North and South Cottonwood Creeks drainages, which lie within Management Unit 25 (see Figure 1-2 in Chapter 1). Elevations range from approximately 8000 to 11000 feet, with annual precipitation ranging from 30 to 40 inches at low elevations to 50 to 60 inches at high elevations. Timber harvesting has occurred since 1919, when removal of trees for railroad ties, mine timbers, and saw timber began. Even-aged timber management was initiated in 1956. Major forest types in the analysis area include lodgepole pine stands and stands of spruce/fir. Large areas of aspen occur, as do non-forested habitats including sagebrush/grass and riparian types. Many species of wildlife reside in the analysis area including, mule deer, elk, moose, lynx, and black bear. Colorado River cutthroat trout and other sensitive species reside in the drainages, as do many native fish and introduced trout species. Dispersed recreation is popular and is supported by a network of roads. Livestock grazing is common throughout the drainages on a number of grazing allotments.

The following analyses are focused in the Halverson, Nylander, Sjhoberg, South Cottonwood, and McDougal Gap sub-watersheds. The analysis area includes approximately 48,541 acres and encompasses the Maki Creek drainage, which was analyzed separately in the Environmental Assessment for the Maki Creek Area Projects (Forest Service 2004b).

3.2 Forest Wildlife and Vegetation (Habitat) Resources

3.2.1 Introduction

Wildlife and vegetation are included in the same section because of the cause and effect relationships between them. These resource areas were identified in several issues in Section 1.9.1, *Significant Issues*. The issues are stated below. The affected environment

and environmental consequences are structured by issue. The discussions are organized around indicators as presented in Section 1.9.1.

3.2.2 Issues

The following two significant wildlife and vegetation issues were identified during public scoping:

- **Old Growth and Canada Lynx (Issue 1, Section 1.9.1).** The project area has been documented as occupied Canada lynx habitat. Effects of the proposed activities on lynx habitat should be addressed.
- **Big Game (Issue 2, Section 1.9.1).** The effects of the proposed activities on big game populations.

In addition to the two issues presented above, a significant watershed issue related to vegetation was identified (Issue 4, Section 1.9.1). Although that issue is mainly addressed in *Section 3.4, Hydrology, Soils, and Water Quality*, the wetland and riparian resource component is addressed in this section. Issue 4 is as follows:

- The effects of the proposed activities on the functions and values of watersheds including vegetation, wildlife, aquatic species, water quality, wetlands, and bank stability

Indicators by which the proposed project will be evaluated relative to these issues include the following:

- Issue 1
  - Estimated change in lynx foraging habitat from project activities
  - Estimated change in lynx denning habitat from project activities
- Issue 2
  - The direct and indirect effects of vegetation management on big game winter range
  - The direct and indirect effects of vegetation management on big game summer habitat
- Issue 4
  - Wetland/riparian impacts

3.2.3 Existing Conditions

The Cottonwood II analysis area consists of several forest vegetation types interspersed with large openings of sagebrush grasslands (Figure 3-1). Current vegetation types are influenced by soils, precipitation patterns, the broken topography of the east slope of the Wyoming Range, and the recent fire intervals. Forested vegetation is primarily lodgepole pine (*Pinus contorta*), mixed stands of subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), and aspen (*Populus tremuloides*). A small amount of Douglas-fir (*Pseudostuga menziesii*) and whitebark pine (*Pinus albicaulis*) forests exist in

the area. This variety of forested patches and openings with species and age class diversity provides cover and forage habitat for the diverse wildlife species discussed in the Wildlife Section.

3.2.3.1 Forested Vegetation

According to 1988 vegetation data used in the Forest Plan, the distribution of vegetation types in the Cottonwood II analysis area and relation to the B-TNF *Properly Functioning Condition* (PFC) *Assessment* (Forest Service 1997) is summarized in Table 3-2. The analysis area is dominated by lodgepole pine and sagebrush/grass vegetation types. The vegetation data are depicted in Figure 3-1.

TABLE 3-2
Properly Functioning Conditions for Cottonwood II Analysis Area

Type	Percentage of Analysis Area	Forest "Properly Functioning Condition" Notes
Lodgepole pine	34	Most lodgepole forests in the analysis area are in the mature and old age classes. Structural stages are not balanced throughout the forest. This includes mixed conifer forests with a significant subalpine fir component.
Sagebrush/grass	30	-
Low density mixed conifer	16	Only 10 percent of whitebark pine stands are in conifer (lodgepole seedling through mid-aged stages. Mostly limber/whitebark pine and high elevation stands spruce-fir/Douglas-fir)
Spruce/fir	11	Structural stages are not balanced throughout the Forest. The majority (70 percent or more) is in the mature to old age classes.
Aspen	8	85 percent of Forest aspen stands are mature or old. Very few 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.

The condition of vegetation in the analysis area was well described in the CPIS (Forest Service 1993). The data and information gathered during that study were used to develop the Proposed Action. Refer to Chapter 2, pages 1 to 6, of the CPIS (Forest Service 1993) for that information. This description is a summary of that information, stand exam data, and new information available since the CPIS study. Intensive stand exam data were 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 are available for review at the Big Piney Ranger District. In addition, 54 aspen community plots were taken in the summer of 2000. This information also is available in the project file.

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 lodgepole pine habitat types (see Table 3-2). 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

Figure 3-1 (front)

Figure 3-1 (back)

an understory or significant component of conifer vegetation. The CPIS (p. 4.1) identified 1,500 acres of aspen in need of treatment (Forest Service 1993). 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 *Section 3.3, Forest Fuels and Fires*, for a more detailed description of fire intervals). A majority of forested areas have not experienced fire disturbance for over 150 years. There were 2 large fires in the area. One was the Bare Creek burn, which covered 6,150 acres of the analysis 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. Much of this area is either classified as aspen or has greater than 40 percent slopes. The Bare Creek and Cottonwood areas are now reforested with a diversity of pole size trees, predominantly lodgepole pine, aspen, and diverse shrubs.

Forests in the analysis area are in similar condition as described in the Forest-wide Properly Functioning Condition (PFC) Assessment (Forest Service 1997). As with 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 75 percent of the forested stands in the analysis area are 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 because of dead and down trees.

Even though the *Aerial Insect and Disease Detection Survey* (Forest Service 1999a) did not show any new epidemic problems for the analysis area, medium to high hazards for damage from bark beetles in lodgepole and spruce are present in many stands. Most mapped insect and disease occurrence is currently at low levels and in isolated pockets. Mortality in subalpine fir resulting from western balsam bark and other beetles continued to be the major active insect problem, increasing slightly from the previous year. Several large pockets of beetle caused tree mortality, with the largest detected at approximately 1,000 trees. This, however, exists in a portion of the analysis area with no access. The damage in subalpine fir is compounded by recent dry weather and dense, older stand conditions. Some agents, such as dwarf mistletoe in lodgepole pine, which reduces the health and vigor of trees, occur throughout the area, but did 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.

By 2002, results of the *Aerial Insect and Disease Detection Survey* (Forest Service 2002a) indicated that populations of mountain pine beetle had concentrated in a number of National Forests, including the Bridger-Teton. An alert was published by the Forest Service in 2003 for mountain pine beetle in the Bridger-Teton, which stated that this species “continues to build in the interior west killing all species of pine” (Forest Service 2003c). The “2003 Forest Health Highlights – Wyoming” (Forest Service 2003d) mentions increasing mountain pine beetle numbers and subalpine fir mortality, noting “Mountain pine beetle populations in Sublette and Lincoln Counties also increased causing tree mortality . . . Insect and disease agents caused significant subalpine fir mortality on the Bridger-Teton and Shoshone National Forests.”

Approximately 23,388 acres of the Cottonwood II analysis area is classified as suitable timber in the Forest Plan. During the past 40 years, 2,227 acres within the total Cottonwood analysis area have been harvested, primarily with clearcut methods. The last active sales in the area were completed in 1993. Of these harvested acres, approximately 1,907 acres have regenerated sufficient trees to no longer be considered a created opening. The remaining 320 harvested acres (1.4 percent 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 from seed. Selective harvesting of trees for railroad ties ("tie hacking") occurred in the 1920s and 1930s 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.

Approximately 30 percent of the stands dominated by conifer are seral aspen stands. Sufficient aspen exist to successfully reestablish following disturbances, though aspen are rapidly declining with little suckering occurring. The conifers are growing into the crowns and overtopping aspen in most of these areas. The aspen stands are primarily aspen/subalpine fir community types with mountain snowberry and meadow rue understories. Aspen stands are at risk of being converted to conifer and/or losing vigor and reproductive capacity if not treated in the near future. They provide important transition range for elk moving off winter range and the nearby Jewett feedground. The area also serves as summer range for elk and deer. Approximately 675 elk that used the Jewett feedground in 2000/2001 can access the analysis area year round, but predominantly in spring, summer, and fall (Forest Service 2003a). Livestock will also graze in aspen stands. The Cottonwood analysis area includes portions of several livestock allotments with over 2,000 head of cattle and 3,000 head of sheep (Forest Service 1993).

Aspen–Conifer Stands

Wyoming Game and Fish personnel collected stand data for 40 aspen stands on 981 acres in the Maki area (Forest Service 2003a). In 27 of these stands, representing 87 percent 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 percent of the area the conifer overstory trees outnumbered and overtopped the aspen.

The aspen stands proposed for conifer removal generally have greater densities of older, larger (greater than 8 inches diameter at breast height [DBH]) conifer and flatter slopes and are more accessible to existing roads than those proposed for burning. Some of the aspen stands proposed for burning are located in designated roadless areas.

Treatment Areas

The proposed Cottonwood II Vegetation Management Project includes five treatment areas based on sub-drainages and timber compartment boundaries. These are listed in

Table 3-3. Table 3-4 is a summary of the stands proposed for treatment in the Cottonwood II Vegetation Management Project. A description of the forested vegetation in each of the five treatment areas follows.

TABLE 3-3
Treatment Areas in the Cottonwood II Vegetation Management Project

Treatment Area	Acres	Compartments	Forest Plan DFC
South Cottonwood: (includes West Fork Bare Creek, Trailer Creek, Lander Creek, and Hidden Basin Creek)	15,811	64, 65, 67, 68, 69, 70	1B
Halverson (includes Lower N. Cottonwood Creek)	4,556	56, 58	1B
McDougal Gap (includes Upper N. Cottonwood Creek)	4,548	51	1B, 10
Nylander	3,600	48	10, 1B
Sjhoberg	2,379	49	1B
Total	30,894		

TABLE 3-4
Summary of Conifer Stands Proposed for Treatment

Stand	Acres	Age	Forest Type	Stand size	Vegetation Size	Treatment Area
48-42	145	145	Lodgepole pine	Sawtimber	Large	Sjhoberg
49-16	21	191	Lodgepole pine	Sawtimber	Large	Sjhoberg
49-22	111	118	Lodgepole pine	-	-	Nylander
49-24	60	>100	Lodgepole pine	-	-	Nylander
49-26	68	>100	Lodgepole pine	-	-	Nylander
49-32	12	-	Aspen	-	-	Sjhoberg
49-33	101	122	Lodgepole pine	Sawtimber	Large	Sjhoberg
49-35	214	101	Lodgepole pine	Sawtimber	Large	Sjhoberg
49-39	14	>100	Spruce/fir	-	-	Sjhoberg
51-10	105	133	Lodgepole pine	Sawtimber	Large	McDougal
51-12	139	100	Lodgepole pine	Sawtimber	Large	McDougal
51-24	58	191	Lodgepole pine	Sawtimber	Large	McDougal
51-30	91	106	Lodgepole pine	Sawtimber	Large	McDougal
51-37	37	122	Spruce/fir	Sawtimber	Large	McDougal
56-1	250	150	Spruce/fir	Sawtimber	Large	Halverson
56-2	192	156	Spruce/fir	Sawtimber	Large	Halverson
56-4	51	146	Douglas-fir	Sawtimber	Large	Halverson
56-5	58	146	Englemann spruce	Sawtimber	Large	Halverson
56-8	84	>100	Spruce/fir	-	-	Halverson
64-1	21	174	Spruce/fir	-	-	South Cottonwood

TABLE 3-4
Summary of Conifer Stands Proposed for Treatment

Stand	Acres	Age	Forest Type	Stand size	Vegetation Size	Treatment Area
64-2	15	152	Spruce/fir	Sawtimber	Large	South Cottonwood
64-3	39	167	Spruce/fir	Sawtimber	Large	South Cottonwood
65-3	61	197	Spruce/fir	Sawtimber	Very Large	South Cottonwood
65-9	44	123	Lodgepole pine	Sawtimber	Large	South Cottonwood
65-10	96	177	Spruce/fir	Sawtimber	Large	South Cottonwood
65-13	39	162	Spruce/fir	Sawtimber	Large	South Cottonwood
65-15	35	176	Spruce/fir	Sawtimber	Large	South Cottonwood
65-16	37	143	Lodgepole pine	Sawtimber	Large	South Cottonwood
66-1	63	118	Spruce/fir	Sawtimber	Large	South Cottonwood
66-2	66	162	Spruce/fir	Sawtimber	Large	South Cottonwood
66-3	110	118	Spruce/fir	Sawtimber	Large	South Cottonwood
66-4	105	136	Spruce/fir	Poletimber	Medium	South Cottonwood
66-5	52	128	Spruce/fir	Sawtimber	Large	South Cottonwood
66-16	266	>100	Lodgepole pine	-	-	South Cottonwood
67-15	83	147	Lodgepole pine	Sawtimber	Large	South Cottonwood
67-16	43	>100	Lodgepole pine	-	-	South Cottonwood
68-2	116	37	Lodgepole pine	Poletimber	Medium	South Cottonwood
68-18	61	184	Lodgepole pine	Sawtimber	Large	South Cottonwood
70-3	65	>100	Spruce/fir	-	-	Halverson
70-8	357	128	Spruce/fir	Sawtimber	Large	South Cottonwood
70-9	29	164	Lodgepole pine	Sawtimber	Very Large	South Cottonwood
70-12	36	146	Spruce/fir	Sawtimber	Large	South Cottonwood
70-13	37	177	Spruce/fir	Sawtimber	Large	South Cottonwood
70-14	7	-	Aspen	-	-	Halverson
70-15	206	189	Lodgepole pine	Sawtimber	Large	South Cottonwood
70-20	41	122	Lodgepole pine	Sawtimber	Large	South Cottonwood
Total	3,941					

Data Source: Stand exam summary and Stand Tables (Forest Service 2000). Supplemental information from 1988 vegetation data used in Forest Service Plan.

- = data not available

South Cottonwood Treatment Area

The South Cottonwood treatment area (compartments 64, 65, 67, 68, 69, 70) is rolling topography, dissected by Lander Creek on the north and Bare, Trailer, and Hidden Basin Creeks on the south, all tributaries to South Cottonwood Creek. It represents by far the largest treatment area in the Cottonwood analysis area, totaling 15,811 acres. Elevation ranges from 8300 to 9200 feet. Soda Lake, a small natural lake, is also in this area. The

mixed conifer vegetation in the vicinity of the lake and adjacent to South Cottonwood Creek contributes to the experience of recreationists, many of whom take advantage of dispersed camping opportunities there. Individual forested stand sizes are small, ranging from 10 to 250 acres, with an average of 50 acres. The stands are shaped by the topography, periodic smaller fires, past timber harvest, and sagebrush/grass openings.

Most stands in the treatment area are older than 120 years old. Measured tree ages are up to 250 years. The overstory of most stands is dominated by either lodgepole pine (45 percent) or subalpine fir (42 percent). A few are dominated by Englemann spruce (9 percent) or Douglas-fir (4 percent). There are from 40 to 300 trees per acre in the overstory, with an average of 150. Mortality of trees in the overstory ranges from zero to 26 percent, with an average of 12 to 15 percent. Mortality is from a variety of causes including bark beetles, commandra rust, and drought stresses. The understory of these stands is dominated by subalpine fir with some Engelmann spruce. There are from 400 to 20,000 trees per acre in the understory, with an average of 2,000. Most of these trees, though, are less than 1 foot tall and severely suppressed. The combination of dead trees, down logs, and heavy understory contribute to moderate to heavy fuel loadings.

Halverson Treatment Area

The Halverson treatment area (compartments 56 and 58) includes Halverson, Irene, and Hardin Creeks, all tributaries to North Cottonwood Creek. It has a total area of 4,556 acres. Elevation ranges from 8000 to 9500 feet. Past harvesting has occurred in this area. Individual forested stands in this area range in size from less than 10 acres to over 200 acres, with an average of 60 to 80 acres. Mature forested patches in the landscape are broken up by larger sagebrush/grass openings, such as Foster Meadows and by patches of regenerating conifers from past harvests.

Forests in the treatment area are over 100 years old, with most being between 150 and 200 years old, initiated by fires in the early 19th century. These forests are a mix of conifer species, including Engelmann spruce, lodgepole pine, subalpine fir, and Douglas-fir. Engelmann spruce is the predominant species in most stands (70 percent) and lodgepole pine is a major component in all stands. Douglas-fir is predominant in about 20 percent of the stands. Subalpine fir is the major understory species with some Engelmann spruce represented. They are from 90 to 270 trees per acre in the overstory, with an average around 180. The understory contains from 1,100 to 8,200 trees per acre, with an average around 3,500. Mortality of overstory trees ranges from 0 to 35 percent, with an average of 15 percent. Bark beetles have been a common cause of mortality, as well as many other agents.

McDougal Gap Treatment Area

The McDougal Gap treatment area (compartment 51) includes a portion of upper North Cottonwood Creek, between Foster Meadows and McDougal Gap, at elevations from 8200 feet to 8600 feet. It has an area of 4,548 acres. The McDougal Gap trailhead for the Wyoming Range is at the north end of this area. Forest Road 10125 from the Big Piney Ranger District over the Wyoming Range to the Greys River Ranger District runs through this area. The visual quality of the landscape from the road and trail are important in this area. There has been past harvesting in this area. Forested patch sizes in

this area, near the crest of the Wyoming Range, are larger than in the lower drainage, averaging around 100 acres. There are fewer natural openings in the forested cover.

Almost all stands are mature to over mature, with many being greater than 150 years old. Lodgepole pine dominates the overstory of these stands with subalpine fir and Englemann Spruce as secondary species. The lodgepole pines attain diameters of 18 to 22 inches, while some Englemann spruce grow to over 40 inches in diameter. There are from 115 to almost 300 trees per acre in the overstory with an average of 150 trees per acre. There are great numbers of subalpine fir in the understory and minor amounts of Englemann spruce and lodgepole pine. There are from 170 to 5,000 trees per acre in the understory, with an average of 3,000. Most of those are less than 1 foot tall, but larger trees do exist in most stands, contributing to ladder fuels to the overstory crowns. Mortality of the overstory trees range from zero to 26 percent, averaging around 14 percent.

Nylander Treatment Area

The Nylander treatment area (compartment 48) lies between Nylander Creek, Chase Creek, and the Maki Creek drainage, at elevations of 8200 feet to 9000 feet. It has an area of 3,600 acres. These are predominantly southwest facing slopes, with mild slopes to the south and steeper slopes on the north end near the ridge. Past harvesting has occurred in this area. Forest stand sizes are relatively small, ranging from 6 to 150 acres, and interrupted by large sagebrush grass openings on ridges, riparian willow bottoms, smaller natural openings, and past harvest units with seedling to sapling size trees and grasses.

Most forests in the Nylander area are greater than 150 years old, with some stands in the lower portion of the area approximately 100 years old. A majority of the stands are dominated by mature lodgepole pines up to 30 inches in diameter, with approximately 25 percent dominated by mature subalpine fir, 10 percent dominated by Englemann spruce up to 45 inches in diameter, and 5 percent dominated by aspen with associated mixed conifer. Mixtures of these species occur in most stands with the alpine fir commonly growing into the existing crowns of lodgepole pine. Approximately 400 acres have an aspen/conifer mix with the potential to regenerate aspen following disturbances. There are from 80 to 375 trees per acre in the overstory, with an average of around 160. The understory is dominated by subalpine fir with from 200 to 4,000 trees per acre, most being less than 1 foot tall and damaged from suppression. Approximately 10 percent of the trees are dead in this treatment area, with up to 40 percent in some stands. Similar damaging agents occur here as in the rest of the Cottonwood II analysis area.

Sjhoberg Treatment Area

The Sjhoberg treatment area (compartment 49) lies between Nylander and Sjhoberg Creeks in the North Cottonwood Creek drainage at elevations of 8200 to 9500 feet. Predominant slopes are southeast to southwest. This is the smallest treatment area with 2,379 acres. The southern portion of the area has gentle slopes with steeper, inaccessible ground near ridges to the north. Past harvesting has occurred in this area. Forested patch sizes are generally between 100 and 200 acres in size, broken by wet meadows, openings along draws, open ridge, and previous harvest units, where seedling to sapling size trees occur.

All stands in the treatment area are mature to over mature, with most between 100 and 150 years old. Subalpine fir is the predominant conifer in almost half the area and occurs in all other conifer stands to differing degrees. Lodgepole pine is the predominant conifer in most other stands in the area and occurs in many of the fir stands to a lesser extent. Engelmann spruce is predominant in only 5 percent of the conifer stands, but occurs as a minor species in most of the fir and lodgepole stands. Aspen occurs in over 30 percent of the conifer stands and would have the potential to regenerate following disturbance. Douglas-fir occurs as a minor species in a few stands in the area. These stands are not as dense as others in the Cottonwood analysis area with around 50 to 180 overstory trees per acre occurring, and averages around 100 trees per acre. The understory is mostly subalpine fir, with lower densities than much of the Cottonwood analysis area. The mortality is also lower in this treatment area.

Wetland and Riparian Resources

The National Wetland Inventory (NWI) shows freshwater forested/shrub wetlands in the Cottonwood II analysis area along South Cottonwood Creek, North Cottonwood Creek, Halverson Creek, and Bare Creek. Wetland data from NWI, however, are not available for most of the analysis area.

The 1988 vegetation data used in the Forest Plan include approximately 1,504 acres of riparian areas mapped along the streams throughout the analysis area. Riparian areas are shown in Figure 3-1. Many of the riparian and wetland areas are dominated by willow bottoms.

Old Growth Forest

Old growth forest occurs within the Cottonwood II analysis area in both designated old growth stands and throughout the analysis area in stands that are not designated. The *Bridger-Teton National Forest Land and Resource Management Plan* (Forest Service 1990) defines old growth as:

> Old-growth stands composed of Douglas-fir and Engelmann spruce will be Douglas-fir, spruce, and fir multi-storied stands having two or more well-developed canopies of trees. The oldest overstory trees should be 140 to 240 years of age and be greater than 18 inches diameter at breast height. Understory trees will normally be composed of many age and size classes. Small openings may exist in the canopy where older trees have fallen. Snags should be present in the stand and average 24 snags per acre. Large-diameter downed logs will be a component of the forest floor.

3.2.3.2 Wildlife Resources

The Cottonwood II project area provides a mix of habitat for a wide variety of wildlife species. The mix of several forest vegetation types interspersed with large openings of sagebrush grasslands provides habitat for a wide range of species, including large ungulates, migratory birds, amphibians, woodpeckers, and raptors.

Figures 3-2 to 3-9 depict a variety of wildlife habitat and occurrence data for the analysis area. Maps showing habitat presence are based on Wyoming GAP analysis and depict the presence of apparently suitable habitat within the analysis area. Maps showing specific locations indicate known occurrences of species based on field surveys.

Harvested Species

Game Birds

No greater sage-grouse or sharp-tailed grouse are known to occur within the analysis area. These species will not be evaluated further.

Mammals

This area supports a diverse group of harvested species, including elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocarpa americana*), moose (*Alces alces*), and black bear (*Ursus americanus*). The analysis area serves as summer, winter, and parturition (birthing) range for these species and also contains important migration corridors between summer and winter ranges.

Although GAP analysis indicates that suitable habitat exists for mountain sheep (*Ovis canadensis*) within the project area, no mountain sheep are known to inhabit the analysis area. For this reason, mountain sheep and their habitat are not evaluated further.

The project area provides parturition habitat for elk and summer range for elk, moose, and deer. Pronghorn may pass through the lower reaches of drainages in the sagebrush communities. Black bear, bobcat (*Lynx rufus*), coyote (*Canis latrans*), and mountain lion (*Felis concolor*) are also present. There are seasons of harvest for all of these species except the coyote and are set by the Wyoming Department of Game and Fish Commission (WGFD) each year.

Population levels for elk, mule deer, and moose are currently above objective levels set by the WGFD. Antelope populations are below WGFD objectives. Population objectives are not the same as “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. Objective numbers may vary by 10 percent, either higher or lower, and still be within desired levels. Table 3-5 provides the individual herds and herd units that are found in the Cottonwood Watershed.

TABLE 3-5
Herds and Herd Units Within the Cottonwood Watershed

Species	Crucial Winter Range (CWR) Acres	Parturition (Birthing) Acres	Spring, Summer, Fall Range or Migration Route	Existing Population (2001)	WGFD Population Objective
Elk—Piney (Herd Unit 106)	None	Yes	Yes	2,535	2,424
Moose—Sublette	None	No data	Yes	5,665	5,500
Mule Deer—Sublette	None	None	Yes	34,700	32,000

Figures 3-2/1

Figure 3-2/2

Figure 3-3/1

Figure 3-3/2

Figure 3-4/1

Figure 3-4/2

Figure 3-5/1

Figure 3-5/2

Figure 3-6/1

Figure 3-6/2

Figure 3-7/1

Figure 3-7/2

Figure 3-8/1

Figure 3-8/2

Figure 3-9/1

Figure 3-9/2

Elk. The Piney Elk Herd Unit (106) is located on the east slope of the Wyoming Range in the B-TNF and extends eastward to Highway 189 and the Green River. Forest Service system lands provide spring, summer, and fall habitat as well as 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 lead 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.

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.

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

Moose. The analysis area is a portion of the Sublette Moose Herd Unit. Moose typically summer at higher elevations on the Forest using spruce/fir forests as well as riparian willow bottoms. Both habitats are available for moose in the analysis 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 the Forest. Moose numbers are slightly above the objective level.

Pronghorn. Pronghorns 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.

Migratory Birds

Executive Order (EO) 13186 was signed January 10, 2001. It lists several responsibilities of federal agencies to protect migratory birds. Additional direction comes from the Memorandum of Understanding (MOU) between the Forest Service and U.S. Fish and Wildlife Service, signed January 17, 2001. Migratory birds use a variety of habitats in the analysis area during the breeding season.

Aspen and conifer forests are preferred by many species of both resident and migratory birds, such as vireos, warblers, and flycatchers (Johns 1993; Hagar *et al*. 1996). Aspen stands support a particularly high diversity of avian species. In a three-year study in Colorado, 50 species of birds were recorded in aspen stands; many of these were migratory birds (Johns 1993).

Sagebrush openings within the analysis area are used by migratory shrub-steppe obligates, such as sage sparrows (*Amphispiza belli*), sage thrashers (*Oreoscoptes montanus*), and Brewer's sparrows (*Spizella breweri*) (Wyoming Natural Diversity Database 2004). These habitats will not be impacted by any project alternatives and these species are not discussed further.

Amphibians and Reptiles

Several species of amphibians and reptiles occur in the analysis area. These include northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), western toad (*Bufo boreas boreas*), spotted frog (*Rana luteiventris/R. pretiosa*), Great Basin spadefoot toad (*Spea intermontana*), and gopher snake (*Pituophis catenifer deserticola*) (Wyoming Natural Diversity Database 2004). Of these amphibians species, the northern leopard frog is particularly widespread within the analysis area. Leopard frogs are found in a variety of wetland habitats such as streams, ponds, lakes, wet prairies, and other bodies of water. They then frequently move into grassy, herbaceous meadows or forest borders some distance from permanent water. Tiger salamanders and western toads also occur across the analysis area in a variety of habitats, but they usually live within a short distance of breeding ponds. Spadefoot toads occur in both forested and sagebrush habitats, as long as the soil is loose or burrows are present. Gopher snakes occur in a variety of habitats from lowlands to mountains, including desert, prairie, brushland, woodland, open coniferous forest, farmland, and marshes. Spotted frogs are very rare in the area and are listed as a sensitive forest species for USFS Region 4. See *Section 3.6.3.2* for additional information regarding spotted frogs in the analysis area.

3.2.4 Desired Future Conditions

3.2.4.1 Forested Vegetation

Desired future condition (DFC) 1B and DFC 10 apply to the Cottonwood II Vegetation Management Project. The DFC timber prescriptions for vegetation are summarized below. For a full description of these DFCs, refer to the *Bridger-Teton National Forest Land and Resource Management Plan* (Forest Service 1990).

DFC 1B, Vegetation: Timber prescription—A full range of biologically appropriate silvicultural practices is used to emphasize production and use of sawtimber and other wood by-products. Timber harvest is scheduled.

DFC 1B, Aspen Management Guideline—Aspen should be managed for its value as wildlife habitat, emphasizing browse and cover for big-game species, and for providing seasonal colors.

DFC 10, Vegetation: Timber prescription—Silvicultural practices including scheduled timber harvest emphasize achieving desired wildlife habitat conditions while developing long-term, overall big-game hiding cover values. Utilization of firewood and other products is encouraged in ways compatible with maintaining wildlife values.

DFC 10, Aspen Management Guideline—Aspen should be managed for its value as wildlife habitat and for providing seasonal colors while emphasizing its value as habitat for selected management indicator species.

3.2.4.2 Wildlife Resources

The DFC timber prescriptions and guidelines for fisheries and wildlife are summarized below. For a full description of these DFCs, refer to the *Bridger-Teton National Forest Land and Resource Management Plan* (Forest Service 1990). Fisheries resources are discussed further in Section 3.5 of this EIS.

DFC 1B, Fisheries and Wildlife

Fisheries and Wildlife Prescription. Habitat is provided for existing populations of game and fish, but hunter-success and recreation-day objectives identified by the Wyoming Game and Fish Department may decrease. A use attainability study may be needed for a specific stream segment to determine if fishery beneficial use is being protected to an adequate level.

Big Game Habitat Guideline. Sufficient habitat should be provided to maintain desired populations and distribution of big game species. For example:

- Elk Calving Areas—About 30 percent of the brush/grassland-rangeland type should be maintained in a brush/forb type, emphasizing the aspen or conifer/brush ecotone.
- Mule Deer Winter Ranges—About 75 percent of the brush/grassland- rangeland type should be maintained in a brush type with about 55 percent in a mature age class.
- Moose Winter Ranges—About 75 percent of the brush/grassland-rangeland type such as serviceberry and mountain mahogany should be maintained in a brush type with about 30 percent in a mature age class. About 95 percent of the willow/grass range should be maintained in a willow type.
- Elk Winter Ranges—About 50 percent of the brush/grassland should be maintained in a brush type with about 30 percent in a mature age class.
- Bighorn Sheep Winter Ranges—About 75 percent of the brush/grassland type should be maintained in grass.

DFC 10, Fisheries and Wildlife

Fisheries and Wildlife Prescription. Groups of species are emphasized, such as early or late succession dependent species, in order to increase species richness or diversity. Habitat is managed to achieve the game and fish populations, harvest levels, success, and recreation-day objectives identified by the Wyoming Game and Fish Department and agreed to by the Forest Service.

3.2.5 Environmental Consequences

3.2.5.1 Forested Vegetation

Site-specific information, stand exam data, aspen community plots, field visits, and applicable research studies are the basis of the analysis of forested vegetation. Forest Vegetation Simulator (FVS) modeling (version 6.21) was performed by the Forest Service on representative stand data for each type of harvest proposed in the Cottonwood II Vegetation Management Project. The FVS summary, presented in Table 3-6, displays effects on selected forest attributes for representative stands and proposed treatments.

TABLE 3-6
FVS Summary

Attribute	Prior to Harvest	Retained	Removed
Stand 49-35 (Sjhoberg) FVS Summary—Clearcut with Reserve			
Overstory (trees/acre)	224	17 (8%)	207 (92%)
Basal Area/Acre (square feet)	165	15 (9%)	150 (91%)
Merchantable Volume/Acre (MBF)	14.3	1.3 (9%)	13.0 (91%)
Stand 56-2 (Halverson) FVS Summary—Clearcut with Reserve			
Overstory (trees/acre)	321	37 (12%)	284 (88%)
Basal Area/Acre (square feet)	238	36 (15%)	202 (85%)
Merchantable Volume/Acre (MBF)	19.3	3.0 (16%)	16.3 (84%)
Stand 70-8 (South Cottonwood) FVS Summary—Clearcut with Reserve			
Overstory (trees/acre)	198	28 (14%)	170 (86%)
Basal Area/Acre (square feet)	194	21 (11%)	173 (89%)
Merchantable Volume/Acre (MBF)	16.0	2.0 (12%)	14.0 (88%)
Stand 66-2 (South Cottonwood) FVS Summary—Clearcut with Reserve			
Overstory (trees/acre)	190	20 (11%)	170 (89%)
Basal Area/Acre (square feet)	154	12 (8%)	142 (92%)
Merchantable Volume/Acre (MBF)	16.3	1.0 (6%)	15.3 (94%)

TABLE 3-6
FVS Summary

Attribute	Prior to Harvest	Retained	Removed
Stand 65-10 (South Cottonwood) FVS Summary—Shelterwood			
Overstory (trees/acre)	171	35 (20%)	136 (80%)
Basal Area/Acre (square feet)	150	52 (35%)	98 (65%)
Merchantable Volume/Acre (MBF)	15.9	8.5 (53%)	7.4 (47%)
Stand 56-2 (South Cottonwood) FVS Summary—Salvage			
Overstory (trees/acre)	285	236 (83%)	49 (17%)
Basal Area/Acre (square feet)	238	153 (64%)	85 (36%)
Merchantable Volume/Acre (MBF)	19.3	9.0 (47%)	10.3 (53%)
Stand 70-8 (South Cottonwood) FVS Summary—Salvage			
Overstory (trees/acre)	184	114(62%)	70 (38%)
Basal Area/Acre (square feet)	162	88 (54%)	74 (46%)
Merchantable Volume/Acre (MBF)	17.8	8.4 (47%)	9.4 (53%)
Stand 56-2 (Halverson) FVS Summary—Group Selection			
Overstory (trees/acre)	285	185 (65%)	100 (35%)
Basal Area/Acre (square feet)	231	139 (60%)	92 (40%)
Merchantable Volume/Acre (MBF)	20.0	10.7 (54%)	9.3 (46%)
Stand 49-35 (Sjhoberg) FVS Summary—Thinning			
Overstory (trees/acre)	224	108 (48%)	116 (52%)
Basal Area/Acre (square feet)	165	88 (53%)	77 (47%)
Merchantable Volume/Acre (MBF)	14.3	6.6 (46%)	7.7 (54%)

TABLE 3-6
FVS Summary

Attribute	Prior to Harvest	Retained	Removed
Stand 55-3 (Maki) FVS Summary—Conifer Removal in Aspen Note: Most aspen would also be retained after harvest, and exist as snags following burning.			
Overstory (trees/acre)	170 (90% subalpine fir)	12 (7%)	158 (93%)
Basal Area/Acre (square feet)	104 (169 including aspen)	9 (9%)	95 (91%)
Merchantable Volume/Acre (MBF)	7.4 MBF (9.6 including aspen)	0.6 MBF (8%)	6.8 MBF (92%)

Alternative A -- No Action

Direct Effects

No direct effects from 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 1920s, 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.

Indirect and Cumulative Effects

Because anticipated indirect and cumulative effects on forested vegetation in the analysis area under the No Action Alternative are very closely related because of their long-term time frames and types of effects, they are discussed under a single heading. Indirect effects are those that are removed in space or time from the action and may be long-term in nature. Cumulative effects are the incremental impacts of the alternative being evaluated in the context of past, present, and reasonably foreseeable future actions.

Indirect and cumulative effects to forested vegetation are expected to result from taking no action under Alternative A. Vegetation condition would remain outside desired conditions in relation to the B-TNF properly functioning conditions and as described below. Tree growth rates would continue an overall decline. Lodgepole pine mortality in older trees in the overstory would continue and increase. Subalpine fir would continue to increase in relative density. Almost all stands in the analysis area have dense subalpine fir understories. Increased stand density and age would result in decreased growth, increased self-thinning with episodic waves of density related mortality, and individual tree stress. Increased tree density resulting in increased mortality, and continued succession of subalpine fir, would increase live and dead fuel loading and forest ladder fuels. Existing subalpine fir understory would continue to age and exhibit suppression damage from competition. These trees growing into overstory trees would compound ladder fuel problems. Broom rusts on subalpine fir would intensify as relative densities increase.

Comandra rust would continue to top-kill lodgepole pine. Dwarf mistletoe would 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.

The CPIS found vegetation to be outside desired conditions and identified 5,044 acres of potential treatment to reach desired conditions. No treatment has been done since the study nor have any wildfires burned in the analysis area. The B-TNF *Properly Functioning Condition Assessment* (Forest Service 1997) found both lodgepole and subalpine fir/spruce forest types to be out of balance with desired conditions forest-wide because of an over-representation of older age classes (greater than 60 percent). This also holds true for the Cottonwood II analysis area.

Aspen stands would continue to decline under the No Action Alternative. In stands that are currently overtopped, aspen could eventually disappear from the site, with limited potential for regeneration. This would have 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. A decrease of up to 3 to 7 inches in water yield may result when conifers replace aspen. In stands with aspen dominance where conifers are less than half of the overstory, conifers (particularly subalpine fir) would continue to spread and regenerate under the aspen overstory utilizing an increasing portion of the available water from the site. Aspen health and vigor would decline. Limited aspen regeneration would 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. Conditions in the Cottonwood drainage are consistent with the B-TNF *Properly Functioning Condition Assessment* (Forest Service 1997), which found aspen at high risk to be replaced with subalpine fir and other conifers. Aspen age classes across the landscape would 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 would continue and increase. Ultimately, forests in this area would burn and be returned to an early seral stage of grass/forbs and brush. Some aspen stands would eventually burn and establish new stands. However, as disturbance is delayed further, declining aspen in many areas would be inadequate to regenerate new aspen stands. Fires would 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 would 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 because of high stem densities and crown interlock. Water quality would not likely meet desired sediment levels for a period of time following the fire, potentially 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, or backcountry uses.

Projects listed in Table 3-1 that were also considered in the cumulative effects analysis would not be expected to contribute to adverse cumulative impacts on forested vegetation in the Cottonwood II analysis area. The proposed Maki Creek Area Projects, which are designed to benefit forested vegetation conditions in the Maki Creek drainage adjacent to the Cottonwood II analysis area, would contribute to improved forested vegetation conditions in the general area.

Alternative B -- Proposed Action

Direct Effects

Manipulation of vegetation is proposed on 2,099 treatment acres to help achieve desired conditions in the five treatment areas. This would include 402 acres clearcut harvest, 581 acres partial cut harvest (thinning, shelterwood, salvage, group selection), 58 acres conifer removal in aspen, and 1,058 acres of prescribed burning in aspen. Vegetative treatments are shown on Figure 2-1. Of the 30,894 total acres among the five treatment areas in the Cottonwood II analysis area, no action would occur on the remaining 28,795 acres (93 percent). On this untreated area, effects from changing vegetation that were described in Alternative A (No Action) would occur. However, by providing a more diverse vegetation mosaic on the landscape and providing some age class diversity, some of the effects described in Alternative A, particularly in conifer and aspen stands, would be ameliorated under the Proposed Action.

Table 3-7 summarizes the acreage affected for Alternative B by treatment and treatment area. Table 3-8 summarizes the acreage affected for Alternative B by treatment and location/site number. Of the 3,857 acres included in forest management location/sites, a total of 2,817 acres (73 percent of the total) is proposed to remain untreated (not harvested).

TABLE 3-7
Summary of Vegetation Treatments by Treatment Area for Alternative B—Proposed Action (Acres)

	Clearcut	Partial Cut Treatments				Aspen Treatments	
Treatment Area		**Thin**	**Shelterwood**	**Salvage**	**Group Select**	**Conifer Removal**	**Prescribe Burn**
South Cottonwood	276	123	85	109	10	0	414
Halverson	41	0	40	30	40	26	55
McDougal Gap	64	30	10	0	0	0	0
Sjhoberg	20	34	10	0	0	33	291
Nylander	0	60	0	0	0	0	298
	402	247	145	139	50	58	1058
Subtotal	**402**	**581**				**1,116**	
Total	**2,099**						

TABLE 3-8
Summary of Vegetation Treatments by Location/Site Number for Alternative B—Proposed Action (Acres)

Location and Site Number	Acres	Proposed Acres Treated	CC	TH	SW	S	GS	Aspen	Area Untreated
48-42	145	8	-	-	-	-	-	8	137
49-16	21	2	-	-	2	-	-	-	19
49-22	111	20	-	20	-	-	-	-	91
49-24	60	20	-	20	-	-	-	-	40
49-26	68	20	-	20	-	-	-	-	48
49-33	101	28	-	10	8	-	-	10	73
49-35	214	44	20	24	-	-	-	-	170
49-39	14	14	-	-	-	-	-	14	0
51-10	105	25	25	-	-	-	-	-	80
51-12	139	10	10	-	-	-	-	-	129
51-24	58	30	30	-	-	-	-	-	28
51-30	91	20	-	20	-	-	-	-	71
51-37	37	20	-	10	10	-	-	-	17
56-1	250	65	10	-	20	20	-	15	185
56-2	192	50	10	-	-	10	20	10	142
56-4	51	10	10	-	-	-	-	-	41
56-5	58	30	10	-	-	-	20	-	28
56-8	84	20	-	-	20	-	-	-	64
64-1	21	10	-	-	-	10	-	-	11
64-2	15	8	8	-	-	-	-	-	7
64-3	39	16	10	-	-	6	-	-	23
65-3	61	14	-	14	-	-	-	-	47
65-9	44	20	20	-	-	-	-	-	24
65-10	96	24	-	-	24	-	-	-	72
65-13	39	15	15	-	-	-	-	-	24
65-15	35	10	-	-	10	-	-	-	25
65-16	37	10	-	-	10	-	-	-	27
66-1	63	19	11	-	-	8	-	-	44
66-2	66	15	15	-	-	-	-	-	51
66-3	110	31	20	-	-	11	-	-	79
66-4	105	23	23	-	-	-	-	-	82

TABLE 3-8
Summary of Vegetation Treatments by Location/Site Number for Alternative B—Proposed Action (Acres)

Location and Site Number	Acres	Proposed Acres Treated	CC	TH	SW	S	GS	Aspen	Area Untreated
66-5	52	18	-	-	-	18	-	-	34
66-16	266	37	27	-	-	-	10	-	229
67-15	83	20	20	-	-	-	-	-	63
67-16	43	26	-	-	26	-	-	-	17
68-2	116	109	-	109	-	-	-	-	7
68-18	61	8	8	-	-	-	-	-	53
70-8	357	80	49	-	-	31	-	-	277
70-9	29	5	5	-	-	-	-	-	24
70-12	36	11	11	-	-	-	-	-	25
70-13	37	15	-	-	15	-	-	-	22
70-15	206	40	35	-	-	5	-	-	166
70-20	41	20	-	-	-	20	-	-	21
Total	**3,857**	**1040**	**402**	**247**	**145**	**139**	**50**	**~58**	**2,817**

The 983 acres of clearcut and partial harvest would utilize timber resource values providing forest products for local and regional economies for 5 to 10 years. The potential harvest volume, depending on treatment area, would range from 1,000 to 5,000 CCF per treatment area, and would be consistent with Objective 1.1 of the LRMP and with harvest levels from the Big Piney Community Interest Area 7 (B-TNF Forest Plan EIS p. 524). Silvicultural systems are consistent with DFCs 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. The CPIS identified 6,140 acres within DFCs 1B and 10 in the Cottonwood II analysis area as opportunity areas to achieve desired conditions for creating openings, treating mortality stands, and thinning.

Vegetation condition would still remain outside desired conditions, but moving toward desired conditions. The FVS summary presented in Table 3-8, based on site-specific stand data, illustrate Alternative B vegetation effects for representative vegetation treatments and stands. Further examples are found in the project file with the Forest Service.

Clearcut Harvest. The 402 acres of clearcut harvest would provide age class diversity and areas of low fuel loads in the 42 harvest units. Because of the nature of lodgepole pine regeneration, the harvest would 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, sizes of harvest units would range from 2 to 27 acres, with an average size of 9.6 acres. Regeneration would come from artificial planting, natural regeneration from stored seed, cone serotiny, and adjacent seed walls. Initial species composition would consist primarily of lodgepole pine.

During the stand initiation structural stage, while new individuals and species begin to establish, grass and forbs would dominate these sites for approximately 10 to 15 years. This stage would be characterized by conifer seedlings (approximately 200 to 1,000 per acre) mixed with grasses and forbs with scattered large snags (approximately 5 to 10 per acre). Stand initiation would continue replacing grass and forbs with lodgepole pine seedlings and saplings for approximately 15 to 40 years out. Young and mid-aged forests would then persist for approximately 41 to 120 years out, followed by mature and old forests until disturbance. Shade tolerant subalpine fir and Engelmann spruce would 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 would be eliminated in the treatment area, with increased risks in 80 years. Maintaining tree lower live limbs on saplings for approximately 40 to 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. Removal of approximately 12 to 18 MBF per acre would provide sawtimber and some other products to help meet Forest Plan objectives. Table 3-8 shows FVS summaries for clearcut with reserve for representative stands and treatment areas.

Partial Cut Harvest. Approximately 581 forested acres would be treated using a partial-cut treatment to reduce overstocked conifer forests while maintaining a forested appearance. This would include 247 acres of thinning, 145 acres of shelterwood, 139 acres of salvage, and 50 acres of group selection. These partial cut harvests would:

- Provide some utilization of the suitable timber resource to help meet Objective 1.1 of the Forest Plan.
- Reduce stocking on 581 acres of existing stands to reduce fuel loadings and reduce insect and disease hazards.
- Leave a forested appearance in the vicinity of all harvest units and forested wildlife habitat attributes. See descriptions below of harvest types for discussion of forest conditions that would be left following harvest.
- Enable shelterwood and group selection to provide favorable conditions for diverse natural regeneration.

Shelterwood. Shelterwood treatment on 145 acres would provide conditions for natural regeneration favoring Engelmann spruce and Douglas-fir, while maintaining healthy trees on the site. The 11 harvest units would range in size from 2 to 26 acres, with an average size of 13.2 acres. The sites proposed are mostly diverse, mature three-storied or multi-story conifer stands. Following harvest, 35 to 60 percent 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. Trees retained would be a range of diameters, mostly larger size classes, and would be a recruitment source for snags and down woody material. Harvest unit size would be minimized 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 10 MBF per acre would provide sawtimber and some other products to help meet Forest Plan objectives. Table 3-8 shows a FVS summary for a shelterwood treatment in stand 65-10 in the South Cottonwood treatment area.

Salvage. Salvage treatment would occur on 139 acres of over mature mixed conifer stands. The 14 harvest units would range from 4 to 26 acres, with an average size of 9.9 acres. Following harvest there would be approximately 70 percent of existing overstory trees of diverse diameters and species 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 8 to 12 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. Fuel ladders would be reduced with removal of more sub-dominant and understory trees that are growing into crowns of overstory 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. Table 3-8 shows FVS summaries for a salvage treatment in stands 56-2 and 70-8 in the South Cottonwood treatment area.

Group Selection. Group selection treatment would occur in cutting units of 2 acres or less on 50 acres of mature or over mature mixed conifer stands. The three harvest areas would range from 10 to 20 acres per stand, with an average of 16.7 acres. A few older healthy trees and some snags would be retained in the units. All trees, including all snags, structure and vegetative diversity, outside of cutting units would be retained.

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 8 to 10 MBF per acre would provide sawtimber and fuel wood products. Table 3-8 shows a FVS summary for a group selection treatment in stand 65-10 in the Halverson treatment area.

Thinning. Thinning would occur on 247 acres of post and pole to small sawlog size lodgepole stands. The 11 harvest units would range from 10 to 68 acres, with an average size of 22.5 acres. Commercial thinning would reduce the basal area of the proposed stands to 40 to 50 percent of existing stocking, depending on the site. There would be around 100 pole to sawtimber size trees, representing the healthiest trees, remaining 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 and 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. Thinning would also reduce bark beetle risk by reducing stand basal area below 120 and reducing average diameter below 8.0 inches DBH. Trees left would be mostly lodgepole pine, along with some Douglas-fir and Engelmann spruce. 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 approximately 6 to 10 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. Table 3-8 shows a FVS summary in a thinning treatment for stand 49-35 in the Sjhoberg treatment area.

Conifer Removal in Aspen Stands. Conifer removal in aspen stands would occur on 58 acres in six harvest units ranging from 7 to 14 acres. This treatment would leave most aspen standing. Slash would be treated by removing tops with merchantable logs and piling concentrations only. Aspen in these stands is typically just beginning to be overtopped by subalpine fir and is still relatively healthy with good crown ratios. Conifer densities are generally low in these stands and, as a result, slash created in logging operations would not pose a significant fuel loading if treated as specified. Aspen would be felled to encourage suckering. Aspen regeneration from root suckering would occur post harvest. It may be patchy, reflecting pre-harvest patchy condition of aspen, but it should meet objectives of 1,000 stems per acre at 10 years following burning. Following logging small clumps of sub-merchantable subalpine fir would be left also. Table 3-8 shows an FVS summary for conifer removal in aspen in stand 55-3 from the *Maki Creek Area Projects Environmental Assessment* (Forest Service 2004).

Prescribed Burning in Aspen Stands. A total of 1,058 acres of aspen stands would be prescribe burned under Alternative B. Approximately 80 to 100 percent of the area would

be burned (without timber removal). Burning would kill most aspen and also burn through most clumps of fir. These would provide snags for forest structure. Aspen root suckering would initiate within the first year after treatment. It is anticipated that snags would remain following treatment, together with some islands of untreated vegetation. Dense aspen regeneration would be expected throughout the unit to meet objectives, reflecting existing widespread aspen occurrence in the stand. Some natural conifer regeneration would also be occurring to add diversity, but would take longer to establish than aspen, giving early competitive advantage to re-establishing aspen. The improvements to the understory vegetation from prescribed burning aspen stands could greatly improve both the long-term (5 to 30 years) quantity and quality of forage for both domestic livestock and wildlife.

The Proposed Action follows Wyoming Fish and Game Department recommendations for treating a large area (greater than 1,000 acres) in the Cottonwood drainages (including Maki) to avoid concentrating elk use and minimize the browsing effects. Therefore, fencing of the aspen stands following burning was not considered. However, livestock grazing allotments would be deferred for up to 5 years to ameliorate livestock effects on early aspen regeneration.

Part of the reason for treating the aspen is to promote elk use of these areas and movement off of the feed grounds sooner. However, overuse of the aspen stands is possible because of the proximity to nearby feed grounds. Therefore, to assess this potential effect, monitoring would occur prior to burning and at the end of the second and fifth growing seasons in at least one site per treatment area. These areas are located primarily in older aspen, aspen/conifer forests near the Jewett feed ground and migration corridors.

Monitoring of 1970s Aspen Prescribed Burn Projects. The following summary is from a WGFD annual report (WGFD 2003a). A series of prescribed burns intended to regenerate aspen were conducted in the Jackson area during the early to mid 1970s. Four sites (Russold Hill, Breakneck Ridge, Burro Hill, and Uhl Draw) were periodically monitored for successful aspen regeneration. Regional WGFD habitat personnel coordinated monitoring of these sites again in October, 2002. Dale Bartos, USFS aspen ecologist/researcher from Logan, Utah, participated in the original project designs and implementation (Bartos et al. 1994), and also assisted with the 2002 monitoring.

Successful enhancement of treated aspen stands in northwest Wyoming is often difficult because of its preference as a browse species and high concentrations of wild ungulates. Maintenance and enhancement of aspen communities can be especially difficult when in close proximity to supplemental feeding grounds for elk. Long-term monitoring of historic aspen treatments provides managers with information important for designing successful treatments in the future. Aspen was successfully regenerated on Russold Hill, Uhl Draw, and Burro Hill. Stem densities ranged from 2,300 to over 3,300 stems per acre on the three sites, which is well above the objective of 1,000 stems per acre, 10 years post-treatment. Taller stems averaged 25 feet in height.

Aspen communities treated with prescribed fire at the Breakneck site, located within the Gros Ventre drainage, were not able to successfully regenerate because of excessive

browsing by elk. The Breakneck site is located near two elk feed grounds and is within an area where elk naturally concentrate prior to the initiation of feeding. While numerous other aspen treatments near elk feed grounds in northwest Wyoming have been successful, failure of aspen regeneration on the Breakneck site is primarily due to elk preferring it as a primary staging area prior to supplemental feeding. Sites with similar characteristics should be carefully evaluated for future aspen enhancement projects. On aspen sites with similar characteristics it is likely that special consideration pre- or post-burn treatments may be required in order to enhance the treatment success. These could run the gamut from various types of fencing (including solar-powered electric fencing), to laying down some smaller-diameter standing dead trees on the project site in a crisscross fashion to make access to elk more difficult, and to provide buffers and safe-sites to regenerating clones. (Large-diameter fire-killed trees need to be left intact for cavity nesting birds and for raptor use.) As noted previously, to assess the potential effect of elk browsing under the Proposed Action, monitoring would occur prior to burning and at the end of the second and fifth growing seasons in at least one site per treatment area.

Riparian. At least 1.5 acres of riparian habitat would be restored as a result of reclaiming 1 mile of the existing Nylander Road, which would be relocated out of the riparian area to the dry ridge area to the east. The road relocation would allow vegetation to reestablish and reduce road-related sediment delivery to Nylander Creek.

Wetlands. No direct impacts to wetlands are expected from this alternative.

Old Growth Forest. There are 15 acres of clearcut and 20 acres of commercial thinning proposed in designated old growth. (This is less than 2 percent of designated old growth in the analysis area.) Older trees, snags, and down material would be retained on the site.

Road Effects. A total of 13.8 miles of temporary roads and skid trails associated with Alternative B would result in the temporary loss of forested vegetation. The temporary roads would be closed, obliterated, and the habitat restored immediately after they are no longer required. This would result in a loss of forest productivity and habitat for 5 to 10 years.

Indirect Effects

It is expected that wildlife and livestock may cause substantial damage to aspen shoots that regenerate following prescribed burning or conifer removal. Overgrazing can impact the quality and number of aspen stems per acre (Bartos et al 1994, Bartos and Campbell 1998, Kay and Bartos 2000). Under the No Action Alternative, aspen stands would be at risk of being suppressed by conifers. However, under Alternative B (Proposed Action), aspen stands would be at risk of being overgrazed.

The process of prescribed burning in overgrown aspen stands may require establishing fuel breaks, which would temporarily impact vegetation. The risk of fire escaping control and causing unintended damage to adjacent vegetation resources is possible, but unlikely because the Forest Service prepares a detailed burn plan for each unit to be burned and includes specific conditions that must be followed and contingencies in place.

Prescribed burning can have indirect effects on the environment. Burning techniques and timing of burns can be varied to alter fire effects. Proper use of prescribed fire, and evaluation of the benefits and costs of a burn, require knowledge of how fire affects vegetation, wildlife, soil, water, and air (Forest Service 1989; National Wildfire Coordinating Group 2001):

- Prescribed burning may increase surface runoff, which may carry suspended soil particles, dissolved inorganic nutrients, and other materials into adjacent streams and lakes reducing water quality.
- Prescribed fires should be planned, to the extent possible, for times when nests are not being used in order to avoid adverse effects of prescribed fire on wildlife, including destroying nesting sites and possibly killing birds, reptiles, or mammals trapped in the fire.
- Prescribed fires may affect air quality.
- Prescribed burning causes temporary effects to aesthetics.

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 would include preventative and control actions for noxious weeds. Timber sale activities would include standard contract clauses to prevent and control noxious weeds. Knutson-Vandeberg (KV) funds would 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 would continue to be used as the tool to control any new noxious weed infestations.

Cumulative Effects

Past Effects. Vegetation in the Cottonwood II analysis area has been affected by past timber harvest and fires. Over 2,200 acres of clearcuts, most in the 1960s and 1970s and most of which have regenerated sufficiently to provide cover, have occurred in the analysis area. Past harvests also included partial cutting for railroad ties in the 1920s and 1930s. This area is considered excellent lynx habitat. More recently in the 1990s, harvest on the Big Piney Ranger District focused in the Beaver Creek drainage, 10 miles north of the analysis area and was approximately 50 percent of Forest Plan allowed levels.

Present Effects. There are no active timber sales in the Cottonwood Creek drainages. There are five recent and active timber sales in the Beaver Creek watershed, 9 to 13 miles north of the analysis area, including 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 area because of gated access.

Reasonably Foreseeable Effects. Cumulative effects may be associated with the planned harvest of timber and improvements to vegetation conditions in the Maki Creek drainage (Forest Service 2004b). This planned harvest is within opportunity areas identified as part of the interdisciplinary CPIS and within areas identified in the Forest Plan as suitable. Planned harvests would not 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 B-TNF 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 (p.317, FEIS for B-TNF Forest Plan). The Cottonwood II Vegetation Management Project is primarily in DFC 1B. The 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 B-TNF Forest Plan). In the 1990s, actual harvest in CIA 7 was approximately 50 percent of allowed levels. For the second decade (2000 to 2010) under the Forest Plan, allowable sale quantity for CIA 7 would increase to 68 MMBF on an estimated 8,050 acres. One of the reasons for this increase is that past harvest areas of the 1960s and 1970s 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 would be 14 to 15.5 MMBF on 1,325 to 1,445 acres. This is 23 percent of the allowable sale volume on 17 percent of the acres estimated to achieve that volume. Even if the lower first decade quantity is extended into the second decade, the reasonably foreseeable volume is 66 percent of allowed on 42 percent of allowed acres.

Alternative C -- Reduced Harvest and Temporary Roads

Direct Effects

The management objective of Alternative C is the same as the Proposed Action (Alternative B). However, in response to public scoping comments suggesting an alternative with less timber harvesting using clearcutting, the Forest Service IDT developed Alternative C. Alternative C reduces the number of acres where vegetation management is conducted, reduces the number of acres clearcut, and increases the acres of aspen treatment for habitat improvement.

Manipulation of vegetation is proposed on 2,032 treatment acres for Alternative C to help achieve desired conditions and respond to project issues in the five treatment areas, 67 acres less than under Alternative B. As shown in Table 2-4, the number of clearcut acres is reduced from 402 to 262 acres. Acres to be thinned increase by 19 acres to 266 acres, and 13 fewer acres would be treated using a shelterwood cut (132 acres total). Sanitation salvage tree removal would be increased by 18 acres (157 acres total), and there would be 11 additional acres treated through group selection (61 acres total). Acres of aspen treatment through harvesting encroaching conifers would be increased from 58 acres to 96 acres. There would be no change in aspen acres treated by prescribed burning (1,058 acres total). The length of temporary roads needed to implement the treatments would be 9.3 miles, a decrease of 4.5 miles compared to the Proposed Action.

Of the 30,894 total acres among the five treatment areas in the Cottonwood II analysis area, no action would occur on the remaining 28,862 acres (93 percent) and the effects described in Alternative A (No Action) related to changing vegetation, would apply to that area. Like Alternative B, Alternative C would provide more of a mosaic of vegetation on the landscape and provide increased age class diversity compared to the No Action Alternative. Treated stands would serve as fuel breaks where fire behavior would be moderated. In aspen stands, at highest risk for deterioration and loss (Forest Service 1997), a higher proportion would be treated in this alternative. This would substantially reduce the effects associated with aspen decline described for the No Action Alternative.

In many cases, the harvest units proposed are the same for Alternative B and Alternative C. Alternative B was modified in several ways to develop Alternative C. For example, several harvest units were removed, the acreage treated in several harvest units was reduced, and the treatment type was changed in some cases.

Table 3-9 summarizes the acreage affected for Alternative C by treatment and treatment area. Table 3-10 summarizes the acreage affected for Alternative C by treatment and location/site number. Of the 3,699 acres included in forest management location/sites, a total of 2,724 acres (74 percent of the total) is proposed to remain untreated.

TABLE 3-9
Summary of Vegetation Treatments for Alternative C—Reduced Harvest and Temporary Roads (Acres)

	Clearcut	**Partial Cut Treatments**				**Aspen Treatments**	
Treatment Area		**Thin**	**Shelterwood**	**Salvage**	**Group Select**	**Conifer Removal**	**Prescribe Burn**
South Cottonwood	168	152	73	112	12	68	414
Halverson	26	0	40	45	20	16	55
McDougal	48	30	9	0	19	0	0
Sjhoberg	20	24	10	0	10	12	291
Nylander	0	60	0	0	0	0	298
	262	266	132	157	61	96	1058
Subtotal	**262**	**616**				**1,154**	
Total	**2,032**						

TABLE 3-10
Summary of Vegetation Treatments by Location/Site Number for Alternative C—
Reduced Harvest and Temporary Roads (Acres)

Location and Site Number	Acres	Proposed Acres Treated	CC	TH	SW	S	GS	Aspen	Area Untreated
49-16	21	2	-	-	2	-	-	-	19
49-22	111	20	-	20	-	-	-	-	91
49-24	60	20	-	20	-	-	-	-	40
49-26	68	20	-	20	-	-	-	-	48
49-32	12	12	-	-	-	-	-	12	0
49-33	101	18	-	-	8	-	10	-	83
49-35	214	44	20	24	-	-	-	-	170
51-10	105	25	15	-	-	-	10	-	80
51-12	139	9	-	-	-	-	9	-	130
51-24	58	33	33	-	-	-	-	-	25
51-30	91	20	-	20	-	-	-	-	71
51-37	37	19	-	10	9	-	-	-	18
56-1	250	65	10	-	20	20	-	15	185
56-2	192	40	6	-	-	14	20	-	152
56-4	51	10	-	-	-	10	-	-	41
56-5	58	10	10	-	-	-	-	-	48
56-8	84	20	-	-	20	-	-	-	64
64-1	21	10	-	10	-	-	-	-	11
64-2	15	6	6	-	-	-	-	-	9
64-3	39	16	10	-	-	6	-	-	23
65-3	61	14	-	14	-	-	-	-	47
65-9	44	20	20	-	-	-	-	-	24
65-10	96	12	-	-	12	-	-	-	84
65-13	39	10	10	-	-	-	-	-	29
65-15	35	10	-	-	10	-	-	-	25
65-16	37	10	-	-	10	-	-	-	27
66-1	63	12	4	8	-	-	-	-	51
66-2	66	24	24	-	-	-	-	-	42
66-3	110	21	10	-	-	11	-	-	89
66-4	105	19	12	-	-	-	7	-	86
66-5	52	18		-	-	18	-	-	34
66-16	266	19	13	-	-	-	6	-	247
67-16	43	26	-	-	26	-	-	-	17
68-2	116	109	-	109	-	-	-	-	7
68-18	61	8	8	-	-	-	-	-	53
70-3	65	61	-	-	-	-	-	61	4
70-8	357	75	23	-	-	52	-	-	282
70-9	29	5	5	-	-	-	-	-	24
70-12	36	11	11	-	-	-	-	-	25
70-13	37	15	-	-	15	-	-	-	22
70-14	7	7	-	-	-	-	-	7	0
70-15	206	30	13	12	-	5	-	-	176
70-20	41	20	-	-	-	20	-	-	21
Total	**3,699**	**975**	**263**	**267**	**132**	**156**	**62**	**95**	**2,724**

The 878 acres of clearcut and partial harvest would utilize timber resource values providing forest products for local and regional economies for 5 to 10 years. Harvest would occur only in areas appropriate and suitable as determined in the Forest Plan EIS. The potential harvest volume, depending on treatment area, would range from 1,000 to 5,000 CCF per treatment area, would be consistent with Objective 1.1 of the LRMP, and

would be consistent with harvest levels from the Big Piney Community Interest Area (CIA) 7 (B-TNF Forest Plan EIS, p. 524). Harvest acres would be significantly less than the 6,140 acres of opportunity areas identified in the CPIS because of other constraints. Silvicultural systems are consistent with Forest Plan DFCs 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.

Vegetation condition in conifer stands would still remain outside desired conditions, but moving towards a desired condition. The FVS summary presented previously in Table 3-8 for representative stands and harvest methods in Alternative B also illustrates effects on forested vegetation for Alternative C. Further examples are found in the project file. A total of 262 acres would be clearcut with this alternative, which is 140 acres less than the area proposed in Alternative B (402 acres). This is the most significant difference between the two alternatives, which is the result of public scoping comments. The 31 clearcut harvest units would range in size from 2 to 19 acres, with an average size of 8 acres.

There are 616 acres of partial cuts planned in Alternative C. This is 35 acres more than proposed under Alternative B. Because of the relatively small increase in acres, the description of effects is the same as Alternative B above. Changes in proposed partial cut treatments are summarized:

- Commercial thinning on 266 suitable acres is 19 acres more than under Alternative B. The 15 thinning units would range in size from 3 to 68 acres, with an average size of 18 acres.
- Shelterwood harvest would provide for conditions favoring natural regeneration of Engelmann spruce and Douglas-fir on 132 acres while maintaining healthy trees on the site. There are 13 acres less proposed for shelterwood than under Alternative B. The 10 shelterwood harvest units would range in size from 2 to 26 acres, with an average size of 13 acres.
- Sanitation salvage harvest would occur on 157 acres of mature or over mature mixed conifer stands. The 13 salvage units would range in size from 4 to 26 acres, with an average size of 12 acres.
- Group selection harvest in units of 2 acres or less, on 61 acres proposed for Alternative C is 11 acres more than under Alternative B. The 6 group selection harvest areas would range in size from 6 to 20 acres per stand, with an average area treated of 10 acres. Effects would be similar to Alternative B.
- Removal of commercial conifer from aspen stands would occur on 96 acres in 5 harvest units. This is 38 acres more than under Alternative B. The 5 aspen harvest units would range in size from 7 to 61 acres, with an average size of 19 acres.

As in Alternative B, 1,058 acres of aspen would be prescribe burned under Alternative C. The descriptions of effects are identical.

Riparian. As in Alternative B, approximately 1.5 acres of riparian habitat would be restored as a result of reclaiming 1.0 mile of the existing Nylander Road, which would be relocated out of the riparian area to the dry ridge area to the east.

Wetlands. No direct impacts to wetlands are expected from this alternative.

Old Growth Forest. There are 10 acres of group selection and 20 acres of thinning proposed in designated old growth. (This is less than 2 percent of designated old growth in the analysis area.) Older trees, snags, and down material would be retained on the site.

Road Effects. A total of 9.3 miles of temporary roads and skid trails associated with Alternative C would result in the temporary loss of forested vegetation. This effect is 4.5 miles less than for Alternative B. The temporary roads would be closed, obliterated, and the habitat restored immediately after they are no longer required. This would result in a loss of forest productivity and habitat for 5 to 10 years.

Indirect and Cumulative Effects

Indirect and cumulative effects under Alternative C would be similar to those described for Alternative B.

3.2.5.2 Wildlife Resources

Alternative A -- No Action

Under this alternative, there would be no vegetation management to regenerate aspen stands and no action to improve roads and trails.

Direct Impacts

There are unlikely to be any direct disturbance effects to wildlife species, particularly to harvested species, migratory birds, or amphibians, under this alternative.

Indirect Impacts

Indirect effects to elk, mule deer, and perhaps to some species of migratory birds would likely occur under this alternative. Aspen management is necessary if aspen stands are to reach DFCs for improving habitat for elk calving areas. The No Action Alternative would allow succession and conifer encroachment into aspen stands to continue. Over time, lack of forest management actions in the analysis area would likely indirectly contribute to the decline in habitat values for elk and migratory birds that use aspen. Dense mature conifer stands often have limited herbaceous and shrub understories, which limit use by a number of species because of lack of cover and food. This is especially true in lodgepole pine stands. These conditions would continue under Alternative A.

Cumulative Impacts

None are likely to occur under the No Action Alternative.

Alternative B -- Proposed Action

Under this alternative, 1,041 acres of coniferous forest would be treated through harvesting and 1,058 acres of aspen would be prescribe-burned to regenerate aspen stands.

Summary of the Effects of Fire on Wildlife. Excerpts from a recent summary of the general effects of forest fire on fauna (Smith 2000) follow as an introduction to the discussion of potential impacts on wildlife resources under the Proposed Action. The effects of fire on wildlife vary considerably depending on the season of the fire and its severity, size, and duration (Lyon et al. 2000). Forest fires generally kill and injure a relatively small proportion of animal populations. For instance, the large fires in the Greater Yellowstone Ecosystem killed about 1 percent of the area's elk population. As expected, the season of burn has a substantial influence on wildlife mortality. Most medium and large mammals leave the burn area. Burning during the nesting season is more detrimental to birds and small mammals than fires later in the summer or fall. Many small mammals seek refuge in underground burrows to survive fires. Any instance of high mortality among small mammals is generally not believed to be a substantial problem because their high reproductive potential allows them to increase rapidly in favorable environments and disperse readily into burned areas. Most adult birds also flee in the face of oncoming fires. A few species are attracted to actively burning fires because fleeing prey animals are more vulnerable to predation.

The duration that wildlife emigration persists following fire also varies. Many species leave an area and do not return for years or decades because of the substantial habitat alteration. Others return almost immediately or after the first year or two to take advantage of new or improved food sources. Among these are elk and deer to forage on new herbaceous growth, and woodpeckers and secondary cavity nesters to utilize newly created snags and increased insect populations.

Many animal-fire studies indicate that wildlife communities are generally "reorganized" following fires with increases in some species accompanied by decreases in others (Huff and Smith 2000). Over the short-term of 5 to 15 or 20 years, there is a general shift from canopy- to ground- and shrub-dwelling species. Huff and Smith (2000) note substantial species turnover following fire in a 200-year old stand of spruce-fir-lodgepole pine forest in Grand Teton National Park.

Direct Impacts

The general effects of fire on wildlife described above would likely occur within burn areas under the Proposed Action. However, the relatively small size of the prescribed burns and the large areas of unburned lands within the analysis area would limit the extent and severity of direct effects on wildlife at the population level. All wildlife species that reside within treatment areas would likely be disturbed during treatment. However, this type of direct disturbance to adult animals is usually of short duration for short-term disturbances, such as small prescribed burns, construction noise, and human presence. Adult animals can be killed during high-intensity, fast-moving wildfires, but small prescribed fires that would be used for this treatment are unlikely to cause significant mortality. Although mortality and injuries from fires, logging, or road construction equipment for most adult wildlife would be minor, young animals may be harmed under the Proposed Action if treatment is done when the young are vulnerable and cannot escape. An exception where both adults and young would be adversely affected is amphibians that inhabit cold streams. Increased water temperatures and sediment resulting from treatments and temporary roads would result in mortality of both adult and young stream amphibians (Bury 2004). Such impacts would probably persist

for a few years until pre-treatment conditions return and areas are repopulated from adjacent untreated areas. Alternative B would include approximately 14 miles of temporary roads and skid trails versus 9.5 miles under Alternative C. Temporary roads would contribute to higher sediment loads in treated areas for a period of up to 5 years, depending on the success of rehabilitation efforts, which is partially dependent on natural moisture conditions.

While treatment would disturb some wildlife species and result in some mortalities, there should be no long-term direct negative population-level impacts from treatments proposed under Alternative B. Direct impacts are likely to be more negative under this alternative than under the No Action Alternative or Alternative C.

Indirect Impacts

The general effects of fire on wildlife described above would likely occur within burn areas. However, the relatively small size of the prescribed burns and the large areas of unburned lands within the project area would limit the extent and severity of indirect effects on wildlife at the population level. Indirect impacts would likely vary by treatment. In prescribed burned aspens stands, indirect impacts to wildlife species that use those areas would likely be negative immediately after burns because vegetative biomass would be removed and plant structural diversity would be greatly reduced. Forbs and grasses generally regrow relatively quickly after fire. Several mammal species readily move into burned areas in early spring because the flush of herbaceous growth is highly nutritious. Within one or two seasons after a fire, mule deer, elk, and moose seek out herbaceous growth in burned areas during spring and summer months, but shrub growth would be limited for longer period after a burn (Lyon *et al*. 2000). Immediate indirect effects would be positive for those species that are attracted to recently burned areas, such as large ungulates. Treatment areas would not overlap crucial big game winter range so there would be no adverse effects in these areas. The increased growth of herbaceous cover and shrubs would dominate treated lodgepole pine sites for a period of 10 to 15 years, and continue at a higher frequency than at present for up to 40 years until the forest canopy begins to close again. This vegetation would also provide habitat for a variety of wildlife species that nest or forage on the ground and in shrubs.

Short-term indirect effects on wildlife species directly after fire or logging treatments may include increased predation rates because of the removal of hiding cover. Predation rates from animals moving from the disturbed area may increase as well, especially if there is no adequate habitat nearby in which to move. Indirect impacts of elk on regeneration from root shoots of aspen is likely to provide increased forage in the short-term but may impact long-term goals.

Migratory birds that nest in aspen or conifer treatment areas would lose habitat for a period of years. The diverse mixture of habitats within the analysis area makes a home for a variety of migratory bird species that occupy or use forested habitats or aspen stands for nesting, particularly warblers, flycatchers, vireos, and western tanagers. These would be the species most impacted by habitat loss resulting from the treatment.

Snags created by treatments and that are left standing (estimated to be 5 to 10 per acre) would provide valuable habitat for primary and secondary cavity nesters for many years

because of additional nest sites and higher insect populations. Current snag densities in treatment areas are not known so it is uncertain if the treatments would result in more or fewer snags. Snags are not likely to be left standing in clear-cut areas.

A study of birds using thinned versus unthinned Douglas-fir stands found that thinning increased bird use for migratory species, such as warbling vireos (*Vireo gilvus*), and decreased bird use for other species, such as Pacific-slope flycatchers (*Empidonax difficilis*) (Hagar *et al*. 1996). Vegetation treatment results in decreased diversity of the structure and composition of both conifer and aspen communities in the short-term. However, conifers invading and overtaking aspen stands, which is presently occurring in the analysis area, results in a long-term loss of habitat diversity as aspen stand integrity is lost without vegetation management.

Long-term browsing of resprouting aspen by elk may deplete aspen clones of root energy stores and prevent the treatment from succeeding. If elk and other large herbivores can be prevented from removing too much regrowth from aspen sprouts, the long-term impacts to vegetation under the Proposed Action would likely be positive. This would lead to positive indirect impacts to wildlife that need aspen stands. This is true for migratory bird species, woodpecker species, and primary and secondary cavity nesting species. Prescribed burned areas would likely provide new snags for bird species that use snags. Rejuvenated aspen stands move treated portions of the forest in the direction preferred by the DFCs concerning elk calving areas. Rejuvenated aspen stands would provide long-term habitat for migratory birds.

Long-term indirect impacts would likely be more positive under the Proposed Action than under the No Action Alternative or Alternative C.

Cumulative Impacts

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 clear cuts. Personal use and small firewood and post and pole sales also occur but are rare in the Maki Creek area because of gated access.

Reasonably Foreseeable: Cumulative effects to wildlife and wildlife habitat may be associated with the planned harvest of timber and improvements to vegetation conditions in the Maki Creek drainage (Forest Service 2004b). This planned harvest is within opportunity areas identified as part of the interdisciplinary CPIS and within areas identified in the Forest Plan as suitable. Planned harvests would not exceed created opening standards and would comply with silvicultural and reforestation standards.

Alternative C -- Reduced Harvest and Temporary Roads

Under this alternative, 974 acres of coniferous forests would be treated by harvesting and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands. Similar to Alternative B, the relatively small size of the prescribed burns and the large areas of

unburned lands within the analysis area would limit the extent and severity of direct and indirect effects on wildlife at the population level.

Direct Impacts

Direct impacts to wildlife from aspen treatment would be the same as described for the Proposed Action. However, disturbance from logging and mechanical treatment would be somewhat less than under the Proposed Action because fewer acres of coniferous forest would undergo these treatments and there would only be 9.5 miles of temporary roads and skid trails. Possible impacts to wildlife under Alternative C would be slightly less than under the Proposed Action, but greater than under the No Action Alternative.

Indirect Impacts

Alternative C would treat less forest land using several types of harvest methods, so there would be fewer overall indirect long-term beneficial impacts to habitat improvement. However, there is a greater area of aspen treated and fewer created openings in conifer stands than under Alternative B. Short-term beneficial impacts would be approximately the same as under the Proposed Action. Long-term habitat improvement and progress towards DFCs under Alternative C would be somewhat less than under the Proposed Action, except for greater aspen regeneration benefits, but greater than under the No Action Alternative.

Cumulative Impacts

Cumulative impacts would be similar to those described for the Proposed Action.

3.3 Forest Fuels and Fire

3.3.1 Introduction

This section discusses the current vegetation conditions in the analysis area as they relate to the management of forest fuels and fires. Potential environmental effects on those conditions from implementing either Alternative A (No Action), Alternative B (Proposed Action), or Alternative C (Reduced Harvest and Temporary Roads) are also discussed. There were no significant issues or indicators identified for forest fuels and fire during public scoping. However, forest fuel conditions and fire occurrence have a direct impact on all the significant issues of the proposed project, and are therefore important considerations in the analysis of project effects.

3.3.2 Existing Conditions

The current conditions within the analysis area were derived from onsite observations and analysis of available vegetation data. Vegetation conditions were described in *Section 3.2, Wildlife and Vegetation Resources* and will not be re-stated in this section of the EIS. Additional references used in the preparation of the existing conditions section of *Forest Fuels and Fire* include Anderson (1982), Johnston and Hendzel (1985), Shepard (1985), Brown and Simmerman (1986), Crane and Fischer (1986), DeByle et al. (1987), Fischer and Bradley (1987), and Gruell et al. (1987).

3.3.2.1 Background

Prior to the appearance of the tie hack industry, lightning caused fire and most likely fire ignited by the indigenous populations played the dominant role in maintaining diversity of species and age classes in the analysis area. In the last 75 years, forest management activities have modified fuel continuity through road construction, fuel wood gathering along existing roads, past timber harvest, brush disposal, grazing, wildland fire suppression, and prescribed fire.

The Cottonwood II analysis area is covered by a variety of vegetation types influenced by the rolling and broken terrain. Forested vegetation is principally lodgepole pine, subalpine fir/Englemann spruce, and aspen with occasional mountain big sagebrush/grass openings. The forests are mostly subalpine fir habitat types and typically have a dense understory of subalpine fir/Englemann spruce with an older component of lodgepole pine or limber pine. There are scattered Douglas-fir and limber pine and whitebark pine stands in the area. Much of the aspen forest in the area has undergone conifer encroachment. Some aspen stands having deteriorated significantly and now are composed mostly of conifers.

Vegetation and dead-and-down fuel within the Cottonwood II analysis area have historically been modified by wildland fire, but more recently fire exclusion through effective wildland fire suppression and public fire prevention education programs has begun to re-shape the landscape. Stand structure and composition were historically influenced by fire severity, available seed sources, and the fire return interval (FRI). Within the Cottonwood Watershed, large fires covering extensive areas appear to have not been the norm. Most fires were small in nature because of broken continuity of the timber fuel, the relatively moist environment, and a comparatively short wildland fire season at these high elevations.

The following text discusses the current vegetation conditions as they relate to fire/fuel management. It is important to note the appropriate management response for the analysis area has been suppression of all ignitions. Because of fire exclusion, wildland fire has been removed as the historical disturbance agent that shaped the general vegetation mosaic and more specifically the plant species and age-class diversity of the analysis area. Fire exclusion is one condition that results in modification of a region’s fire regime condition class (FRCC). Changes in FRCC may also result from previous land management practices other than fire exclusion. In the event of a wildland fire in an area with a significantly modified FRCC which has resulted from advanced vegetation/fuel succession, the effects of wildland fire severity can cause a departure from the FRI. A departure from NVR can lead to many other vegetation management problems, such as noxious weed spread. A lack of wildland fire in an area does not necessarily mean a departure from NVR has occurred. Dry forest habitat types tend to have more frequent FRIs than more mesic or wet habitat types and, as a result, might have a greater departure in NVR. A significant departure from the FRI can potentially lead to a change in NVR, usually resulting from changing forest structure and accumulation of live and dead fuel.

The Bare Creek and Cottonwood fires are the two most recent wildland fires that escaped initial suppression efforts in the larger Cottonwood analysis area. The effects from these two fires are evident from the vegetation composition and structure today. The Bare

Creek fire occurred in 1940 and was mostly a stand replacement fire. The burn was all naturally regenerated and is now reforested with pole size trees, primarily lodgepole pine, with a mixture of subalpine fir and Engelmann spruce and large areas of aspen regeneration. There is an average of 500 to 600 trees per acre, with heights of 35 to 40 feet. A few scattered snags from the fire remain, but most have fallen down and are now down, decomposing logs. These down logs contribute to a light to moderate fuel loading, with some potential for a re-burn in the area. Most regenerations are healthy now, but overstocked conditions can lead to future forest health problems such as stagnated growth, unhealthy crowns, and susceptibility to bark beetles. The 1,003-acre Cottonwood fire in 1956 was the last large wildland fire to occur.

Numerous other ignitions were initial attacked and suppressed as very small fires and are not now easily identified. How these suppressed wildland fires might have impacted the fire history of the analysis area if they had not been extinguished is pure speculation. They may have remained small and gone out on their own as most historical fires in the area appear to have done, or they may have grown larger and had a significant impact on the vegetation. Wildland fire suppression will continue to be a vital component of any fire management program, but the issue of wildland fire exclusion will be addressed by treating fuel accumulations (mechanical, prescribed fire, wildland fire use, or a mixture of all three management techniques). The goal of active land management will also address historic disturbance processes, preferably at the landscape level. Continued total wildland fire exclusion will continue to degrade properly functioning ecosystems.

The South Cottonwood area is characterized by several different Fire Groups (based on vegetation data used within the 1988 Forest Service Plan) with a variety of differing FRIs. Fire Groups are forest habitat types with a similar response of the tree species to fire and the role these tree species take during succession stages. The exception is Fire Group Zero, which is a description of miscellaneous vegetation types. It is believed that within the coniferous forest of the Cottonwood analysis area, periodic wildland fires occurred at roughly 100 to 150 year intervals. Most timbered stands are now greater than 100 to 150 years old. This would indicate that most of the coniferous forest within the analysis area is either within, or just entering, the upper limits of natural variation for known FRIs for the various Fire Groups represented.

Lower elevations within the Cottonwood analysis area occupied primarily by mountain big sagebrush/forb/grass communities with scattered clones of aspen may have had more frequent FRIs because of fire sweeping into the foothills from the grasslands below. However, by the late 1800s as a result of European-American settlement and associated cultivation, irrigation, and extensive livestock grazing, there were major barriers to the continuity of grassy fuel that restricted the spread of fire. These aspen/shrub/grassland areas provide a mosaic on the landscape and break up the fuel continuity of the conifer stands; they do not normally pose a particularly hazardous fuel condition or suppression concern. However, under the proper environmental conditions these vegetation types can exhibit significant fire behavior. At the elevations in the Cottonwood area, curing of fuel does not typically occur until late summer—frequently not until after the first killing frost, inhibiting fire behavior. As a result, summer and early autumn season fires tend to spread through accumulations of previous year's cured growth unless it has been removed by either grazing or mechanical means. Communities with a large component of

sagebrush are the exception and will carry fire more readily. Because of the relative ease of control and safety considerations, these aspen/shrub/grassland areas are frequently used by both suppression and prescribed fire personnel to establish fire control features such as wet or black lines following natural fuel breaks and the least flammable fuel type. Conifer encroachment is noticeable throughout the aspen/mountain sagebrush/forb/grass community because of fire exclusion. This fuel component will increase localized fire behavior as well as contribute to potential spotting from embers.

3.3.2.2 Undesignated Fire Group (Based on Forest Habitat Types)—Mountain Big Sagebrush/Forb/Grass

The FRI within communities with mountain big sagebrush is highly variable. Mountain big sagebrush is quite sensitive to fire-induced mortality and does not resprout. Seed has been shown to germinate more readily following a light heat treatment. Seed is neither highly dispersed nor long-lived in the soil. Seed retained within the sagebrush canopy is destroyed by fire. Young plants grow rapidly and reach reproductive maturity within 3 to 5 years. Herbaceous vegetation following fire has improved growing conditions by increased availability of soil moisture, nutrients, and sunlight. The response potential of grasses and forbs will vary depending on preburn condition and density. Herbage production may be less than preburn levels the first growing season following a fire but can be expected to increase significantly by the fifth growing season if moisture is adequate.

3.3.2.3 Fire Group Zero—Aspen Groves in Varying Degrees of Succession [Aspen, Aspen (seral slow), Aspen (seral/fast)]

Groves of quaking aspen can occur as local climax vegetation on streamside sites or as fire maintained seral stands in areas that would otherwise be dominated by conifers. In the fire-maintained areas, the absence of fire can result in the gradual elimination of the deciduous tree species because of a lack of successful regeneration. The FRI for aspen stands has been estimated to be 100 to 300 years.

Fire Management Considerations in Fire Group Zero

Fire Group Zero habitat types will not burn readily under normal summertime weather conditions. Fire managers can take advantage of this fact when developing pre-attack plans and when delineating fire management areas, units, or zones. These areas can also serve as anchor points for fuel breaks and firebreaks.

Meadows and aspen groves can be important wildlife habitats. Prescribed fire is a suitable tool for maintaining desired forage conditions in these habitats.

3.3.2.4 Fire Group Seven—Cool Habitats Usually Dominated by Lodgepole Pine

Fire Group Seven contains two groups of habitat types. The first group consists of lodgepole pine climax series habitat types (and community types) that support essentially pure stands of lodgepole pine, which constitutes the persistent dominant species on these sites. The other group consists of those Douglas-fir, spruce, and subalpine-fir habitat

types that are usually found supporting lodgepole pine-dominated stands. Wildfires evidently recycle the stands before the lodgepole pine dies out and frequently long before climax forest conditions are ever attained.

Fire maintains lodgepole pine as a dominant seral species and as a persistent dominant in later successional stages. Lodgepole pine dominates sites either because it is the only species that occurs there (edaphic climax) or fire eliminates other conifer species. Given sufficient time, shade-tolerant species emerge through the overstory, resulting in a greater diversity of age-classes and vegetation species. Periodic crown fires play a significant role in the development of these lodgepole pine forests.

Subalpine fir, spruce, Douglas-fir, and white-bark pine occur in varying amounts with lodgepole pine on most sites. Undergrowth often consists of dense mats or layers of grasses or shrubs.

Forest Fuel in Fire Group Seven

The average downed woody loading in Fire Group Seven is about 18 tons per acre. Inventories have shown a range of about 3 to 35 tons per acre of naturally accumulated fuel, but maximum loads may greatly exceed this range.

Fuel loads are characterized by relatively large amounts of material 3 inches or more in diameter. At least half of the total weight is usually contributed by large material. As a general rule, the proportion of the total fuel load, in this Fire Group, made up of 3 inches or more in diameter increases as the total fuel load increases.

Live fuel can be a problem but not to the extent it is in some other Fire Groups. The primary live fuel consideration is related to the occurrence of dense patches or entire stands of young lodgepole pine with intermingled crowns and entire lower branches extending down to the surface fuel. When ignited under favorable conditions, such stands are usually destroyed in a few minutes.

Role of Fire in Fire Group Seven

On lower elevation sites the role of fire in seral lodgepole forests is almost exclusively as an agent that perpetuates or renews lodgepole pine. Without periodic disturbance, the shade-tolerant species replace lodgepole pine because it does not regenerate well on duff or under shaded conditions. Fire interrupts the course of succession and increases the proportion of lodgepole pine with each burn. Within 50 to 100 years following a severe fire in a lodgepole-dominated stand, a re-established lodgepole pine forest will exist even though shrubs and herbaceous cover may become dominant immediately following the burn.

Large-scale, stand-replacing fires play a major role in the ecology of lodgepole pine stands. The natural periodicity of severe fires in seral lodgepole stands probably ranges from less than 100 years to about 500 years. Recurring cool fires may thin the stand or otherwise rejuvenate it without doing serious damage. However, in stands greater than 60 to 80 years old, fuel will build up to hazardous levels because of natural thinning,

mountain pine beetle outbreaks, dwarf mistletoe infestations, and fire-killed timber (snags) from previous fires. Eventually a chance ignition followed by a major weather front passage with associated strong winds sets off a major conflagration. Such a fire can cover thousands of acres. Vast tracts of lodgepole can develop in this manner as the serotinous cones open and shower the burn with seeds. However, not all lodgepole in the area are serotinous.

The almost exclusive dominance of lodgepole pine within the lodgepole pine community types is attributed in large part to fire. Several suggestions have been forwarded for the absence of other species on lodgepole pine climax series site, as follows: 1) Historic, repeated fires over large areas may eliminate seed sources of potential shade-tolerant competitors; 2) light ground fires may remove invading shade-tolerant competition from the understory; 3) dense stands may prevent regeneration of all conifers for years in the absence of disturbance or stand deterioration; 4) sites may be unfavorable for the establishment of other conifers.

At higher elevations the role of fire in lodgepole pine forests appears to differ from the classic pattern. At these altitudes the fire season is relatively short in most years, productivity is low, and mountain pine beetle activity is inhibited by low temperatures and the short growing season. Small, lightning-caused fires burn out patches of forest several acres in area and then die out. The result may be a mosaic of age classes, not uniform single-aged forests prevalent on many lower elevation sites.

Fire Management Considerations in Fire Group Seven

Perhaps the primary fire management consideration in Fire Group Seven is protection from unwanted fire during extreme periods of drought and during severe fire weather conditions. Fires at such times often crown and become short-term catastrophic fire events if the lodgepole pine stand is ready to burn.

Opportunities for fire use are limited in natural stands because of the low fire resistance of lodgepole pine, spruce, and subalpine fir. The other side of this problem is that during “safe” fire weather, it is often difficult to sustain a fire. But low- to medium-severity surface fires do occur. Thus, there may be opportunities to use prescribed fires to accomplish specific management objectives.

The primary use of prescribed fire in lodgepole pine has been and undoubtedly will continue to be for hazard reduction and site preparation in conjunction with tree harvesting and subsequent regeneration. Broadcast burning and pile and windrow burning have been the most often used methods of accomplishing these tasks. Successful broadcast slash burning usually yields increased forage production for big game. Slash disposal of any kind aids big game movement.

As indicated earlier, the primary concern in the fire management for many commercial lodgepole pine forests is the prevention of stand-destroying fires. Timber harvest for a variety of products, and subsequent slash disposal, are the primary means to this end. Harvest schedules can be developed and implemented to create age-class mosaics of lodgepole pine. This minimizes the areal extent of stand-destroying fires. Silvicultural

practices designed to harvest trees susceptible to insect attack before the trees are attacked can greatly reduce the threat of severe fires in second-growth stands of lodgepole pine. The use of lodgepole pine for firewood, poles, posts, wood chips, and sawlogs may provide opportunities for fuel management-related harvesting.

3.3.2.5 Fire Group Eight—Dry, Lower Subalpine Habitat Types

Fire Group Eight consists of dry lower subalpine habitat types where spruce or subalpine fir are the indicated climax species. Douglas-fir and lodgepole pine are dominant seral species, with lesser amounts of spruce. The prevalence of Douglas-fir and lodgepole pine may be due, in part, to periodic wildfire that sets back the invasion of subalpine fir and spruce. Stands usually contain luxuriant undergrowth, including a wide variety of herbaceous and shrub species.

Forest Fuel in Fire Group Eight

The downed woody loading in Fire Group Eight is highly variable, with measured ranges from as low as 1 ton per acre, with 20 tons per acre usually being about the low end, to about 80 tons per acre. Dense understories develop in many stands and provide fuel ladders to tree crowns. Live fuel can contribute significantly to overall fire hazard during dry conditions. Burning in deep duff layers can cause considerable mortality to shallow rooted trees species such as subalpine fir and Engelmann spruce.

Role of Fire in Fire Group Eight

The occurrence of periodic low- to moderate-severity fire favors Douglas-fir and lodgepole pine. Such fires set back invasion by the more tolerant subalpine fir and spruce, which in the absence of fire form dense understories and eventually take over the site. Fires of moderate severity probably help Douglas-fir maintain a position of dominance or co-dominance with lodgepole in many stands. The more fire-resistant Douglas-fir has a better chance of surviving such fires and is able to successfully regenerate in fire-created openings where mineral soil has been exposed. Severe, stand-destroying fire will generally favor lodgepole pine on many of these sites. Some large, thick-barked Douglas-fir trees will often survive fires severe enough to kill all the lodgepole pine trees, thereby assuring the presence of Douglas-fir in the new stand.

Fire Return Intervals probably fell between those reported for Fire Group Seven lodgepole pine stands (less than 100 years) and those identified for the more moist lower subalpine fir types of Fire Group Nine (90 to 150 years).

Fire Management Considerations in Fire Group Eight

Fire protection is usually an important fire management consideration during severe burning conditions, especially where timber production is a management objective. When conditions are less severe, fires may be of low- to moderate-severity and result in only moderate damage or no damage to overstory trees, despite the relatively low resistance of many of the species present.

Where timber production is not a management objective, opportunities may exist for the use of fire to accomplish management objectives. Such fires can create vegetation mosaics that in turn provide a diversity of wildlife habitats, diverse scenery, and enhanced recreational opportunities. Vegetation mosaics can also reduce the probability of widespread wildfire damage to watershed values.

3.3.2.6 Fire Group Nine—Moist, Lower Subalpine Habitat Types

Fire Group Nine is composed of moist and wet lower subalpine habitat types in the spruce and subalpine fir climax series. Soils are moist or wet much of the year. Engelmann spruce is usually a major component of seral stands along with lodgepole pine and occasionally Douglas-fir. Older stands are usually dominated by subalpine fir and spruce, although Douglas-fir and lodgepole pine may be well represented. A notable exception to this general pattern of species composition occurs when the sites are too wet for Douglas-fir. Whitebark pine occurs either accidentally or on some sites as a minor seral species. Abundant undergrowth occurs on these sites.

Forest Fuel in Fire Group Nine

Fuel loads are similar to those found in Fire Group Eight with considerable material in larger downed dead wood on the forest floor. The combination of deep duff and large quantities of dead and down material can result in severe surface fire during dry conditions. Where dense understories exist, these can easily transition into crown fire situations. Even if a surface fire does not crown, most overstory trees will be killed by cambium heating. Under normal moisture conditions, a lush understory of shrubs and herbs usually serves as an effective barrier to rapid fire spread.

Role of Fire in Fire Group Nine

In northwestern Montana the fire history in a Fire Group Nine forest ranged from 117 years in valleys to 146 years on lower alpine slopes. These fires were reported to be small, moderate severity surface fires that occasionally crowned, especially near ridge tops.

The impact of fire on Group Nine sites is indicated by stand condition and species composition. The general absence of spruce or subalpine fir climax condition is evidence of disturbance by past fires. The dominance of lodgepole pine on many sites suggests these stands developed on a fire-created mineral soil seedbed. Frequent moderate to severe fires may be restricted in their occurrence because many mature stands have an overstory that includes fire-sensitive spruce and lodgepole.

The frequency of light surface fires is difficult to surmise. The moist nature of these sites would limit the opportunity for such fires to a brief period during summer. It seems reasonable to assume that lightning did in fact start such fires and that a certain amount of fuel reduction was accomplished. Left undisturbed, these fires probably flared up occasionally and created openings that favored establishment of seral species.

Fire Management Considerations in Fire Group Nine

Fire protection is usually necessary in undisturbed stands during severe burning conditions. This is especially true for areas where timber production is a management objective. When burning conditions are less than severe, fires may be of low- to moderate-severity and result in only moderate damage or no damage to overstory trees (other than subalpine fir), despite the relatively low fire resistance of many of the species present. If slash is present, unacceptable tree mortality can result even during moderate burning conditions.

3.3.2.7 Fire Group Ten—Old, Moist Upper Subalpine and Timberline Habitat Types

Fire Group Ten consists of high-elevation forests near and at timberline. All of the stands lie above the climatic limits of Douglas-fir, and many stands are above the cold limits of lodgepole pine. Subalpine fir is the indicated climax in all of the upper subalpine habitat types. Whitebark pine and Engelmann spruce are long-lived seral species. Lodgepole pine occurs on some upper subalpine sites.

Timberline habitat types support stands composed of whitebark pine, Engelmann spruce, and subalpine fir. Trees characteristically grow in groups with open areas in between. Competition resulting from differences in tolerance is not as pronounced at timberline as it is in lower forests. Undergrowth in the upper subalpine habitat types is usually composed of only a few important species, and in timberline habitats undergrowth occurs in mosaics.

Forest Fuel in Fire Group Ten

Fire Group Ten is characterized by relatively sparse fine fuel and moderate heavy loadings of widely scattered large-diameter fuel. Much of the duff layer is composed of rotten dead and down material resulting from wind and snow breakage, wind throw, and insect- and disease-caused mortality. Fire usually has difficulty spreading in this fuel type because of the normally cool, moist locations, the short fire season at the higher elevations, and the usually sparse and discontinuous nature of the fine fuel necessary to carry a fire in the Fire Group.

Role of Fire in Fire Group Ten

Fire is secondary to site factors (climate and soil) as an influence on forest development on these sites. The cold, moist, rocky, snowbound, unproductive, and otherwise fire resistant environment that characterizes many of the sites not only makes fires infrequent but severely limits their areal extent. Lightning does ignite fires, but the paucity of continuous surface fuel coupled with rain that commonly accompanies thunderstorms usually limits fire spread and severity.

In more continuous forests of this group, the most pronounced fire effect is to produce stand-replacing fires at long intervals, perhaps 200 years or more. Stand-destroying fires are most likely to occur during extended drought conditions when severe wind-driven crown fires develop in the forests below and burn into the upper subalpine and timberline

forests. Forest vegetation recovery following such fires is usually slow because of the extremely short growing season and cold climate. Burned herbaceous vegetation that was not beneath burned forest or adjacent to dead and down forest fuel usually responds with new growth the next growing season.

Fire Management Considerations in Fire Group Ten

Timber production is rarely an important management objective for forests in this group. Most areas are managed as watersheds, natural areas, and sanctuaries for wildlife. Most are roadless, and many are designated as wilderness or primitive areas. Fire is an infrequent visitor, and when it does occur, damage in terms of management objectives is generally slight. But these sites are often fragile and can easily be damaged by modern, mechanized fire fighting equipment.

3.3.2.8 Analysis Area Fuel Loads and Fuel Types

The Cottonwood drainage conifer stands are a combination of Fuel Model 8 (Closed Timber Litter), and Fuel Model 10 (Timber - Litter and Understory). Significant clumps of live subalpine fir and understory brush will contribute to torching. A majority of the coniferous forest in this area is within or near the upper range of natural variation for their Fire Group FRI, meaning they could easily burn provided an ignition source and the proper environmental conditions. Subalpine fir dominates many of the understories in typical climax succession. Fuel loads are reported to range from 20 to 80 tons per acre. Heavy surface fuel loads combined with the subalpine fir understory and dense canopies in a multi-storied environment allow for torching of individual or small groups of trees, short-distance spotting, and intermittent or passive crown fire runs during periods of moderate to high fire danger. During periods of very high to extreme fire danger these forests are susceptible to sustained active crown fire runs with long distance spotting. These factors make controlling fires during times of prolonged drought and seasonal drying of fuel challenging and potentially risky to wildland firefighters.

The exclusion of wildland fire from the Cottonwood analysis area has likely altered the structure of the coniferous stands and their associated fuel loads, but most likely not significantly beyond the upper levels of natural variance. The greatest influence has probably been the potential for greater significant fire behavior by making the available fuel more contiguous by eliminating numerous small burn areas that could have potentially inhibited larger fire growth. Fuel is the only manageable component of the fire triangle (fuel, 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 keeping the area within acceptable fuel load limits and providing a safer work environment for forest/fire personnel and the visiting general public.

Aspen is found throughout the Cottonwood area in large clones at the lower elevations (Aspen/Low Forb Fuel Type) or as smaller clones and stringers in more moist higher elevation forested areas or adjacent to riparian zones ([Aspen] Mixed Forb and Aspen/Tall Forb Fuel Types). The clones within the Cottonwood area are most likely in all cases seral and currently exist in various levels of succession. Stable, climax clones of aspen can be found in the region. Seral aspen are gradually replaced by conifers. In

general, aspen stands in the Cottonwood area are 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 aspen stands, aspen/lodgepole, aspen/mixed conifer, and aspen/sage/grass are all evident in the analysis area. The ungrazed Aspen/Low Forb Fuel Type in the lower elevations usually will exhibit low fire behavior and generally be resistant to rapid fire spread. Fire managers look to these areas as places where fire behavior will moderate and fires can be more easily controlled. Torching and crowning are relatively nonexistent and surface fires are slow moving because of low herbaceous and woody fuel loads. As stands in more moist conditions age, the slower growing conifers establish in the understory and fuel loads from dead and dying vegetation increase. The Aspen/Tall Forb and (Aspen) Mixed Forb Fuel Types can support moderate to high fire behavior in an ungrazed condition. These later communities reflect the addition of shrub and conifer fuel to the total loading, plus increased herbaceous fuel reflected by greater levels of soil moisture. 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. If succession continues without fire, aspen will eventually be crowded out.

Infrequent fires produce a variety of effects on stand structure. Low intensity fires cause thinning and encourage an all-aged condition. High intensity fires result in new even-aged stands. 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 passive crowning are part of the expected fire behavior. The fire behavior in these stands will be very similar to those observed within the forested Fire Group in which they occur. Fuel loads are heavy, subalpine fir dominates the understory, and aspen, if present, is found only in isolated pockets.

Prescribed fire in aspen stands can offer an economical and environmentally acceptable means of rejuvenating aspen through suckering. Frequently fire can be applied in combination with clearcutting or partial cutting, but timing is critical that fire does not injure stimulated resprouting. Fire, when properly applied, also stimulates temporary biomass increases in production of grasses, forbs, and shrubs. Fire can also increase the diversity of cover types and tree sizes on the landscape. Aspen stands have a highly nutritious understory and burning can further improve the quality of selected species during the first post-burn season. Burning can also shift an aspen shrub layer temporarily into an abundance of palatable and nutritious forbs.

The purpose and need for the Cottonwood II Vegetation Management Project (see *Section 1.3, Purpose and Need for Action*) identifies needed improvements, including the need to lower aspen age classes, increase conifer age class diversity while maintaining stand structure in some location and lowering stand density in others, reduce fuel loadings, and generally provide a range of successional conditions. Aspen forests are specifically targeted for treatment because of decadence and conifer encroachment. A goal for aspen management is to maintain half in younger age classes. Fire exclusion has

altered the vegetation and fuel on the landscape. Modification of current vegetation/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.

3.3.3 Desired Future Conditions

DFCs 1B and 10 for fire protection include using a full range of suppression techniques. Both DFCs call for maintaining fuels conditions that will permit fire suppression forces to meet fire protection objectives for the area under historic weather conditions. In DFC 1B, fire management emphasizes the preservation and enhancement of timber and range values scheduled for current use, the suppression of wildfires during the normal fire season, and the containment, confinement, or surveillance of wildfires during the pre- and post-fire seasons. In DFC 1B, prescribed fire should be used to favor reducing fuel loadings, improving livestock forage conditions on primary ranges, and improving site conditions to increase wood fiber production. In DFC 10, fire management emphasizes the preservation and enhancement of habitat, and the suppression of wildfires below 400 BTU per second per foot and when they threaten plantations.

3.3.4 Environmental Consequences

3.3.4.1 Alternative A – No Action

Alternative A does not meet the purpose and need outlined in the Landscape Analysis completed for the project area and as described in this EIS in *Section 1.3, Purpose of and Need for Action*. Implementation of the No Action Alternative would result in a continued increase in fuel loading within timbered stands, loss of fire resistant aspen communities to succession, and decadence. Continued fire exclusion of all types would continue to exclude fire from playing its historical ecological role in the analysis area.

3.3.4.2 Alternative B – Proposed Action

Alternative B meets the purpose and need for the proposed project. Alternative B would treat 1,041 acres of conifer forest and 1,058 acres of aspen forest by burning in the analysis area. Thinning overstocked stands and harvesting timber (with effective activity fuel treatment) would modify fuel characteristics and help break up fuel continuity within the analysis area. Future expected fire behavior in treatment areas would be reduced. Fuel loads would continue to increase in unmanaged timber and aspen stands. Fire would be reintroduced under a controlled scenario to play its historical role in the analysis area. Aspen stands would be regenerated by commercial harvest and prescribed fire, providing forage and renewed cover for elk, which migrate through the area, and other wildlife. Encroaching conifers would be reduced in density and coverage by the Proposed Action. Surface fuel in aspen stands would be reduced, reducing potential fire behavior. Partial-cut treatments would be used in conifer forests to remove insect and disease-infested trees, further reducing future fuel loads.

Alternative B proposes the most modification and reduction of fuels among the alternatives evaluated, and would therefore reduce future fire behavior within the analysis area the most. Commercially harvested units with post-activity fuels treatment also would be anticipated to reduce future expected fire behavior. Thinning regenerating stands would promote stand resiliency by reducing crown densities and promoting health of the stand. The reduction of crown densities would decrease the chance of a stand-replacing crown fire.

3.3.4.3 Alternative C – Reduced Harvest and Temporary Roads

Alternative C does not meet project purpose and need as well as Alternative B (Proposed Aaction). Under Alternative C, reduced harvest levels of 974 acres of conifer forest and meeting the proposed 1,058 acres of aspen burning only meets project need in part. Thinning overstocked stands and harvesting timber (with an effective activity fuel treatment) would modify fuel characteristics and help break up fuel continuity within the analysis area. Future expected fire behavior in treatment areas would be significantly reduced. The identified need in the CPIS to restore aspen communities within the analysis area through the use of prescribed fire is proposed as a cost effective and historically beneficial means of achieving the desired outcome for identified treatment units. Fuel loads would continue to increase in unmanaged timber and aspen stands. Fire would be reintroduced under a controlled scenario to play its historical role in the analysis area.

3.4 Soils, Hydrology, and Water Quality

3.4.1 Introduction

Hydrology, soils, and water quality are included in the same section because of the cause and effect relationships between them. These resource areas were identified as a significant issue.

The Cottonwood II analysis area includes North and South Cottonwood Creeks, as well as tributaries to those streams. Tributaries to North Cottonwood Creek include Nylander Creek, Chase Creek, Sjhoberg Creek, McDougal Creek, Ole Creek, Hardin Creek, Irene Creek, and Halverson Creek. Tributaries to South Cottonwood Creek include Lander Creek, Eagle Creek, Hidden Basin Creek, Trailer Creek, and Bare Creek including West Fork Bare Creek and South Fork Bare Creek. The analysis area contains five treatment areas: Nylander, Sjhoberg, McDougal Gap, Halverson, and South Cottonwood.

The climate in the analysis area is cool, humid, and slightly windy. The skies are usually clear. Daily and seasonal temperatures vary widely. The coldest temperatures are associated with deep, cold Canadian air masses penetrating the analysis area. The bulk of annual precipitation (75 to 90 percent) falls as snow. Only about 30 to 37 inches of the total precipitation is available to the analysis area's hydrologic system because of wind-generated evaporation, snow sublimation, and other non-biological evaporative losses.

The analysis area lies to the east of the Overthrust Belt, with a fault on the western boundary of the analysis area. The geology is dominated by Cretaceous conglomeritic sandstone, siltstones, claystones, and bentonite, with a north-south band of older

Cretaceous shale, siltstone, and claystone near the eastern boundary of the analysis area. The North Cottonwood Creek drainage flows through younger Quaternary unconsolidated terrace gravels, while the South Cottonwood Creek drainage flows through a glacial morraine (till). Just to the east of the western fault scarp, toe slopes are a mixture of unconsolidated, angular debris.

Many disturbances have affected the watershed's soil including fire, fire suppression, road building and maintenance, recreational use, grazing, and timber harvest. Other sections of this EIS address impacts to biological resources from these management activities.

3.4.2 Issues

Watershed health was identified as a significant issue during public scoping (Issue #4, Section 1.9.1). Specifically, the issue is:

- The effects of the proposed activities on the functions and values of watersheds including vegetation, wildlife, aquatic species, water quality, wetlands, and bank stability

Indicators by which the proposed project will be evaluated relative to this issue include:

- Sediment deposition into streams
- Miles of road moved from the riparian corridor
- Protection of designated stream beneficial uses
- Change in peak discharge in North and South Cottonwood Creeks
- Wetland/riparian impacts (addressed in Section 3.2, Wildlife and Vegetation [Habitat] Resources).

3.4.3 Existing Conditions

3.4.3.1 Soils

Soil types, called map units, have been identified and mapped across the analysis area. All soil polygons on the landscape within the same map unit will have similar soil properties. Soil properties of interest to this proposed project are erosion hazard, compaction hazard, revegetation limitation, and slope stability. All of these properties affect erosion and thereby, potential deposition of sediment into streams. Table 3-11 lists the mapping units and associated soil characteristics for the treatment areas. Table 3-12 lists soil mapping units specifically associated with harvest units.

Erosion hazard, compaction hazard, and revegetation limitations are categories shown in Tables 3-11 and 3-12 for soil interpretations and ratings. These rating criteria were adopted from the B-TNF's Soil Interpretive Guide (Forest Service 1985). All ratings are based on the midpoint of the range in the database or criteria used for that interpretation, so some areas of a mapping unit may have a less restrictive or more restrictive condition than shown in Table 3-11.

The limitation ratings identify the severity of limitations that may restrict the use of a soil for a specific use. Limitation ratings are defined as:

- **Slight.** This rating is given to soils that have properties favorable for a specific use. This degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.
- **Moderate.** This rating is given to soils that have properties moderately favorable for a specific use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. The expected performance of the structure or other planned use is somewhat less desirable than for soils rated slight.
- **High/Severe.** This rating is given to soils that have one or more properties unfavorable for the rated use. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some soils can be improved by reducing or removing soil features that limit use, but it is difficult and costly in most situations to alter the soil or to design a structure so as to compensate for a high/severe degree of limitation.

The types of ratings important to the proposed project are discussed below and include Erosion Hazard, Compaction Hazard, and Revegetation Limitations. Table 3-13 shows acres of each limitation rating contained within the stands to be treated.

Erosion Hazard

Erosion hazard is the probability that damage will occur as a result of activities that expose the soil surface. Site preparation, timber harvest, skid trail construction, log landings, fire lanes, and off-road and off-trail travel are activities that can initiate erosion.

TABLE 3-11
Soil Mapping Units and Soil Characteristics

Mapping Unit	Acres	Compaction Hazard	Erosion Hazard	Soil Stability	Revegetation Limitation	Sensitive Ground
101	800	Severe	Moderate	Stable	Severe	No
121	86	High	High	Stable	Severe	Yes
131	404	Moderate	Moderate	Stable	Severe	No
161	458	Moderate	High	Stable	Moderate	No
202	2,522	High	High	Marginally Unstable	Severe	Yes
203	912	High	High	Marginally Stable	Severe	Yes
205	2,719	High	High	Unstable	Severe	Yes
206	310	Low	Low	Marginally Unstable	Slight	No
226	1	Moderate	High	Marginally Stable	Severe	No
253	1,833	High	High	Unstable	Severe	Yes
255	2,301	High	High	Unstable	Severe	Yes
266	3	Moderate	High	Marginally Stable	Severe	No

TABLE 3-11
Soil Mapping Units and Soil Characteristics

Mapping Unit	Acres	Compaction Hazard	Erosion Hazard	Soil Stability	Revegetation Limitation	Sensitive Ground
276	417	High	High	Marginally Stable	Severe	Yes
282	2,438	Moderate	Moderate	Stable	Severe	No
286	4,391	High	High	Marginally Unstable	Severe	Yes
301	3,391	High	High	Stable	Moderate	No
303	2,084	High	High	Marginally Unstable	Severe	Yes
311	512	High	High	Stable	Severe	Yes
322	3,571	Moderate	High	Stable	Severe	No
325	528	Moderate	High	Stable	Severe	No
332	2,127	High	High	Marginally Stable	Severe	Yes
335	2,063	Moderate	High	Marginally Stable	Severe	No
336	2,201	Moderate	High	Stable	Severe	No
345	2,394	High	High	Marginally Unstable	Severe	Yes
355	2,407	Moderate	High	Marginally Unstable	Severe	No
365	2,609	High	High	Marginally Stable	Moderate	No
402	941	High	High	Stable	Severe	Yes
412	414	Moderate	High	Stable	Severe	No
413	1,221	High	High	Marginally Stable	Severe	Yes
422	665	Moderate	Moderate	Stable	Severe	No
432	611	High	High	Stable	Severe	Yes
442	405	Moderate	High	Marginally Unstable	Severe	No
462	805	High	High	Stable	Severe	Yes
TOTAL	**48,541**					

TABLE 3-12
Soil Mapping Units, Soil Characteristics, and Extent of Soil Mapping Units Within Stands to be Treated

Mapping Unit	Acres Alternative B	Acres Alternative C	Compaction Hazard	Erosion Hazard	Soil Stability	Revegetation Limitation	Sensitive Ground
205	9	0	High	High	Unstable	Severe	Yes
255	202	244	High	High	Unstable	Severe	Yes
301	297	296	High	High	Stable	Moderate	No

TABLE 3-12
Soil Mapping Units, Soil Characteristics, and Extent of Soil Mapping Units Within Stands to be Treated

Mapping Unit	Acres Alternative B	Acres Alternative C	Compaction Hazard	Erosion Hazard	Soil Stability	Revegetation Limitation	Sensitive Ground
311	10	10	High	High	Stable	Severe	Yes
322	301	266	Moderate	High	Stable	Severe	No
325	24	9	Moderate	High	Stable	Severe	No
332	80	59	High	High	Marginally Stable	Severe	Yes
345	44	29	High	High	Marginally Unstable	Severe	Yes
365	73	59	High	High	Marginally Stable	Moderate	No
442	1	1	Moderate	High	Marginally Unstable	Severe	No
Total	**1,041**	**973**					

TABLE 3-13
Area of Soil Limitation Ratings for Selected Soil Characteristics Within Stands to be Treated

Soil Limitation	Soil Rating	Alternative B (Acres)	Alternative C (acres)
Compaction Hazard	Slight	0	0
	Moderate	326	276
	High	715	697
Erosion Hazard	Slight	0	0
	Moderate	0	0
	High	1,041	973
Revegetation Limitation	Slight	0	0
	Moderate	370	355
	Severe	671	618
Soil Stability	Stable	623	581
	Marginally Stable	153	118
	Marginally Unstable	45	30
	Unstable	211	244
Sensitive Ground	Yes	345	342
	No	696	631

Erosion hazard ratings are based on slope, k-factor, and rock fragments on the surface layer (see Figure 3-10). A "Slight" rating refers to soils where erosion is unlikely under ordinary climatic conditions. A "Moderate" rating refers to soils where some erosion is likely and control measures may be needed. A "High/Severe" rating refers to soils where erosion is very likely and where structural measures and/or control measures for vegetation re-establishment on bare areas are advised.

Ratings assess the potential that sheet and rill erosion would result from exposed soil surfaces caused by various management and silvicultural practices such as grazing, mining, fire, firebreaks, etc. These are activities that disturb the site, and typically result in 50 to 75 percent bare ground in the affected area. Bare ground can be exposed from operation of equipment or from uncontrolled livestock grazing. The ratings shown in Table 3-11 assume that 50 to 75 percent of a site's soil would be exposed. The ratings do not assume clean tillage and other similar activities that disturb up to nearly 100 percent of the area or change the character of the soil. As was shown in Table 3-12, all harvest units fall within the "High" erosion-rating category.

Soil Compaction Hazard

Soil compaction ratings assume an undisturbed soil surface and soils that are not saturated. The rating only considers the potential for compaction by vehicles crossing terrain in a random fashion. Repetitive, intensive use invariably results in highly compacted soils and the potential for an irreparable reduction in soil productivity. Soils are rated for compaction according to limitations that affect their suitability for off-road vehicles, camping areas, picnic areas, playgrounds, paths, and trails. Off-road vehicles would be the most limiting criteria used to establish an overall rating for a map unit. Snowmobiles are not considered in this category, but it does include four-wheel-drive vehicles, dune buggies, and other all-terrain vehicles.

Soils with a slight compaction limitation rating would generally not suffer an irreparable reduction in their long-term natural productivity level as a result of intensive use by wheeled off-road vehicles. Intensive use by wheeled off-road vehicles on soils with a moderate compaction limitation rating though, would be expected to result in a significant reduction in the long-term natural productivity of those soils. However, soils with a moderate rating could be managed for sustained natural productivity by controlling the timing and intensity of use, and their natural productivity could be restored through the application of relatively simple soil compaction amelioration treatments. Soils with a severe limitation rating generally would suffer irreparable reduction in their long-term natural productivity level, even with limited use of off-road vehicles.

All soils in stands to be treated fall into the "Moderate" or "High" compaction hazard category. There are 326 acres in Alternative B and 276 acres in Alternative C that have a moderate potential for compaction. Approximately 715 acres in Alternative B and 697 acres in Alternative C have a high rating for compaction hazard.

Figure 3-10/1

Figure 3-10/2

Revegetation Limitation Ratings

Revegetation limitation ratings are based on limitations for revegetation on cut and fill slopes. Ratings are based on uniform, one-to-one grade slopes, that were seeded during the first growing season following construction. Soil moisture is the predominant mechanism resulting in revegetation failure. The revegetation failure could be the result of either too much water (wetness) or too little water (droughty). Lack of rainfall at the right time, low available water capacity, rooting depth less than 40 inches, and high evaporation all can lead to droughty soil conditions.

The amount of water that can be held in the soil for plant use is dependent on the amount of water the soil can hold per unit area (available water capacity) and the volume of soil on the site (depth to bedrock or a cemented pan). Seedlings can survive on soils with low available water capacity if rains come at the right time, frequency, and duration. Soil texture must be course enough so that water enters readily, but not so course as to have low available water capacity. The higher temperatures and evaporation associated with steep, south and west-facing slopes could contribute to revegetation failure. There are "Severe" revegetation limitations on 671 acres to be treated under Alternative B and 618 acres to be treated under Alternative C. There are 370 acres to be treated under Alternative B and 355 acres to be treated under Alternative C with a "Moderate" revegetation limitation.

Sensitive Ground

Soils with a high erosion hazard, a high compaction hazard, and with severe revegetation limitations are classified as "Sensitive Ground". Soils within this classification are potentially slow to recover from ground-disturbing activities and may require special measures to revegetate and stabilize. Figure 3-11 shows the location of Sensitive Ground within the analysis area. There are 345 acres to be treated under Alternative B and 342 acres to be treated under Alternative C that are "Sensitive" soils.

Soil Stability Rating

Soil stability is another factor that can determine the success of revegetation activities. Land is classified as "Unstable Ground" in areas where landslides are present and mass movement is evident. It would be more difficult to achieve revegetation goals in these areas.

Soil stability is rated for all mapping units. Rating categories include:

- **Stable.** No historic landslide evidence is present and observable characteristics of the land are evidence that future landslide activity is not probable.
- **Marginally Stable.** No historic landslide evidence is present and observable characteristics of the land indicate that future landslide activity is possible.
- **Marginally Unstable.** Historic landslide evidence is present, but not recent (within the last 50 years). This rating assumes the area is gaining stability, but disturbances at certain locations could reactivate mass movements.

- **Unstable.** Evidence of recent mass movement or fresh tension cracks are observable. There is a high probability that additional mass movements could occur.

The majority of soils to be treated under Alternatives B (623 acres) and C (581 acres) are stable. There are 211 acres (Alternative B) and 244 acres (Alternative C) to be treated that have unstable soils. Treatments in the unstable soil areas will be confined to benches or lower hillsides with less than 20 percent slope.

3.4.3.2 Hydrologic Function (Watershed Runoff Processes)

Watersheds

The analysis area has been subdivided into 17 subwatersheds for evaluation. Figure 3-12 illustrates the watershed boundaries. Table 3-14 summarizes information relative to the watersheds and subwatersheds analyzed:

TABLE 3-14
Watersheds Within the Analysis Area

Watershed	Analysis Subwatershed	Area (acres)	Treatment Areas Within Subwatershed	Roads Within Subwatershed
Upper South Cottonwood Creek	Lander Creek	1,683	Yes	Yes
	Hidden Basin and Trailer Creeks	3,478	Yes	Yes
	South Cottonwood Creek	2,611	Yes	Yes
	Bare Creek	5,313	Yes	Yes
	Dry Basin and Snowdrift Creeks	5,059	No	No
	Eagle and Upper SF Cottonwood Creeks	3,369	No	No
	Mickelson Creek Headwaters	482	No	No
	Red Castle Headwaters	1,906	No	No
Upper North Cottonwood Creek	Sjhoberg Creek	2,305	Yes	Yes
	McDougal Creek	2,955	Yes	Yes
	Ole Creek	2,992	Yes	Yes
	Nylander Creek	2,826	Yes	Yes
	Halverson and Irene Creeks	2,178	Yes	Yes
	North Cottonwood Creek	2,081	No	Yes
	Hardin Creek	1,446	No	Yes
	Maki Creek	6,832	No	No
	Chase Creek	730	No	No

Figure 3-11/1

Figure 3-11/2

Figure 3-12/1

Figure 3-12/2

Road System

Approximately 108 miles of roads exist in the Cottonwood II analysis area. This includes seldom-used two-tracks, closed roads, and all roads ever used. Many of these roads have been rehabilitated. The majority of these roads are in the Upper North Cottonwood Creek Watershed.

Road Density

The road density calculations consider all possible roads in the watershed. Roads once built never fully recover unless they are completely obliterated, which means the hill slopes, soils, and vegetation are restored. If undisturbed, roads will naturally revegetate over time. This passive restoration will reduce runoff volumes and sediment delivery from these roads but not totally eliminate runoff or sediment delivery. The hill slope drainage is still disrupted by the hardened road surface that diverts flows from natural flow paths and concentrates runoff. This assessment assumes that all roads are 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 (Forest Service 2004b). Table 3-15 summarizes existing road densities within the analysis area.

TABLE 3-15
Existing Road Density

Watershed	Analysis Subwatershed	Watershed Area (square miles)	Total Length All Roads (miles)	Road Density
Upper South Cottonwood Creek	Lander Creek	2.6	2.1	0.8
	Hidden Basin and Trailer Creeks	5.4	8.5	1.6
	South Cottonwood Creek	4.1	7.6	1.9
	Bare Creek	8.3	12.8	1.5
	Dry Basin and Snowdrift Creeks	7.9	0.9	0.1
	Eagle and Upper SF Cottonwood Creeks	5.3	2.8	0.5
	Mickelson Creek Headwaters	0.8	1.4	1.8
	Red Castle Headwaters	3.0	5.5	1.8
Subtotal		**37.4**	**41.6**	**1.1**
Upper North Cottonwood Creek	Sjhoberg Creek	3.6	5.6	1.5
	McDougal Creek	4.6	6.3	1.4
	Ole Creek	4.7	5.3	1.1
	Nylander Creek	4.4	10.1	2.3
	Halverson and Irene Creeks	3.4	8.2	2.4

TABLE 3-15
Existing Road Density

Watershed	Analysis Subwatershed	Watershed Area (square miles)	Total Length All Roads (miles)	Road Density
	North Cottonwood Creek	3.3	8.5	2.6
	Hardin Creek	2.3	4.6	2.1
	Maki Creek	10.7	17.5	1.6
	Chase Creek	1.1	0.2	0.2
Subtotal		**38.0**	**66.4**	**1.7**
Total Analysis Area		**75.4**	**108**	**1.4**

Hydrologically Connected Roads

The extent of roads hydrologically connected to the stream network is useful to indicate the potential for several important adverse effects:

- Delivery of road-derived sediments to streams
- Hydrologic changes associated with subsurface flow interception, concentration, and diversion; increased drainage density; and extension of the stream network
- The potential for road-associated spills to enter streams
- This indicator can help to distinguish between roads that have the potential for these effects (those that are connected to streams) and roads that do not have these effects or potential (unconnected roads). A road-sediment inventory of the analysis area was used to evaluate where the road system is hydrologically connected to the stream system.

Road Sediment Inventory

A road sediment inventory was completed 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 fish passage though the site.

A portion of 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 eliminated, the formation of channelized flow along the road surfaces (Forest Service 2004b).

Overall, the road system in the analysis area is not highly connected to the drainage system (Forest Service 2004). Data for the sites where there are road stream crossings are summarized below:

- **Lander Creek (RX2).** Forest Road 10341 crosses Lander Creek at this site. There are no ditches hydrologically connected to Lander Creek. The sole sediment sources are from hill slopes adjacent to the creek that may erode during intense precipitation. However, most of the hill slopes are stable with adequate vegetation to resist erosion. Because of the large elevation difference between the water surface and road surface, diversion potential is low. There are large heavily vegetated terraces on the right side of the road that would intercept much of the overland flow. If the terraces were to overtop, flow would have a short path across the road and then return to the channel. The road has a low point at the end of the terrace that appears to have over-topped at some point in the past. A small secondary side stream has slightly greater diversion potential.
- **West Fork Bare Creek (RX1).** Forest Road 10046 crosses the West Fork of Bare Creek at this site. Inboard ditches enter both the right and left stream banks adjacent to the culvert inlet, causing this site to be hydrologically connected to the West Fork of Bare Creek. In high flows, water may back up at the culvert inlet and fill marshy areas on the upstream side of the road. Water would overtop about 40 feet from the culvert, flow across the road, and then flow about 40 feet through a grassy area to the stream.
- **South Fork Bare Creek (RX3).** Forest Road 10046 crosses the South Fork of Bare Creek at this site. This site is generally in good condition with the culvert properly aligned and the fill well vegetated. Inboard ditches enter both the right and left stream banks adjacent to the culvert inlet, causing this site to be hydrologically connected to the South Fork of Bare Creek. There are substantial gullies that have formed from erosion of the road embankment and these gullies are also hydrologically connected to the stream. Furthermore, grading at the crossing is poor. These conditions combined with runoff from the road surface are causing erosion of the fill adjacent to the culvert outlet. Continued erosion from precipitation and snowmelt may cut into the roadway. In high flows, water would pool around the left bank near the inlet and flow down the right inboard ditch, then into an inactive culvert. Overtopping or diversion is unlikely at this site because of the culvert's very large size (3-foot diameter).
- **Hidden Basin Creek (RX2).** Forest Road 10050 crosses Hidden Basin Creek at this site. No specific information is available for this location.
- **Trailer Creek (RX1).** Forest Road 10050 crosses Trailer Creek at this site. No specific information is available for this location.

Water Runoff Processes

Reductions in vegetation canopy may 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 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, Hydrological Effects of Vegetative Manipulation (Forest Service 1974 in Forest Service 2004b). 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 (Forest Service 2004b).

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 and should not be taken as an absolute measure. The method treats all vegetation types in a similar way (Forest Service 2004b).

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 a measurable difference is detected only when more than 20 percent of a watershed is harvested. The Forest Plan standard requires that no more than 30 percent of any second order or higher watershed will be in created-opening status during a 30-year period. See Table 3-16 for a comparison of the existing ECA values versus the Forest plan standard for the watersheds analyzed within the analysis area (Forest Service 2004b).

The timber harvest and roads ECA percentages are used to evaluate the amount of soil disturbances. Road ECA values were calculated by multiplying the length by an estimated average road width of 16 feet. The hiking trails were multiplied by an average width of 4 feet. For each analysis subwatershed, Forest Service-supplied GIS layers were used to derive lengths associated with roads and trails and areas associated with historic timber harvest and fires.

To estimate the hydrologic recovery of the previously harvested timber stands and fire areas, Galbraith (1972 in Forest Service 2004b; 1975 in Forest Service 2004b) and the Forest Service (1974) have developed hydrologic recovery curves based on habitat types common for the northern Rocky Mountains. Areas within the analysis area that have been previously harvested were grouped into five categories:

- Clearcuts that occurred previous to 1975 have an age greater than 29 years. Using Galbraith's (1993 in Forest Service 2004b) graphs and considering the vegetation type, the ECA analysis assumed the past harvest units are 53 percent recovered.
- Clearcuts that occurred from about 1975 to 1980 have an average age between 24 and 29 years. Using Galbraith's (1993 in Forest Service 2004b) graphs and considering the vegetation type, the ECA analysis assumed the past harvest units are 50 percent recovered.
- Clearcuts that occurred from about 1979 to 1987 have an average age between 17 and 25 years. The ECA analysis assumed the past harvest units are 42 percent recovered.

- Clearcuts that occurred after 1987 have an average age less than 17 years. The ECA analysis assumed the past harvest units are 40 percent recovered.
- Partial cuts that occurred after 1980 have an average age less than 25 years. The ECA analysis assumed these units are 50 percent recovered.

TABLE 3-16
Percent Equivalent Clearcut Area (ECA) Within the Analysis Area

Watershed	Analysis Subwatershed	Percent ECA permitted by Forest Plan (30-year period)	Percent Existing ECA (2002)
Upper South Cottonwood Creek	Lander Creek	30	3.0
	Hidden Basin and Trailer Creeks	30	4.6
	South Cottonwood Creek	30	2.2
	Bare Creek	30	1.8
	Dry Basin and Snowdrift Creeks	30	10.2
	Eagle and Upper SF Cottonwood Creeks	30	1.4
	Mickelson Creek Headwaters	30	0.0
	Red Castle Headwaters	30	0.0
Subtotal		**30**	**3.9**
Upper North Cottonwood Creek	Sjhoberg Creek	30	6.3
	McDougal Creek	30	4.7
	Ole Creek	30	4.7
	Nylander Creek	30	9.8
	Halverson and Irene Creeks	30	9.4
	North Cottonwood Creek	30	2.2
	Hardin Creek	30	8.5
	Maki Creek	30	2.2
	Chase Creek	30	2.2
Subtotal Upper North Cottonwood Creek:		**30**	**5.1**
Total Analysis Area		**30**	**4.5**

Stream Channel Condition Stability

Stream channel condition is typically determined by a given stream reach's ability to transport sediment and the water yield of its watershed. The streams in the analysis area are generally in good condition. However, resource damage to streams has occurred from livestock and human recreational trampling of the streambanks. 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." (Forest Service 2004b)

Increased runoff may 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 increased runoff. Channel conditions with the analysis area, based on in-channel inventories, indicate bank stability is acceptable for most stream reaches. Channel sensitivity to disturbance, based on channel type (Rosgen 1996 in Forest Service 2004), indicates that some tributaries are sensitive to disturbance. Channel type was determined from the in-channel inventories using channel geometry, Wolman pebble counts, sinuosity, and slope. Channels with fine-grained substrate are particularly vulnerable to bank erosion. Extensive data on each tributary were not available. Stream channel degradation, downcutting, and erosion of streambanks may occur when runoff rates increase to levels too high for the stream to convey flows within the channel (Forest Service 2004b).

Percent Fines

Various authors suggest that cutthroat trout survivability is negatively affected when fine sediment comprises greater than 20 percent or more of the spawning gravels. Survivability declines rapidly above 35 percent fine sediment levels. Measurement of subsurface fine sediment from the year 2000 averaged 33.5 percent in the mainstem of North Cottonwood Creek. Data collected in the South Cottonwood Creek watershed is about 5 percent lower or 28.5 percent. The drainages are similar in most ways. However, 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 percent fines), although this is considered an outlying value. 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 (Forest Service 2004).

Table 3-17 summarizes data previously reported in the Maki Creek Area Projects Environmental Assessment. See *Section 3.5, Fisheries* for further discussion on limiting aspects to local trout populations.

TABLE 3-17
Estimated Fine Sediment Component of Inventoried Redds of North Cottonwood Creek and Predicted Survival Of Trout Embryos

Location		Percent Particles < 6.4 Millimeters	Percent Predicted Trout Embryo Survival to Emergence [a]
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

TABLE 3-17
Estimated Fine Sediment Component of Inventoried Redds of North Cottonwood Creek and Predicted Survival Of Trout Embryos

Location	Percent Particles < 6.4 Millimeters	Percent Predicted Trout Embryo Survival to Emergence [a]
Stream System Average [c]	35.5	22.1

Source: Forest Service 2004

[a] Based on Irving and Bjornn's (1984) equation
[b] Considered an outlying value
[c] Does not include Hardin Creek value or below Sjhoberg Creek #2 value

3.4.3.3 Water Quality

Beneficial Uses of Water

Currently, Wyoming has designated all the major rivers and reservoirs in the state with specific beneficial uses. However, some tributaries to these water bodies (including the streams within the analysis area) are not designated.

The uses that are protected on Wyoming waters are listed and described in Section 3 of the Surface Water Quality Standards. There are also numerous classifications for surface waters of the state. Except for Class 1, waters are classified according to their designated uses. Class 1 waters are specially designated waters on which the existing water quality is protected regardless of the uses supported by the water. The objectives of the Wyoming program are to provide, wherever attainable, the highest possible water quality commensurate with the following uses:

- **Agriculture.** For purposes of water pollution control, agricultural uses include irrigation or stock watering.
- **Fisheries.** The fisheries use includes water quality, habitat conditions, spawning and nursery areas, and food sources necessary to sustain populations of game and non-game fish. This use does not include the protection of exotic species that are designated "undesirable" by the Wyoming Game and Fish Department or the U.S. Fish and Wildlife Service within their appropriate jurisdictions.
- **Industry.** Industrial use protection involves maintaining a level of water quality useful for industrial purposes.
- **Drinking Water.** The drinking water use involves maintaining a level of water quality that is suitable for potable water or intended to be suitable after receiving conventional drinking water treatment.
- **Recreation.** Recreational use protection involves maintaining a level of water quality which is safe for human contact. It does not guarantee the availability of water for any recreational purpose.

- **Scenic Value.** Scenic value use involves the aesthetics of the aquatic systems themselves (odor, color, taste, settable solids, floating solids, suspended solids, and solid waste) and is not necessarily related to general landscape appearance.
- **Aquatic Life Other Than Fish.** This use includes water quality and habitat necessary to sustain populations of organisms other than fish in proportions that make up diverse aquatic communities common to the waters of the state. This use does not include the protection of insect pests, human pathogens, or exotic species that may be considered "undesirable" by the Wyoming Game and Fish Department or the U.S. Fish and Wildlife Service within their appropriate jurisdictions.
- **Wildlife.** The wildlife use includes protection of water quality to a level that is safe for contact and consumption by avian and terrestrial wildlife species.
- **Fish Consumption.** The fish consumption use involves maintaining a level of water quality that will prevent any unpalatable flavor and/or accumulation of harmful substances in fish tissue.

Waters within the state are classified based on the above listed uses. Within the analysis area, all waters have been assigned classification codes 2AB or 3B. Table 3-18 shows the uses designated on each of these use-based water classifications. Table 3-19 presents the classification codes for those waters that have been assigned designated uses.

TABLE 3-18
Designated Uses for Selected Use-Based Classifications

	Classification	
Use	**2AB**	**3B**
Drinking Water	Yes	No
Game Fish	Yes	No
Non-Game Fish	Yes	No
Fish Consumption	Yes	No
Other Aquatic Life	Yes	Yes
Recreation	Yes	Yes
Wildlife	Yes	Yes
Agriculture	Yes	Yes
Industry	Yes	Yes
Scenic Value	Yes	Yes

TABLE 3-19
Classification of Waters Having Designated Uses

Water Name	Tributary To	Classification
Cottonwood Creek, North Fork	Cottonwood Creek	2AB
Cottonwood Creek, South Fork	Cottonwood Creek	2AB
Bare Creek	South Fork Cottonwood Creek	2AB
Hardin Creek	North Fork Cottonwood Creek	2AB
Irene Creek	North Fork Cottonwood Creek	2AB
Lander Creek	South Fork Cottonwood Creek	3B
McDougal Creek	North Fork Cottonwood Creek	3B
Nylander Creek	North Fork Cottonwood Creek	2AB
Ole Creek	North Fork Cottonwood Creek	2AB
Sjhoberg Creek	North Fork Cottonwood Creek	2AB

The analysis area is located within the Upper Green River Subbasin (HUC 14040101). The Upper Green Subbasin includes all tributaries into the Green River above Fontenelle Dam, except the New Fork Subbasin. Headwaters are in the B-TNF, primarily in well indurated igneous and metamorphic geology. Lower elevation areas of the subbasin lie in primarily fine grained sedimentary rocks which are a natural source of fine sediment and TDS in surface waters. Primary land uses are grazing, recreation, irrigated hay production, and oil and gas development.

303(d) Listed Streams

303(d) refers to a section in the federal Clean Water Act (CWA) relating to the protection of beneficial uses of surface waters. However, the administration, identification, and protection of these uses fall primarily to the individual states. Streams that are documented as not fully supporting their beneficial uses are listed on Wyoming's 303(d) list. Wyoming's 2004 305 (b) State Water Quality Assessment Report and 2004 303(d) List of Waters Requiring TMDLs (Total Maximum Daily Load) was published June 2004.

None of the streams within the analysis area appear on the 303(d) List. Within the subbasin, the lower 3 miles of Reardon Draw is on the 303(d) List and the Green River below Reardon Draw has been scheduled for monitoring.

3.4.4 Desired Future Conditions

3.4.4.1 Soils

Soil quality, productivity, and hydrologic function are maintained and restored where needed within Cottonwood II treatment areas of the North and South Cottonwood Creeks

drainages. Physical, chemical, and biological soil properties are maintained to support desired vegetation conditions and soil-hydrologic functions and processes. Soils have adequate protective cover, levels of soil organic matter (litter), and coarse woody material to minimize erosion and facilitate nutrient cycling. Soil productivity is maintained by complying with Regional Soil Guidelines. Regional guidelines recommend that no more than 15 percent of an activity area should have detrimentally disturbed soils after treatment. For purposes of this analysis, the activity area is the analysis area within North and South Cottonwood Creeks drainages.

3.4.4.2 Hydrologic Function

Watersheds are managed to maintain soil productivity to keep soil erosion to a minimum, and to prevent excessive increases in stream flow. State of Wyoming Water Quality Standards will be followed for all activities. Best management practices will be applied to all alternatives to limit non-point water pollution (Forest Plan). Riparian areas are protected and rehabilitated to retain and improve their value for fisheries, aquatic habitat, wildlife, and water quality (Forest Plan).

Over the life of the Forest Plan, the average *open* road density will be 1 mile per square mile of standard or equivalent road with 1-year to 5-year variations of 0.25 to 1.25 miles of road per square mile. (Discussions and figures in Sections 3.4.3.2 and 3.4.5.2 on road density include not only open roads but also those that have been closed and rehabilitated.) Temporary roads would be returned to Elimination class 3 or 4 standards. Some roads will be closed with stream channels that seem natural because of removal of bridges and culverts.

3.4.4.3 Water Quality

Water quantity and quality are retained or improved for local users. Management activities do not cause deterioration in water-flow timing, quality, or quantity. Waters within the Forest meet or exceed current state water quality standards and Forest Service water quality goals. Management prescriptions meet Wyoming Best Management Practices or equivalent (Forest Plan).

Road management preserves wildlife security, soil, visual, and water-quality values. New road building is minimized and existing roads are closed or downgraded to maintain or improve water quality. Roads and structures are designed to retain water-quality values. Logging or certain logging practices with potential detrimental effects on water quality are prevented (Forest Plan).

3.4.5 Environmental Consequences

This section discloses the effects of each alternative on the watershed resources. The assessment discusses direct, indirect, and cumulative effects on the soils, hydrologic function (watershed runoff processes), and water quality.

Direct and indirect effects were evaluated for the five treatment areas including South Cottonwood, Halverson, McDougal Gap, Sjhoberg, and Nylander. 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 entire North Cottonwood Creek and South Cottonwood Creek drainages up to the point where the creeks leave the analysis area. 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:

- No equipment or harvest activities would occur within or adjacent to riparian areas, wetlands, or floodplains. This would retain the necessary structure and function of the riparian areas and would significantly reduce the risk of sediment being delivered to stream channels via overland flow.
- Anticipated ECA increases from all proposed alternatives are expected to be at or below levels found to make measurable differences in downstream water yield or peak flow measurements. This would reduce the risk of stream channel erosion or bank instability occurring during high flow events.
- The proposed aspen fire treatment would recover relatively fast, thereby limiting the risk of downstream effects occurring.

3.4.5.1 Soils

Detrimental disturbed soil can result from management activities that displace soil, compact soil, puddle soil, reduce ground cover, or reduce above ground organic matter.

Timber harvesting activities would result in some displacement of soil as trees are skidded to landings. Compaction would increase as the number of trips made over skid trails increase. However, slash left on skid trails would reduce the amount of compaction. Landings, skid trails, and temporary roads would be temporarily removed from the productive land base while they are open and being used and maintained. However, if soils are protected during harvesting activities, there would be no irreversible loss of soil productivity following restoration. Typically, no more than 5 percent of an area being treated would be committed to landings, skid trails, or temporary roads. Therefore, the proposed project is within Regional Guidelines of no more than 15 percent of an activity area being in a detrimentally disturbed soil condition.

Mitigation measures and implementation of BMPs would avoid detrimental soil impacts, as discussed below.

Displace Soil. Soil can be displaced by erosion or through movement of equipment. To avoid displacing soil, an erosion control plan would be prepared prior to any activity commencing. Where feasible, topsoil would be preserved and utilized for phased rehabilitation. Cut slopes would not be constructed on slopes steeper than 2:1, except where the natural slope makes a 2:1 impossible or in areas of rock cuts. And finally, where soil erosion hazard is rated as “High,” slopes greater than 30 percent would be avoided.

Soil Compaction. Compacted soils arise when equipment passage reduces the air volume in the soil. Bare soils and wet soils are particularly vulnerable to compaction. Roots have difficulty penetrating compacted soil. Compaction would be avoided by leaving adequate slash (10 to 12 tons per acre; greater than or equal to 3 inches diameter material) to protect the soil. In lodgepole pine/spruce-fir ecosystems, a minimum of 5 to 10 tons per acre of large woody debris (greater than or equal to 3 inches in diameter) would remain scattered throughout the harvest unit. Designating skid trails and restricting mechanical operations to periods of the year when the surface soil is dry, frozen, snow covered, and/or slash covered would also reduce compaction. Lopping and scattering limbs and branches on landings and skid trails would further mitigate for compaction.

Soil Puddling. Heavy equipment would not be used when soil conditions are wet enough to rut or displace soil. Equipment operation on wet soil can result in puddled soil with subsequent reduction of water infiltration.

Ground Cover Reduction/Above Ground Organic Matter. Designating skid trails to reduce the area disturbed would protect ground cover. Utilization of partial-cut treatments leaves a portion of the stand's vegetation intact and minimizes ground cover removal. Retention of adequate quantities of slash preserves organic matter above ground.

There would be no effect to slope stability from implementation of the proposed project, either within or outside of the analysis area. Road construction and maintenance has affected slope stability in the past, but known sites are limited to small cut and fill failures (slumps) along the road prisms and surface erosion associated with road related run-off. No large management-induced landslides exist within the analysis area. Geotechnical field surveys will identify and avoid unstable areas. Prescribed fire to regenerate aspen would occur at low to moderate intensities and is not expected to increase or initiate landslide activity.

Alternative A – No Action

This alternative would have no measurable direct, indirect, or cumulative impacts on soil displacement, compaction, puddling, soil erosion, or ground cover. However, watershed condition would not be improved through vegetation treatment. If a large stand replacement fire occurs, it could cause a reduction in soil productivity, as existing fuel loadings are not consistent with fuel loadings expected for these vegetation types. This could result in hotter fires, which can cause soil sterilization, alter revegetation processes, and contribute to accelerated soil erosion. This would reduce ground cover and possibly lead to increased sediment loading to streams.

There are approximately 100 acres of soils in a detrimental condition within the 30,894 acres contained in the five treatment areas. Existing detrimentally disturbed soils in the treatment areas are restricted to existing roads, assuming 51.7 miles of open and restricted access roads with an average width of 16 feet. Therefore, only 0.3 percent of the treatment area has detrimentally disturbed soils, which is far below the Regional Guideline threshold of 15 percent.

No management activities are planned, therefore this alternative should have no direct or indirect impacts on hill slope stability. There would be no watershed improvement activities implemented under the No Action Alternative so larger fires are possible. Hill slope stability could be compromised following a large, hot fire. Given the terrain there would likely be numerous slumps and some debris slides.

No cumulative effects are anticipated, as this alternative would have little affect on hill slope stability or soil productivity within the analysis area.

Alternative B – Proposed Action

Direct Impacts

Implementation of the Proposed Action would result in 402 acres of conifer regeneration harvest and 581 acres of conifer partial-cut harvest. Aspen regeneration would be accomplished by commercial harvest of encroaching conifers (58 acres) and prescribed fire (1,058 acres). Overall watershed stability would improve because of the reduction in the potential for stand replacement fires. The vegetation treatments would reduce the possibility of a larger hotter fire degrading the soils in the area, so in the long-term soil productivity should be maintained. However, soil conditions in the harvest areas would have a reduced productivity in the short-term. Soil improvements would occur in the aspen burn treatment areas as nutrients from the burns enter the soil and denser ground cover is produced.

Implementation of BMPs and mitigation measures described above, in addition to other mitigation measures described in *Section 2.6, Mitigation Common to All Action Alternatives*, would prevent additional detrimentally disturbed soils in the treatment areas. Therefore, only approximately 0.3 percent of the treatment areas (from roads) is in a detrimentally disturbed soil condition. Typically, no more than 5 percent of an area being treated would be committed to landings, skid trails, or temporary roads. Therefore, the Proposed Action is within Regional Guidelines of no more than 15 percent of an activity area being in a detrimentally disturbed soil condition.

The proposed 1,041 acres of harvest are on low slope areas (less than 30 percent). Even though 265 acres of the harvest units are proposed on marginally unstable or unstable soils, it is unlikely there would be landslides, because of the low slope.

The Proposed Action activities would have minimal effects on soil productivity and stability within the analysis area if the Forest Plan Standards and Guidelines, the R1/R4 Soil Management Measures (Forest Service 1988), and the Regional Soil Quality Guidelines are applied and monitored.

Indirect Impacts

Soil productivity would continue to be lost in the areas occupied by existing roads. This has an indirect impact on vegetation, in that no vegetation is supported in these areas. However, the level of impact would be well below the threshold in the Regional Guidelines for soil. Long-term beneficial indirect impacts would occur as the potential for future stand replacing fires is lowered.

Cumulative Impacts

Detrimentally disturbed soils are within Regional Guidelines in the areas surrounding the treatment areas. There would be no soil stability effects. Therefore, there would be no cumulative impacts. None of the projects listed in Table 3-1 for cumulative impacts consideration would occur within the proposed treatment areas. Similar proposed vegetation treatments in the Maki drainage to the northeast would also be expected to have minimal impacts on soils.

Alternative C – Reduced Harvest and Temporary Roads

Direct Impacts

Implementation of Alternative C would reduce the acreage harvested compared to the Proposed Action. There would be 140 less regeneration harvest acres (262 acres total) and 35 more partial-cut acres. The overall reduced harvest levels would require 4.5 miles less of temporary roads constructed. Aspen regeneration acreage would increase by 38 acres and be accomplished by commercial harvest of encroaching conifers (96 total acres). Prescribed fire in aspen stands would remain the same at 1,058 acres. As with the Proposed Action, overall watershed stability and long-term soil productivity would improve because of the reduction in potential for stand replacement fires. Short-term productivity losses would be lower in this alternative, as there are fewer temporary roads to lose sediment or be compacted. Soil conditions in the harvest areas would have reduced productivity in the short term, but to a lesser degree than the Proposed Action, because of the reduction in total harvested acres. Soil improvements would occur in the aspen burn treatment areas as nutrients from the burns enter the soil and denser understory vegetation is produced.

Implementation of BMPs and mitigation measures described above, in addition to other mitigation measures described in *Section 2.6, Mitigation Common to All Action Alternatives*, would prevent additional detrimentally disturbed soils in the treatment areas. Therefore, only approximately 0.3 percent of the treatment area (from roads) is in a detrimentally disturbed soil condition. Typically, no more than 5 percent of an area being treated would be committed to landings, skid trails, or temporary roads. Therefore, the proposed project is within Regional Guidelines of no more than 15 percent of an activity area being in a detrimentally disturbed soil condition.

The proposed 974 acres of harvest are on low slope areas (less than 30 percent). The percentage of harvests proposed on marginally unstable or unstable soils would increase by 18 acres to a total of 274 acres compared to the Proposed Action. It is unlikely this level of harvest would result in landslides, because the slope is low.

The proposed activities under Alternative C would have minimal effects on soil productivity and stability within the analysis area if the Forest Plan Standards and Guidelines, the R1/R4 Soil Management Measures (Forest Service 1988), and the Regional Soil Quality Guidelines are applied and monitored.

Indirect Impacts

Indirect impacts would be the same as described for the Proposed Action.

Cumulative Impacts

Cumulative impacts would be the same as described for the Proposed Action.

3.4.5.2 Hydrologic Function

Road Density and Hydrologically Connected Roads

On the Forest, roads introduce more sediments to streams than any other single man-made activity. Erosion from the cut and fill slopes, the surface of the road, and the ditch paralleling the road can result in sediment delivery to streams. Factors that affect potential sediment delivery are the location of the road in relation to streams, the effectiveness of the filter strip between the road and the stream, the road surfacing, the cross drainage off the road surface, and the soil type of the road and cut and fill slopes. Stream crossings are sensitive locations where inadequate allowance for volume of flow can create sediment problems by undersized or improperly aligned culverts, too narrow bridge spans, or poorly designed wing walls. Another potential problem is road alignment across unstable slopes resulting in slumping onto the roads or slope failure beneath the road.

For comparison of alternatives, road density is used as an indicator of potential sediment delivery to streams. For this assessment it was assumed that all roads were equal in their effects to the water runoff processes. However, closed roads that have partially revegetated do not disrupt drainage patterns to the extent open roads do. The road density estimates are primarily for comparing the alternatives and not detailed sediment modeling calculations. Alternative A (No Action) represents the existing condition that is described in Section 3.4.3.2. Figure 2-1 depicts roads for Alternative B and Figure 2-3 displays roads for Alternative C. The changes in road densities from the alternatives do not substantially change from the existing condition. Table 3-20 presents a comparison of alternatives.

The Cottonwood II analysis area road-sediment inventory did not locate many road segments that connect to the stream system. However, several road and trail stream crossings are contributing water and sediment runoff as indicated by flow paths and sediment plumes observed at most crossings. The additional road segments proposed in Alternatives B and C are not expected to compound adverse effects to the watersheds. These crossings would be located in low-gradient areas and are relatively short in length. However, they would detrimentally disturb the soils and change water infiltration capabilities.

TABLE 3-20

Comparison of Road Density by Alternative

Analysis Subwatershed	Area (square miles)	Alternative A		Alternative B		Alternative C	
		Total Length All Roads (miles)	Road Density (miles/ square mile)	Total Length All Roads (miles)	Road Density (miles/ square mile)	Total Length All Roads (miles)	Road Density (miles/ square mile)
Upper South Cottonwood Creek							
Lander Creek	2.6	2.1	0.8	2.5	0.9	2.3	0.9
Hidden Basin and Trailer Creeks	5.4	8.5	1.6	11.5	2.1	11.3	2.1
South Cottonwood Creek	4.1	7.6	1.9	9.5	2.3	9.5	2.3
Bare Creek	8.3	12.8	1.5	13.3	1.6	13.0	1.6
Dry Basin and Snowdrift Creeks	7.9	0.9	0.1	0.9	0.1	0.9	0.1
Eagle and Upper SF Cottonwood Creeks	5.3	2.8	0.5	2.8	0.5	2.8	0.5
Mickelson Creek Headwaters	0.8	1.4	1.8	1.4	1.8	1.4	1.8
Red Castle Headwaters	3.0	5.5	1.8	5.5	1.8	5.5	1.8
Subtotal	**37.3**	**41.6**	**1.1**	**47.4**	**1.3**	**46.8**	**1.3**
Upper North Cottonwood Creek							
Sjhoberg Creek	3.6	5.6	1.5	6.5	1.8	6.4	1.8
McDougal Creek	4.6	6.3	1.4	7.6	1.7	7.6	1.7
Ole Creek	4.7	5.3	1.1	5.6	1.2	5.4	1.2
Nylander Creek	4.4	10.1	2.3	11.9	2.7	10.8	2.5
Halverson and Irene Creeks	3.4	8.2	2.4	10.4	3.0	10.1	3.0
North Cottonwood Creek	3.3	8.5	2.6	9.0	2.8	9.0	2.8
Hardin Creek	2.3	4.6	2.1	4.6	2.1	4.6	2.1
Maki Creek	10.7	17.5	1.6	17.5	1.6	17.5	1.6
Chase Creek	1.1	0.2	0.2	0.2	0.2	0.2	0.2
Subtotal	**38.0**	**66.4**	**1.7**	**73.4**	**1.9**	**71.6**	**1.9**
Total	**75.4**	**108**	**1.4**	**120.7**	**1.6**	**118.5**	**1.6**

Water Runoff Processes

As described in *Section 3.4.3.2, Hydrologic Function (Watershed Runoff Processes),* reductions in vegetation canopy may lead to increases in annual water yield or peak flow runoff. The ECA method is commonly used for quantifying the effects that past and proposed mechanical harvest, fire, and road-building activities have on water runoff. 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 (Forest Service 2004).

For each alternative, road ECA values were calculated by multiplying the road length by an estimated average road width of 16 feet. The hiking trails were multiplied by an average width of 4 feet. For each analysis subwatershed, Forest Service-supplied GIS layers were used to derive lengths associated with roads and trails and areas associated with historic timber harvest, previous fires, and the treatment types for the alternatives. The hydrologic recovery rates previously described in Section 3.4.3.2 were applied to the previously harvested timber stands and fire areas.

Figure 2-1 depicts treatment areas for Alternative B and Figure 2-3 displays treatment areas for Alternative C. Assumed ECA percentages applied to the treatment areas are as follows:

- Clearcutting areas are assumed to be 100 percent ECA.
- Thinning treatment areas are assumed to be 60 percent ECA.
- Shelterwood treatment areas are assumed to be 60 percent ECA.
- Salvage treatment areas are assumed to be 50 percent ECA.
- Group Selection treatment areas are assumed to be 40 percent ECA.
- Aspen Treatments treatment areas are assumed to be 100 percent ECA.

The Forest Plan standard requires that no more than 30 percent of any second order or higher watershed will be in created-opening status during a 30-year period. Numerous experimental forest studies show that measurable change can be detected when a watershed approaches about 20 to 30 percent ECA (Troendle 1983, in Forest Service 2004b). Table 3-21 summarizes ECA percentages by alternative. The maximum ECA estimated is 14.8 percent for the Halverson and Irene Creeks Subwatershed under Alternative B. Based on the 20 to 30 percent ECA threshold, 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.

All the assessed watersheds are under the recommended Forest Plan threshold of less than 30 percent of the watershed in 10-year-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 (Forest Service 2004b).

TABLE 3-21
Comparison of Percent Equivalent Clearcut Area (ECA) by Alternative

Watershed	Analysis Subwatershed	Alternative A Percent ECA	Alternative B Percent ECA	Alternative C Percent ECA
Upper South Cottonwood Creek	Lander Creek	3.0	4.8	4.5
	Hidden Basin and Trailer Creeks	4.6	10.4	9.2
	South Cottonwood Creek	2.2	6.5	8.2
	Bare Creek	1.8	3.8	3.4
	Dry Basin and Snowdrift Creeks	10.2	10.2	10.2
	Eagle and Upper SF Cottonwood Creeks	1.4	1.4	1.4
	Mickelson Creek Headwaters	0.0	0.0	0.0
	Red Castle Headwaters	0.0	0.0	0.0
Subtotal		**3.9**	**5.8**	**5.6**
Upper North Cottonwood Creek	Sjhoberg Creek	6.3	7.2	7.0
	McDougal Creek	4.7	6.9	6.5
	Ole Creek	4.7	5.2	5.3
	Nylander Creek	9.8	12.2	11.9
	Halverson and Irene Creeks	9.4	14.8	13.6
	North Cottonwood Creek	2.2	2.2	2.2
	Hardin Creek	8.5	8.5	8.5
	Maki Creek	2.2	2.2	2.2
	Chase Creek	2.2	2.2	2.2
Subtotal		**5.1**	**6.3**	**6.1**
Total Analysis Area		**4.5**	**6.0**	**5.9**

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 (for example, 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" (Forest Service 2004b).

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. 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 percent (Schmidt 1998, in Forest Service 2004b).

Alternative A – No Action

The No Action Alternative reflects no change from the existing situation. Under the No Action Alternative, no vegetation management activities would occur in the North and South Cottonwood Creeks drainages. There would be no road or trail improvements and culverts acting as fish passage barriers or not acting as fish barriers would not be addressed. Routine maintenance of existing roads and trails would continue, as would suppression of fire and District-wide Christmas tree and firewood sales. Oil and gas activities, outfitting, and range management covered by other site-specific decision documents would also continue to occur.

This alternative would have no measurable direct, indirect, or cumulative impacts on water runoff processes, stream channels, soil erosion, or ground cover. However, watershed condition would not be improved through vegetation treatment. If a large stand replacement fire occurs, it could cause a reduction in soil productivity. This could result in hotter fires, which can cause soil sterilization, alter revegetation processes and contribute to accelerated soil erosion. This would reduce ground cover and possibly lead to increased sediment loading to streams. 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 channel erosion.

Natural processes would continue to function except for fire related processes, and no immediate human-caused changes would occur. The current hydrologic function would show little change except that the existing clearcuts would continue to recover and the aspen and sage/grass vegetation communities would 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.

No management activities are planned, therefore this alternative should have no direct or indirect impact on runoff processes or sediment delivery to streams. No watershed improvement activities would be implemented under the No Action Alternative so larger fires are possible. Hill slope stability could be compromised following a large, hot fire. Given the terrain there would likely be numerous slumps and some debris slides. No cumulative effects are anticipated, as this alternative would have little affect on runoff processes or sediment delivery to streams.

Alternative B – Proposed Action

Implementation of the Proposed Action would result in 402 acres of conifer regeneration harvest and 581 acres of conifer partial-cut harvest. Aspen regeneration would be accomplished by commercial harvest of encroaching conifers (58 acres) and prescribed fire (1,058 acres).

The Proposed Action includes timber haul road relocation and end-of-road trailhead improvements. Approximately 1 mile of the existing Nylander Road, which is to be used as a timber haul road for tree thinning units, would be re-located out of the riparian area to the dry ridge area to the east. The relocation would reduce road-related sediment delivery into Nylander Creek. The existing road, which is easily rutted, difficult to maintain, and contributes sediment directly to Nylander Creek, would be reclaimed. The relocated road would end at an existing dispersed camping area, which would be managed to include trailhead facilities. A low-standard road beyond this point, which crosses boggy, wet soils, would be closed.

The Proposed Action includes reconstructing the South Cottonwood Road from Hidden Basin to just short of the South Cottonwood Creek crossing (approximately 1 mile). Culverts would be replaced and stream crossings improved to compensate for potential adverse effects to the Colorado River cutthroat trout from implementation of the Proposed Action (timber harvest). The increased amount of habitat made accessible by improving fish passage or preventing upstream migration of undesirable fish would result in an overall positive effect. Culvert replacement is also needed because of road design, access, and increased flows expected from the Proposed Action.

The 1998-99 road and stream-crossing inventory and a July 2, 2004, field review were used to identify potential culvert replacements and stream-crossing improvements along the timber haul routes. All culverts along haul routes to be used for this project were evaluated for replacement or improvements during timber sale design. Culverts would be designed to either act as fish barriers where genetically pure populations of Colorado River cutthroat trout occur upstream, or to allow passage of fish, as identified in the inventory and survey. As described in detail in Chapter 2, twelve culverts and two bridges have been identified as needing improvements (Figure 2-2).

Direct Impacts

Overall watershed stability would improve because of the reduction in the potential for stand replacement fires. Implementing the Proposed Action would result in an increase in percent ECA in the Cottonwood II analysis area (Table 3-21). These increases would not exceed the Forest Plan standard. The maximum percent ECA would be 14.8 percent in the Halverson and Irene Creeks Subwatershed. The proposed activities would have minimal effects on runoff processes and stream channel stability.

Areas that are in a degraded condition such as livestock damaged streambanks could be affected by slight changes in stream flow. These areas should be managed through livestock permit administration.

Implementation of BMPs and mitigation measures described above, in addition to other mitigation measures described in *Section 2.6, Mitigation Common to All Action Alternatives*, would prevent effects downstream to North and South Cottonwood Creeks.

The proposed 1,041 acres of harvest are on low slope areas (less than 30 percent). Even though 265 acres of the harvest units are proposed on marginally unstable or unstable soils, it is unlikely there would be landslides, because of the low slope. However, there may be a slight increase in sediment delivery to streams as a result of harvest and road-building activities.

Indirect Impacts

Indirect impacts are those that occur later in time or are spatially removed from the activity, but would be an effect in the foreseeable future. Indirect effects that may occur with implementation of Alternative B include increases in sediment (related to bank damage, infiltration capacity, and ground cover density), flow alterations (increased overland flow resulting from reduced infiltration capacity), and temperature (related to reduced stream bank vegetation). These indirect impacts are expected to be minimal.

Cumulative Impacts

Table 3-1 lists those future actions within or in the vicinity of the analysis area considered in the analysis of cumulative effects. The cumulative impacts boundary encompasses the entire North Cottonwood Creek and South Cottonwood Creek drainages up to the point where the Creeks leave the analysis area. This boundary delineates the area that upstream activities are likely to impact.

Potential cumulative impacts of these projects, together with ongoing projects, on hydrologic function would be expected to continue under Alternative B. For example, cumulative impacts under Alternative B include the potential cumulative effects from ongoing projects such as road maintenance by the Forest Service and the potential for localized, inadvertent sediment delivery to drainages during maintenance activities. Potential resultant effects include localized increases in sediment fines.

Potential cumulative impacts may result from other projects listed in Table 3-1 and ongoing projects, including treatment of noxious weeds, prescribed fire activities, fire suppression activities, and recreation uses near and on area drainages. These effects may be manifested as impacts to hydrologic function because of streambank disturbance, erosion, sediment delivery, and degradation of riparian and aquatic habitat—all of which can collectively act to limit aquatic productivity and degrade water quality.

These effects would continue affecting water quality especially in localized areas. Some streams would be at risk for decreased bank stability and increased sediment production. The channels would also be more susceptible to damage in high flow events.

Alternative C – Reduced Harvest and Temporary Roads

Implementation of Alternative C would reduce the acreage harvested compared to the Proposed Action. There would be 140 less regeneration harvest acres (262 acres total) and 35 more partial-cut acres. The overall reduced harvest levels would require 4.5 miles

less of temporary roads constructed. Aspen regeneration acreage would increase by 38 acres and be accomplished by commercial harvest of encroaching conifers (96 total acres). Prescribed fire in aspen stands would remain the same at 1,058 acres. As with the Proposed Action, overall watershed stability would improve because of the reduction in potential for stand replacement fires.

Alternative C also reduces the number of temporary roads needed for the treatments and increases the number of acres of aspen treated to improve habitat. The length of temporary roads needed to implement the treatments would decrease by 4.5 miles compared to the Proposed Action. No new permanent roads would be constructed as part of this alternative. All other project features, including culvert replacement and stream-crossing improvements, would remain similar to the Proposed Action.

Direct Impacts

As with the Proposed Action, overall watershed stability would improve because of the reduction in potential for stand replacement fires. Implementing this alternative would result in an increase in percent ECA in the Cottonwood II analysis area (Table 3-21). These increases would not exceed the Forest Plan standard. The maximum percent ECA would be 13.6 percent in the Halverson and Irene Creeks Subwatershed. The proposed activities would have minimal effects on runoff processes and stream channel stability.

Implementation of BMPs and mitigation measures described above, in addition to other mitigation measures described in *Section 2.6, Mitigation Common to All Action Alternatives*, would prevent effects downstream to North and South Cottonwood Creeks.

The proposed 974 acres of harvest are on low slope areas (less than 30 percent). The percentage of harvests proposed on marginally unstable or unstable soils increases by 18 acres to a total of 274 acres. It is unlikely this level of harvest would result in landslides, because the slope is low. However, there may be a slight increase in sediment delivery to streams as a result of harvest and road-building activities.

Indirect Impacts

Indirect impacts would be the same as described for the Proposed Action.

Cumulative Impacts

Cumulative impacts would be the same as described for the Proposed Action.

3.4.5.3 Water Quality

Within the analysis area, the critical indicator of water quality is the amount of fine sediment in spawning gravels of Colorado River cutthroat trout. The desired condition is 10 to 20 percent fine sediment in trout spawning gravels (less than 6.4-millimeter-diameter) or less.

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 (Forest Service 2004b).

The desired fine sediment levels are exceeded 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 to 20 percent fine sediment [less than 6.4 millimeters] in trout spawning gravels. This adds to other problems such as strong competition by invasive species (brook trout), and problems with habitat connectivity (impassable culverts). Implementation and monitoring of the Forest Service's soil and water conservation practices and the Wyoming BMPs would help ensure that amounts of fine sediment are not increased (Forest Service 2004b).

Alternative A – No Action

This alternative would have no measurable direct, indirect, or cumulative impacts on water quality. However, watershed condition would not be improved through vegetation treatment. Currently there are no streams within the analysis area included on Wyoming's 303(d) list (documented as not fully supporting their beneficial uses).

Alternative B – Proposed Action

Direct Impacts

Implementation of the Proposed Action would result in 402 acres of conifer regeneration harvest and 581 acres of conifer partial-cut harvest. Aspen regeneration would be accomplished by commercial harvest of encroaching conifers (58 acres) and prescribed fire (1,058 acres).

As described in Section 3.4.5.2, approximately 1 mile of the existing Nylander Road would be re-located out of the riparian area to the dry ridge area to the east. The relocation would reduce road-related sediment delivery into Nylander Creek. The existing road, which contributes sediment directly to Nylander Creek, would be reclaimed. South Cottonwood Road would be reconstructed from Hidden Basin to just short of the South Cottonwood Creek crossing. There may be a short-term increase in the amount of fine sediment delivered to the stream channels from the road construction and relocation activities. However, the long-term reductions in sediment delivery as a result of these changes would out-weigh the short-term increases.

Culverts would be replaced and stream crossings improved to compensate for potential adverse effects to Colorado River cutthroat trout from implementation of the Proposed Action (timber harvest). Twelve culverts and two bridges along haul routes would be improved. Figure 2-2 displays locations of culvert and bridge replacement activities. Culverts would be designed to either act as fish barriers where genetically pure populations of Colorado River cutthroat trout occur upstream, or to allow passage of fish. There may be a short-term increase in the amount of fine sediment delivered to the stream channels from the replacement of culverts and bridges. However, the long-term watershed benefits from these changes would out-weigh these short-term increases. The

increased amount of habitat made accessible by improving fish passage or preventing upstream migration of undesirable fish would result in an overall positive effect.

Although some decreases in water quality could be expected under the Proposed Action because of the level of timber harvesting and road building, State of Wyoming water quality standards would be met. Currently there are no streams within the analysis area included on Wyoming's 303(d) list (documented as not fully supporting their beneficial uses). Implementation of Alternative B is not expected to result in a 303(d) listing of any stream within the analysis area.

Implementing the Proposed Action would result in an increase in road density in the Cottonwood II analysis area (Table 3-20). Localized maximum road density would be 3.0 miles per square mile in the Halverson and Irene Creeks Subwatershed. Road density in the Upper South Cottonwood Watershed would be 1.3 miles per square mile and in the Upper North Cottonwood Watershed 1.9 miles per square mile. Of the 17 subwatersheds analyzed, 3 exceed the desired standard of 2.5 miles per square mile. Because the desired standard is based on a broad scale evaluation, these exceedences at the subwatershed level are not significant.

The proposed activities would have minimal effects on water quality.

Indirect Impacts

Indirect impacts would be the same as described for the Proposed Action under the discussion of Hydrologic Function.

Cumulative Impacts

Cumulative impacts would be the same as described for the Proposed Action under the discussion of Hydrologic Function.

Alternative C – Reduced Harvest and Temporary Roads

Direct Impacts

Implementation of Alternative C would reduce the acreage harvested compared to the Proposed Action. There would be 140 less regeneration harvest acres (262 acres total) and 35 more partial-cut acres. The overall reduced harvest levels would require 4.5 miles less of temporary roads constructed. Aspen regeneration acreage would increase by 38 acres and be accomplished by commercial harvest of encroaching conifers (96 total acres). Prescribed fire in aspen stands would remain the same at 1,058 acres. As with the Proposed Action, overall watershed stability would improve because of the reduction in the potential for stand replacement fires.

Water quality effects from road relocation, road construction, culvert replacements, and bridge replacements would be the same as described for Alternative B.

Although some decreases in water quality could be expected under this Alternative C because of the level of timber harvesting and road building, State of Wyoming water quality standards would be met. Currently there are no streams within the analysis area

included on Wyoming's 303(d) list (documented as not fully supporting their beneficial uses). Implementation of Alternative C is not expected to result in a 303(d) listing of any stream within the analysis area.

Implementing this alternative would result in an increase in road density in the Cottonwood II analysis area (Table 3-20). Localized maximum road density would be 3.0 miles per square mile in the Halverson and Irene Creeks Subwatershed. Road density in the Upper South Cottonwood Watershed would be 1.3 miles per square mile and in the Upper North Cottonwood Watershed 1.9 miles per square mile. Of the 17 subwatersheds analyzed, 2 exceed the desired standard of 2.5 miles per square mile. Because the desired standard is based on a broad scale evaluation, these exceedences at the subwatershed level are not significant. The proposed activities would have minimal effects on water quality.

Indirect Impacts

Indirect impacts would be the same as described for the Proposed Action under the discussion of Hydrologic Function.

Cumulative Impacts

Cumulative impacts would be the same as described for the Proposed Action under the discussion of Hydrologic Function.

3.4.5.4 Summary

Table 3-22 presents of summary of evaluation criteria as applied to the alternatives.

TABLE 3-22

Summary of Evaluation Criteria Assessment

Evaluation Criteria	Desired Ranges	Alternative A	Alternative B	Alternative C
Detrimentally disturbed soils	Less than 15 percent	No change expected	Slight increase but would remain less than 15 percent	Slight increase but would remain less than 15 percent
Unstable areas	No projects located on marginally unstable and unstable soils	No change expected	265 acres on marginally unstable and unstable soils	274 acres on marginally unstable and unstable soils
Road density	Maintain road densities below desired standard of 2.5 miles per square mile	No change expected (one subwatershed exceeds 2.5 miles per square mile)	Road density would increase by a small amount (three subwatersheds exceed 2.5 miles per square mile)	Road density would increase by a small amount (two subwatersheds exceed 2.5 miles per square mile)
Hydrologically connected roads	Road drainage system is disconnected from the stream system	No change expected	Decrease in hydrologically connected roads because of road-crossing improvements	Decrease in hydrologically connected roads because of road-crossing improvements

TABLE 3-22

Summary of Evaluation Criteria Assessment

Evaluation Criteria	Desired Ranges	Alternative A	Alternative B	Alternative C
Equivalent clearcut area	Forest Plan: < 30 percent in 2nd or high order watersheds	No change expected (all watersheds are below 30 percent)	Minor increase in the percent ECA but all watersheds remain below 30 percent	Minor increase in the percent ECA but all watersheds remain below 30 percent
Stream channel disturbance	management related activities do not increase stream channel instability	No change expected	Short-term increase in disturbance because of culvert and bridge replacements	Short-term increase in disturbance because of culvert and bridge replacements
Percent fine material	10 to 20 percent fine sediment in trout spawning gravels (<6.4 mm in diameter)	No change expected	Short-term increase in fine sediment because of culvert, bridge, and road improvements	Short-term increase in fine sediment because of culvert, bridge, and road improvements

3.5 Fisheries

3.5.1 Introduction

The Cottonwood II Project analysis area includes North and South Cottonwood Creeks, as well as tributaries to those streams. The North and South Cottonwood Creeks analysis area is composed of the Halverson, McDougal Gap, Nylander, Sjhoberg, and South Cottonwood treatment areas on the Big Piney Ranger District (RD). These treatment areas are within the analysis area for the Cottonwood II Project and for aquatic resources.

3.5.2 Issues

The potential effects to fisheries were identified as a significant issue during public scoping (Issue 3, Section 1.9.1). Specifically, the issue is:

- The effects of the proposed activities on Colorado River cutthroat trout (CRCT) habitat.

Indicators by which the proposed project will be evaluated relative to this issue include:

- The direct and indirect effects of vegetation management on CRCT habitat.
- Barriers
  - Access restored to miles of habitat

3.5.3 Existing Conditions

The B-TNF hosts several federally listed fishes and the habitats critical to those fishes. The aquatic species and habitats found on the B-TNF include endangered Kendall Warm Springs dace (*Rhinichtys osculus thermalis*), Colorado pikeminnow (*Ptchocheilus lucius*), humpback chub (*Gila cypha*), bonytail chub (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). However, none of the federally listed aquatic species or their habitats are found within the analysis area. There is no habitat for the Kendall Warm Springs dace on the Big Piney RD and the closest populations are found on the Pinedale RD, some distance away (FWS 2003 in Forest Service 2003a). The Colorado pikeminnow, humpback chub, bonytail chub, and razorback sucker were once native to the Upper Colorado River Basin and its major tributaries, but where known inhabit much larger streams than those found within the analysis area (FWS 2003 in Forest Service 2003a).

3.5.3.1 Colorado River Cutthroat Trout

The Cottonwood II area streams contain populations of both native game and non-game fish species (Table 3-23). However, primary analysis focus is on Colorado River cutthroat trout *(Oncorhynchus clarki pleuriticus)* and its habitat, as a management indicator species (MIS) (Forest Service 1990). MIS are those species used to indicate the effects of habitat changes associated with forest management activities (Forest Service 1990). MIS may include harvested species, ecological indicator species, Forest Service sensitive species, and federally listed threatened and endangered species. The MIS in the Cottonwood II analysis area include Colorado River cutthroat trout (CRCT) and rainbow trout (*Oncorhynchus mykiss gairdneri*); however, rainbow trout are a non-native introduced species within the Green River system (Trotter 1987) so the focus of this analysis is on CRCT. Further, CRCT are designated as a species of special status by the states of Colorado, Utah, and Wyoming and are classified as a sensitive species by Regions 2 and 4 of the Forest Service (CRCT Task Force 2001).

TABLE 3-23
Fishes from Selected Streams Within the Cottonwood II Analysis Area

Stream Name	Perennial Stream (miles)	Intermittent Stream (miles)	Fish Species Present[a]
Halverson Creek [a]	0	1.3	None Reported
Irene Creek [a]	0.3	1.4	CRCT, MSC, BKT
Hardin Creek [a]	1.9	1.3	CRCT, MSC, BKT
Ole Creek [a]	1.3	7.5	BKT
McDougal Creek [a]	0	1.2	None Reported
Sjhoberg Creek [a]	2.8	4.5	CRCT
Nylander Creek [a]	2.4	3.3	CRCT, MSC, BKT
Chase Creek [a]	0	1.4	None Reported

TABLE 3-23
Fishes from Selected Streams Within the Cottonwood II Analysis Area

Stream Name	Perennial Stream (miles)	Intermittent Stream (miles)	Fish Species Present[a]
South Cottonwood Creek [b]	12	No Information	CRCT, BKT, SRC

[a] CRCT = Colorado River cutthroat trout, MSC = mottled sculpin, BKT = brook trout, SRC - Snake River cutthroat
[b] Forest Service (2004)
[c] CRCT Task Force (2001)

CRCT were historically distributed throughout the headwaters of the Green and Colorado Rivers as far south as the San Juan River; they perhaps occupied portions of the lower reaches of large rivers in winter (Trotter 1987). CRCT are currently limited to a few small headwater streams of the Green and upper Colorado Rivers in Colorado, Utah, and Wyoming. In Wyoming it is estimated that only 70 populations of CRCT remain and they occupy less than 280 miles of streams (CRCT Task Force 2001). CRCT population decline is related to hybridization with introduced rainbow trout; displacement by introduced brook trout; competition with other established populations of non-native salmonids; and habitat alteration/fragmentation from overgrazing by livestock, logging, roads, and water diversion for irrigation (CRCT Task Force 2001).

WGFD has assigned the North Cottonwood Creek watershed as its third highest priority conservation population of CRCT within the Pinedale Region, with particular habitat concerns for stream, riparian, and aspen-beaver habitat alterations (WGFD 2003b). Several tributaries (Sjhoberg, Nylander, Maki, Irene, Hardin, and Ole Creeks) within the North Cottonwood Creek watershed provide important spawning and rearing habitat. WGFD has constructed several barriers within the North Cottonwood Creek drainage to prevent hybridization and competition with CRCT (WGFD 2003b).

CRCT seem to have adapted better to small streams, lakes, and ponds rather than large rivers. They tend to be most abundant in higher elevation streams with cobble-boulder substrates. They prefer cold, clean waters and can be found in higher gradient (> 4 percent) streams. A good balance of pools to riffles is important to CRCT persistence and the species appears to be well adapted to conditions created by active beaver colonies (Trotter 1987). Behnke (2002) supports the previous description by stating that habitat for CRCT generally includes cool, clear streams (often headwaters), well-vegetated streambanks for cover and bank stability, and instream cover in the form of deep pools, boulders, and logs.

The Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming (CRCT Task Force 2001), describes the five threats to CRCT as:

> "1) Present or threatened destruction, modification or curtailment of the species habitat or range, 2) Overutilization of the species for commercial, recreational, scientific or educational purposes, 3) Disease

> or predation, 4) Absence of regulating mechanisms adequate to prevent decline of the species or degradation of its habitat, and 5) Other natural or manmade factors affecting continued existence of the species."

Of these threats, the proposed Cottonwood II project is most likely to affect the *present or threatened destruction, modification or curtailment of the species habitat or range.* The project indicators for CRCT listed in *Section 3.5.2, Issues* will address the potential habitat impacts of vegetation management and stream barriers from this proposed project.

3.5.3.2 Fisheries Habitats

Impacts to the Cottonwood II analysis area watershed streams are primarily from recreation, timber harvest, grazing, and the development of the road system (Forest Service 1999; Smith 2003). Little information is available that describes the riparian conditions within the analysis area as most recent management projects tend to avoid riparian areas because of their complex nature and to minimize potential impacts to aquatic habitats. A typical buffer width for riparian areas during upland management projects leaves 300 feet of unmanaged area for riparian protection (Forest Service 2004b). This lack of management within riparian areas tends to leave a gap in available riparian information. Within the analysis area, a range analysis conducted in 1962 rated the riparian conditions within North and South Cottonwood Creeks as good to excellent, and a more recent project conducted in 1996 (Forest Service 1996a) examined the Cottonwood riparian areas and stated,

> "By and large, the streams within the area show many signs of recovery from grazing impacts and timber activities which occurred prior to the 1980s. The green-line sedge species that indicate vegetative recovery are well represented. Also there is an abundance of healthy, uneven aged willows along the green-line indicating vegetative health and improvement for providing streambank stability. Vegetation in the green-line is in mid to late successional stage as is the vegetation farther back on the streambanks. In many areas the vegetation is approaching that of the potential natural community (PNC)."

In 1999, the Cottonwood Watershed Analysis (Forest Service 1999b) identified many issues and opportunities to improve stream conditions within the analysis area. Those existing vegetation issues include over 3,000 acres of poor to very poor range conditions from grazing. The Cottonwood Watershed Analysis identified opportunities to improve these conditions that would likely lead to improved conditions for CRCT. In addition, the WGFD (2003b) states that the CRCT population within the watershed is probably most limited by competition and hybridization from non-native fishes, however, habitat conditions may also be limiting population recovery. The WGFD (2003b) notes that early 1990 surveys of Irene, Hardin, and Nylander Creeks found a decrease in willows and sedges along stream channels and recommended the enhancement of aspen and woody riparian communities to improve conditions for beaver, and thus CRCT. Further, the WGFD (2003b) notes that private access, diversions, grazing on public and private lands, drought, and past timber harvest may further contribute to the current conditions of CRCT. The CRCT Task Force (2001) also identified several streams within the analysis area where land management activities are limiting CRCT habitat. The concerns of the

WGFD (2003b) and the CRTC Task Force (2001) suggest that there may be opportunities to help recover CRCT through vegetated management within the Cottonwood Creeks drainages.

In addition to the vegetation concerns within the analysis area, riparian roads (open and closed) continue to deliver sediment to area streams and may be an additional threat to CRCT recovery (Forest Service 1999b). Smith (2003) identified sediment reductions into Nylander Creek through road obliteration, and the improvement of other watershed roads (open and closed) and trails as means of improving CRCT habitat.

In summary, opportunities exist to improve CRCT habitat within the Cottonwood II analysis area through vegetation management and sediment reduction actions. Forest Service (1999b) identified site-specific areas that may improve CRCT habitat and lead to recovery of the Cottonwood CRCT population.

3.5.3.3 Stream Barriers

Culvert surveys were conducted in 2004 to assess resource conditions within the Cottonwood II analysis area. Fourteen crossings were identified throughout the analysis area as needing improvements for CRCT passage or as a barrier to minimize CRCT hybridization and competition with non-native species. Records of hybridization and competition for habitat between CRCT and introduced rainbow trout date back to the late 1800s (Trotter 1987). Few stocks of CRCT have not been exposed to some degree of hybridization (Trotter 1987), including those within the analysis area. Inadvertent barrier construction and hybridization and competition with non-native species were all identified as threats by the *Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming* (CRCT 2001). Culverts are the most commonly installed stream crossing, are found throughout the analysis area, and are the most likely stream crossing device to create an unintentional barrier to fish passage (Furniss et al. 1991). Intentional barriers are also installed to minimize hybridization (CRCT 2001) and have been placed within the analysis area in Nylander, Irene, and Hardin Creeks (WGFD 2003b). Both unintentional and intentional barriers can fragment and isolate CRCT populations by restricting movements from seasonally preferred habitats and can lead to localized extinction (CRCT 2001). Where CRCT are known to inhabit streams upstream of crossings (Irene Creek, Hardin Creek, and Bare Creek) with introduced fishes downstream, the CRCT (2001) recommends the removal of non-natives and the re-establishment of connections between CRCT sub-populations.

3.5.4 Desired Future Conditions

3.5.4.1 Fisheries Habitats

The B-TNF Plan (Forest Service 1990) provides CRCT habitat direction for the Management Prescriptions (MPs) within the Cottonwood Management Area within the analysis area. Table 3-24 outlines the forest-wide and MPs direction for fish habitat within the analysis area. In general, improved habitat conditions and coordination with the WGFD are the desired conditions described within the B-TNF Plan (1990). The WGFD has assigned the Cottonwood watershed, primarily North Cottonwood, the region's third priority as a CRCT conservation population. Further, the cooperative

efforts of the WGFD, Forest Service, and others have developed goals and objectives to conserve and enhance habitat for CRCT to provide the Forest direction for CRCT habitat management within the analysis area (CRCT 2001).

TABLE 3-24
Applicable Forest-Wide and MPs for Issue-Related Fisheries Habitat Resources Within the Cottonwood II Analysis Area

Forest-Wide Direction	Prescription	Provide habitat adequate to meet the needs of dependant fish populations, including those of threatened, endangered, and sensitive species
	Sensitive Species Guideline	Quantifiable objectives developed to identify and improve the status of sensitive species to eliminate the need for listing. The Forest Service will cooperate with WGFD on programs to maintain species objectives.
	Fish Habitat Management Guideline	Fish habitat at or near its potential will be maintained at existing levels. Fish habitat below potential should be improved and maintained to at least 90 percent of potential. Priority should be on streams supporting CRCT and Bonneville CT.
	Sensitive CT Habitat Guideline	Habitat occupied by existing and reintroduced populations of CRCT, Bonneville, and Snake River CT should be managed to protect species purity.
MPs for MA 25 (Cottonwood Creek)	**MA Prescriptions, Standards, and Guidelines**	
1B	Provides habitat for existing populations of fish and a use-attainability study may be needed for a specific stream segment to determine if fishery-beneficial use is being protected to an adequate level.	
2A	Habitat is managed to achieve the fish populations as identified by WGFD and agreed to by the Forest Service.	
	Diverse fish habitat types should be maintained in each watershed to provide sufficient habitat to meet WGFD population objectives and distribution of fish.	
10	Habitat is managed to achieve the fish populations as identified by WGFD and agreed to by the Forest Service.	
	Diverse fish habitat types should be maintained in each watershed to provide sufficient habitat to meet WGFD population objectives and distribution of fish.	
12	Habitat will be managed to help fully achieve the fish populations identified by WGFD as agreed to by the Forest Service	

Source: Forest Service 1990

3.5.4.2 Stream Barriers

The B-TNF Plan (Forest Service 1990) provides CRCT stream barrier direction for the MPs within the Cottonwood Management Area within the analysis area. Table 3-25 outlines the forest-wide and MPs direction for fish passage within the analysis area.

TABLE 3-25
Applicable Forest-Wide and MPs for Issue-Related Fisheries Stream Barriers Within the Cottonwood II Analysis Area

Forest-Wide Direction	Fish Passage Guideline	Streams with fisheries resources - culvert installations will be designed to facilitate fish passage. Structural modifications of existing culverts will be necessary where excessive water velocities, insufficient water depth, elevated outlets, and debris accumulation obstruct fish passage.
	Sensitive Species Guideline	Quantifiable objectives developed to identify and improve the status of sensitive species to eliminate the need for listing. The Forest Service will cooperate with WGFD on programs to maintain species objectives.

Source: Forest Service 1990

3.5.5 Environmental Consequences

This section discloses the effects of each alternative on fishery resources. The assessment discusses direct, indirect, and cumulative effects on CRCT habitat and barriers within the analysis area.

Direct and indirect effects were evaluated for the five treatment areas including South Cottonwood, Halverson, McDougal Gap, Sjhoberg, and Nylander. 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 project plus other past, present, or reasonably foreseeable future actions, regardless of who is taking the action. The cumulative effects boundary encompasses the entire North Cottonwood Creek and South Cottonwood Creek drainages up to the point where the creeks leave the analysis area. This boundary delineates the area where upstream activities are likely to cause impacts. Several reasons why the cumulative effects boundary was delineated to this location follow:

- No equipment or harvest activities would occur within or adjacent to riparian areas, wetlands, or floodplains. This would retain the structure and function of CRCT habitat areas and would reduce the risk of sediment being delivered to stream channels via overland flow from the harvest treatments.
- All road and stream crossing treatments would occur within the analysis area and on B-TNF lands (see discussion in Section 2.4.2). Although downstream effects may occur to CRCT habitat from these treatments, upstream passage within the analysis area is of primary interest and all effects would likely remain within the analysis area.

- The proposed aspen fire treatments and their effects would be contained within the treatment area. Aspen treatment areas are expected to recover quickly, thereby limiting the risk of instream effects to CRCT habitat from occurring.

3.5.5.1 Fisheries Habitats

Alternative A – No Action

Direct, Indirect, and Cumulative Impacts

Under the No Action Alternative, no vegetation management activities would occur in the North and South Cottonwood Creeks drainages. Isolated areas of poor quality riparian vegetation would likely persist and some open and closed roads would likely continue to contribute fine sediments to area streams. There would be no road or trail improvements to reduce sediment sources to CRCT habitat. It would likely not be possible under the No Action Alternative to comply with Forest Plan direction relative to vegetation management in the Cottonwood Creeks drainages and, thus, there would be no benefit to active beaver colonies, and subsequently CRCT. Desired future conditions, as described in the Forest Plan and shown in Table 3-24, would likely not be attained. Because no action is associated with this alternative, no direct, indirect, or cumulative effects would occur.

Alternative B – Proposed Action

Direct Impacts

Direct effects to CRCT habitat would likely result from road relocation, reconstruction, and temporary construction (see *Section 2.4.2*). Road relocation and realignment is generally implemented to move a road from an area of concern (Forest Service 2002d). Within the Nylander Creek treatment area (Figure 2-2 in Chapter 2), 1 mile of existing road would be relocated to outside the riparian area. The relocated road would not likely directly affect CRCT habitat because the new location would be intentionally located outside of the riparian area. Direct effects would likely come from reclamation of the closed road, and would likely result in short-term increases of sediment to the local stream channel until vegetation is reestablished on the reclaimed road surface.

Temporary road construction may contribute to direct effects on CRCT habitat through the life of the road. Furniss et al. (1991) detail the direct degrading effects of road construction on stream habitats, with emphasis placed on sediment introduction. Mitigation measures are included in the Proposed Action that are designed to minimize the delivery of sediments to streams. These measures are described in *Section 2.6, Mitigation Common to all Action Alternatives*. Negative direct effects to CRCT habitat may occur as fine sediment inputs that enter the stream system despite mitigation measures. These sediment inputs can result in altered channel morphology and substrate composition, which can directly affect CRCT habitat. However, the closure and reclamation of the roads should result in long-term benefits to CRCT habitat by reducing a chronic source of fine sediment where the road was reclaimed. Temporary roads would also be reclaimed to attempt to return to pre-road conditions.

Mechanical treatment of vegetation would include a 300-foot-wide buffer and would not result in direct impacts. Table 2-4 describes the types of proposed aspen treatments within the analysis area. Ignition of aspen stands would occur outside of and be allowed to back into riparian stands, but this would not be expected to directly affect CRCT habitat.

In summary, the direct effects of the Proposed Action on CRCT habitat would result in short-term disturbances from potential sediment introductions. However, there would be long-term benefits to CRCT habitat from the removal of chronic sediment inputs.

Indirect Impacts

Indirect effects to CRCT habitat would likely result from road relocation, road reconstruction, and vegetation treatment. Indirect effects from road relocation would likely come from the reestablishment of riparian vegetation on the former road prism. Riparian vegetation can, for example, indirectly affect and benefit CRCT habitat by filtering surface sediments, lowering summer water temperatures, increasing forage for fishes, stabilizing streambanks, and providing future large woody debris (Platts 1991). These indirect effects should result in localized benefits to CRCT habitat.

Vegetative treatment may result in indirect affects to CRCT habitat. Logging and burning as a means of vegetative treatment can cause runoff to be higher than under unlogged conditions (Chamberlin et al. 1991). The more severe the alteration of the hydrologic cycle (timing of the runoff), the more likely that runoff would affect fish habitat. Mitigation measures *(*see *Section 2.6)* implemented during vegetative treatments should minimize the indirect risks of these vegetative treatments on CRCT habitats. The vegetative treatments may also indirectly benefit CRCT habitat by improving forest health within the watershed.

In summary, the indirect effects to CRCT habitat may result in localized improvements in riparian habitat, slight alterations in the hydrologic cycle, and general improvements in watershed health.

Cumulative Impacts

The cumulative effects issue associated with the Proposed Action is CRCT habitat. The direct and indirect effects to CRCT habitat associated with cumulative effects of the Proposed Action include the potential for short-term alterations in channel conditions from increased sediment delivery to streams. Vegetation treatment may lead to minor increases in watershed runoff. Long-term benefits to CRCT habitat should be realized from road relocation and reclamation efforts.

Past and current actions that have influenced CRCT habitat within the Cottonwood II analysis area include the following:

- Domestic livestock grazing—five federal permits and private lands' agriculture
- Historic timber harvest for railroad ties
- Commercial timber harvest since the 1960s on approximately 2,059 acres
- Oil and gas development with 1 operating well and associated infrastructure

- Fifty-four miles of existing (open and closed) roads, and 33 miles of trails
- Passage barriers

Although CRCT are reported present throughout the analysis area, genetically pure populations are only found in selected headwater streams because of non-native introductions and habitat alteration. The WGFD (2003b) suggests that non-native competition and hybridization are most limiting to CRCT, but habitat alterations could limit future recovery. Links between aquatic habitat quality and fish population size and distribution are not clearly defined within the Cottonwood II analysis area.

The combination of the low embryo survival, non-native competition and hybridization, local population isolation, and general habitat modification from land management activities places the local CRCT populations within the North and South Cottonwood Creeks drainages at a high risk of extinction from stochastic events (Forest Service 2004b).

Reasonably foreseeable future actions include the following:

- Continued domestic livestock grazing on five federal permits
- Timber harvest on approximately 900 acres (this proposed project)
- Prescribed and natural fires
- Construction of four trailheads
- Bridge and culvert replacements
- System road upgrades
- Watershed restoration projects

All of the reasonably foreseeable actions listed above have the potential to impact fish habitat and fish populations in the long-term and short-term. All activities related to the Proposed Action should result in long-term benefits to CRCT habitat and thus benefit CRCT populations. However, any streamside road-related reclamation project is likely to contribute some amount of sediment into the stream channel. Mitigation measures associated with the Proposed Action should minimize the input of sediments and result in long-term benefits to the CRCT habitat and CRCT local populations.

Among the projects listed in Table 3-1 for consideration in the cumulative effects analysis, the Maki Creek Area Projects, which are within the Cottonwood II analysis area, would similarly benefit CRCT habitat through a vegetation management program and an anticipated reduction in sediment delivery. Within the Maki Creek project area, 3.6 miles of Maki Creek contain CRCT. The combined effects of the Maki Creek and Cottonwood II projects would cumulatively benefit CRCT habitat and local populations in the analysis area.

Alternative C – Reduced Harvest and Temporary Roads

Direct Impacts

Alternative C contains the same management objectives as the Proposed Action (see *Section 2.4.3*). However, fewer acres would be treated with timber harvest, resulting in approximately 4.5 miles fewer temporary roads. Direct effects from sediment inputs to CRCT habitat would be less than under the Proposed Action. Vegetation treatments would have similar effects under Alternative C as the Proposed Action.

In summary, fewer benefits to CRCT habitat would likely be realized under Alternative C than the Proposed Action because fewer restorative actions would be implemented under Alternative C.

Indirect Impacts

Indirect effects of Alternative C would be similar to the Proposed Action. Indirect effects from temporary road construction and vegetative treatments would likely be fewer. Indirect effects from aspen treatments would be similar to those of the Proposed Action.

Cumulative

Cumulative effects associated with Alternative C would be similar to the Proposed Action, except those actions that would be beneficial to CRCT habitat would be lessened by the reduced actions under Alternative C.

3.5.5.2 Stream Barriers

Alternative A –No Action

Direct, Indirect, Cumulative Impacts

Under the No Action Alternative, no improvements to stream crossings or stream passage would occur in the North and South Cottonwood Creeks drainages. Isolated areas of restricted passage from poorly designed and installed culverts would continue to persist. Three culverts are designed to restrict fish passage as a means to temporarily protect CRCT from hybridization with non-native trout and habitat competition (WGFD 2003b). It would likely not be possible under the No Action Alternative to comply with Forest Plan direction relative to fish passage (Table 3-25). Because there is no action associated action with this alternative, no direct, indirect, or cumulative effects would occur.

Alternative B – Proposed Action

Direct Impacts

Table 2-3 describes the fourteen stream crossing improvements proposed under the Proposed Action. Culvert designs are often not compatible with the stream area and result in increased water velocities through the culvert (Bell 1986), creating channel modifications and fish passage restrictions (WDFG 2003b). The Proposed Action proposes to stabilize the banks upstream and downstream of culverts using riprap at four of the crossings (Table 2-3 in Chapter 2). Three of these culverts (Irene, Hardin, and Bare Creeks) are designed fish passage barriers, while the fourth (West Fork Bare Creek)

currently provides CRCT passage (Nelson 1999) and is proposed for stabilization. The three barriers would continue to serve as barriers under the Proposed Action and directly affect upstream CRCT passage to approximately 0.3, 2, and 2.5 (respectively) miles of perennial habitat. In the case of Irene Creek, this CRCT population may be extremely susceptible to local extinction from stochastic events because of the very limited available habitat and the barrier to upstream passage.

Two bridges are proposed for bank stabilizing repair or replacement (Table 2-3). These currently provide fish passage (Nelson 1999) and would continue to do so under the Proposed Action. The North Cottonwood Creek bridge would be replaced with a wider bridge while the Ole Creek bridge is under evaluation for repair or replacement with a wider bridge for road maintenance purposes. These actions should have no direct effect on CRCT passage as upstream access would not be modified.

Seven other culverts – Halverson, North Cottonwood Creek, North Cottonwood at Nylander Creek, McDougal Creek, Hidden Basin Creek, the unnamed tributary in Bare Creek, and upper North Cottonwood Creek -- all currently restrict upstream fish passage (Nelson 1999). The Halverson Creek culvert provides access to little perennial habitat and contains approximately 1 mile of intermittent stream upstream of the culvert. This replacement may directly benefit CRCT by providing additional seasonal habitat. The North Cottonwood Creek culvert (FS Road 10342) replacement should greatly benefit CRCT by providing access to nearly 6 additional miles of perennial habitat. The North Cottonwood Creek at Nylander culvert replacement could provide up to two additional miles of habitat access for CRCT if replaced. McDougal Creek provides little perennial habitat and contains approximately 2 miles of intermittent stream upstream of the culvert. This culvert replacement may directly benefit CRCT by providing additional seasonal habitat. Hidden Basin Creek also provides little perennial habitat and contains approximately 2 miles of intermittent stream upstream of the culvert. This culvert replacement may also directly benefit CRCT by providing additional seasonal habitat. The unnamed tributary in Bare Creek is also primarily an intermittent stream and provides little perennial habitat. It contains less than 1 mile of intermittent stream upstream of the culvert. This culvert replacement may also directly benefit CRCT by providing additional seasonal habitat. Finally, there are more than 3 miles of intermittent streams upstream of the upper North Cottonwood Creek culvert that could b e accessed and provide seasonal habitat to CRCT if the culvert is replaced.

Finally, the Trailer Creek culvert currently provides fish passage in this primarily intermittent stream. The culvert consists of an undersized pipe that causes the stream to flow over the road at high flows. This pipe would be replaced with a larger culvert and provide access to up to 1 mile of seasonal habitat.

Most of these replacements or repairs should directly affect (benefit) CRCT within the project area by expanding available upstream habitat access. However, the direct effect of the Irene Creek barrier may need to be reassessed as it may be detrimental to the upstream CRCT because available habitat appears to be minimal.

Indirect Impacts

Indirect effects of the culvert replacements on access to upstream habitats are difficult to ascertain. The potential exists that sediment produced during culvert replacement may affect growth or fish food production, which may further affect fish movement. The likelihood of this indirect effect occurring is difficult, if not impossible to determine, given the implementation of mitigation measures included with the Proposed Action that are intended to minimize sediment input to streams.

Cumulative Impacts

The cumulative effects of the Proposed Action on CRCT access to habitat within the analysis area are most likely related to the presence of the road system within the analysis area. Forest roads present threats to aquatic systems by their mere presence and the associated hydrologic disruptions they cause (Waters 1995). The next threat within the analysis area to fish passage is likely from grazing within riparian areas. Potential grazing effects to the stream channel can greatly alter the channel form, creating a wider and shallower stream that can restrict upstream fish access seasonally, or year-round (Platts 1991). Finally, water diversions remove water from the stream system that serve to shape the stream and hydrologic system (Wesche and Issak 1999). Water diversions directly reduce flows that are often necessary for fish movement and can cause the alterations of channels that also can disrupt fish movement and passage. The replacements and repairs of the road crossings of streams within the analysis area would, no doubt, be beneficial to CRCT access within the Cottonwood Creek drainages.

All of the reasonably foreseeable actions listed above in discussions of cumulative effects on CRCT habitat have the potential to affect fish passage in the long- and short-term. Activities related to the Proposed Action should result in long-term benefits to CRCT by providing increased access to habitat, increasing the quantity and quality of available habitat, and aiding in the recovery of CRCT local populations. Similar fish passage improvements in the Maki Creek drainage under the proposed Maki Creek Area Projects, together with the proposed fish passage improvements under the Cottonwood II Vegetation Management Project, would cumulatively benefit CRCT in the Cottonwood II analysis area.

Alternative C – Reduced Harvest and Temporary Roads

Direct Impacts

There is no difference in the actions proposed under Alternative B (Proposed Action) and Alternative C as they relate to culvert replacement and repairs (see Section 2.5). The direct effects of this alternative on CRCT passage are expected to be the same as described for the Proposed Action.

Indirect Impacts

There is no difference in the actions proposed under Alternative B (Proposed Action) and Alternative C as they relate to culvert replacement and repairs (see Section 2.5). The indirect effects of this alternative on CRCT passage are expected to be the same as described for the Proposed Action.

Cumulative Impacts

There is no difference in the actions proposed under Alternative B (Proposed Action) and Alternative C as they relate to culvert replacement and repairs (see Section 2.5). The cumulative effects of this alternative on CRCT passage are expected to be the same as described for the Proposed Action.

3.5.6 Summary

The land management impacts within the Cottonwood II analysis area have likely led to the currently suppressed population conditions seen in the local populations of CRCT. Both action alternatives (Alternative B and C) are expected to result in short-term disturbances to the aquatic system and thus CRCT and their habitat. These short-term disturbances would most likely result in inputs of sediment into the streams. The degree of disturbance from the input of sediments would be greatly minimized by the project design features that include mitigation measures for sediment. However, the long-term benefits of the actions should lead to a reduction in chronic sediment inputs, especially under the Proposed Action. Both action alternatives would improve CRCT access to other potentially important habitats within the Cottonwood Creeks drainages that are currently unavailable. Overall, the expected effects (benefits) to CRCT habitat and passage from the action alternatives would provide a better opportunity for the recovery of the local CRCT populations than that of Alternative A or the existing condition. The Proposed Action provides more opportunities for chronic sediment reductions than Alternative C. Both Alternatives B and C equally improve access to upstream habitats. Given this information, the Proposed Action appears to provide more opportunities to improve conditions related to the issue of effects of the proposed activities on CRCT habitat as measured by the two indicators.

3.6 Special Status Species

3.6.1 Introduction

This section discusses special status plant, fish, and wildlife species that were considered in the analysis of the proposed Cottonwood II Project and potential environmental consequences to these species from implementing Alternative A (No Action), Alternative B (Proposed Action), or Alternative C (Reduced Harvest and Temporary Roads). Special-status species include federally-listed threatened, endangered, and candidate species, Forest Service sensitive species, and Forest Service management indicator species (MIS).

3.6.2 Issues

One of the significant conservation issues identified during public scoping is in regards to a federally listed species, Canada lynx.

- Old Growth and Canada Lynx (Issue #1, Section 1.9.1) - The project area has been documented as occupied Canada lynx habitat. Effects of the proposed activities on lynx habitat, especially on foraging and denning habitat, is a significant issue.

Indicators by which the proposed project will be evaluated corresponding to this issue are the following:

- Estimated change in lynx foraging habitat from project activities.
- Estimated change in lynx denning habitat from project activities.

3.6.3 Existing Conditions

3.6.3.1 Federally Listed Species

The FWS provided the B-TNF with a Forest-wide list (ES-61411/W.19/WY7936) of threatened, endangered, and candidate species that may occur within the analysis area or potentially be impacted by the project on January 13, 2004. Under provisions of the Endangered Species Act of 1973 (ESA), 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 habitats. Table 3-26 provides the FWS list of species for the analysis area. A separate Biological Assessment including these species will be forwarded to the FWS for concurrence.

TABLE 3-26
Threatened, Endangered, and Candidate Species that may Occur Within the Analysis Area or be Impacted by the Proposed Project

Species	Scientific Name	Status	Habitat
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Riparian habitats widespread.
Canada lynx	*Lynx canadensis*	Threatened	Montane forests.
Gray wolf	*Canis lupus*	Experimental	Greater Yellowstone ecosystem.
Grizzly bear	*Ursus arctos horribilis*	Threatened	Montane forests.
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils below 7000 feet
Colorado River fish:		Endangered	Downstream riverine habitat of the Yamps, Green and Colorado Rivers
Colorado pikeminnow	*Ptychocheilus lucius*		
Humpback chub	*Gila cypha*		
Bonytail chub	*Gila elegans*		
Razorback sucker	*Xyrauchen texanus*		
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Riparian zones

Federally Listed Plant Species

Ute ladies'-tresses was listed as threatened on January 17, 1992 (57 FR 2053). Ute ladies'-tresses is a perennial, terrestrial orchid that is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The lowest elevation within the project analysis area is 7960 feet. This plant is not known to occur in southwestern Wyoming. All known Wyoming populations are in eastern Wyoming (Fertig 2000b). This project would not impact

vegetation in riparian zones or other wetland habitats, nor would it impact elevations below 7960 feet. For these reasons, this species is dropped from further analysis.

Federally Listed Fish Species

The FWS Colorado River fish, Colorado pikeminnow, humpback chub, bonytail chub, and razorback sucker, were once native to the Upper Colorado River Basin and its major tributaries but were known to inhabit much larger streams than those found within the project area (Forest Service 2003a). The FWS requested analysis of impacts to this group of endangered fish only if the project would lead to depletions of water to the Colorado River system. Activities associated with the Cottonwood II Project would not affect instream flow as it relates to the recovery of these large stream fishes (Biological Resource Research Center 2004). Therefore, they are dropped from further analysis.

Federally Listed Wildlife Species

Bald eagle

This species was listed as endangered on March 11, 1967. The status was reclassified from endangered to threatened status in the lower 48 states because of recovery progress on July 12, 1995. This species is also a MIS for the B-TNF.

Bald eagles are closely associated with lakes and large rivers in open areas, forests, and mountains. They nest near open water in late-successional forest with many perches or nest sites, and low levels of human disturbance (McGarigal 1988; Wright and Escano 1986). The nest site is usually within 1/4 to 1 mile of open water with less than 5 percent of the shore developed within 1 mile. Nests are placed in large-diameter trees and are often re-used year after year. Perches are generally at the edge of forest stands, near foraging areas, or near the nest tree, and have panoramic views of surrounding areas. They need large trees along rivers with good visibility, preferably snags, for perching. Protected deep ravines with large trees are often used as night roosts.

Critical winter habitat is located near food sources, such as lakes, rivers, and uplands with big game winter range. These sites have adequate perch sites and sheltered roost sites. Human activity may be a major factor limiting bald eagle distribution on wintering habitats (Steenhof 1976).

No known bald eagle nests or sightings exist within the project analysis area (Wyoming Natural Diversity Database 2004). Wyoming Gap Analysis data indicate that there is habitat for bald eagles throughout the analysis. Bald eagles may travel through the area or use gut piles and carrion during hunting season when available.

Conservation Requirements

In order to reduce adverse effects to bald eagles, the FWS requires the maintenance of a 1-mile disturbance-free buffer zone be maintained around eagle nests and winter roost sites (FWS letter Appendix B). Activity within 1 mile of an eagle nest or roost may disturb the eagles and result in "take." If a disturbance-free buffer zone of 1 mile is not

practicable, the activity should be conducted outside of February 15 through August 15 to protect nesting eagles and November 1 through April 15 to protect roosting birds.

Grizzly Bear

This species was listed as endangered on March 11, 1967. This status was changed to threatened on July 28, 1975. A recovery zone was subsequently delineated. This species is also a MIS for the B-TNF.

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 (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 (especially whitebark pine).

Grizzly bears once roamed the Wyoming Range, but were extirpated from much of their historic range by the middle of the twentieth century (FWS 1993 in Forest Service 2003a). A small population has persisted in Yellowstone National Park, north of the project analysis area. Approximately 400 to 600 bears are believed to live in the Greater Yellowstone Ecosystem.

In 2002, the Wyoming Game and Fish Department (WGFD) finalized and adopted the Wyoming Grizzly Bear Management Plan (WGBMP) (Moody *et al*. 2002). This plan defines the most suitable grizzly bear habitat, both biologically and socially, as the northwestern portion of Wyoming because it is an area with large tracts of undisturbed habitat and minimal human disturbance. According to the WGBMP, the Wyoming portion of the Greater Yellowstone Ecosystem with suitable grizzly bear habitat includes all lands within the Shoshone, Bridger-Teton, and Targhee National Forests, Yellowstone and Grand Teton National parks, the National Elk Refuge, and the western portion of the Wind River Indian Reservation. The Recovery Zone (Primary Conservation Area) boundary does not include the entire B-TNF. The analysis area, therefore, falls within the designated habitat for grizzly bears, but it is south of the Primary Conservation Area.

Reports of grizzly bears in the Wyoming Range are received annually, but the validity of these observations is usually unknown. The grizzly bear population in the Yellowstone area appears to be increasing at 4 to 6 percent per year (Moody *et al*. 2002). The number of female bears with cubs has been 15 or higher since 1988. Since 1996, the number of females with cubs has been 30 or higher (Moody *et al*. 2002). This increasing population is expected to expand into adjacent suitable habitat areas. A grizzly bear was killed in the summer of 2002, approximately 20 miles northwest of Maki Creek near Deadman Peak. Suitable habitat is present within the analysis area, and grizzly bears may live or travel through the analysis area, particularly remote areas of the analysis area.

Gray Wolf

This species was listed as endangered on March 11, 1967. Although wolves in Wyoming remain listed and protected under the ESA, additional flexibility was provided for their

management under the provisions of the final rule and special regulations promulgated for the nonessential experimental population on November 22, 1994.

Gray wolves were historically found throughout Wyoming, but were virtually exterminated from the western United States by the 1940s (FWS 1994 in Forest Service 2003a). Wolves use a variety of habitats including coniferous forests, montane meadows, and shrub-steppe. 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 (FWS 1987 in Forest Service 2003a). The analysis area is considered ungulate spring, summer, and fall range as well as being adjacent to an elk feeding ground. Preferred wolf prey species of deer, elk, and moose are all found in and adjacent to the analysis area.

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 B-TNF. Observations of wolves have been reported as far south as Kemmerer, but no packs are known to be within or adjacent to the analysis area. Wolves were observed near the Jewett feeding ground in the winter of 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.

Canada lynx

The Canada lynx was listed as a threatened species March 24, 2000. On December 26, 2002, the District Court for the District of Columbia issued a decision that enjoins the FWS from issuing “written concurrence[s]” on actions proposed by federal agencies that “may affect, but are not likely to adversely affect" Canada lynx. Until further notice, all FWS consultations concerning effects to Canada lynx must be conducted in accordance with the direction of the Court. Specifically, any actions subject to consultation that may affect Canada lynx require formal consultation as described in 50 CFR 402.14, as well as preparation of a Biological Opinion (BO) that addresses how the proposed action is expected to affect Canada lynx in order to complete the procedural requirements of Section 7 of the ESA.

Historically, lynx were observed in every mountain range in Wyoming with concentrations of observations in western Wyoming (See Appendix B). 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). A variety of stand ages and structures of forest cover provides 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 to 3 meters 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).

Historic wildfire and timber harvest were factors in some areas in promoting dense natural regeneration. There were large expanses of dense natural regeneration, as indicated by present-day forests. The resulting mix of residual overhead cover and dense lodgepole and aspen regeneration provided the best possible conditions for snowshoe hares. Also, these disturbances occurred across an area large enough to have a very substantial impact in regards to the amount of productive snowshoe hare and lynx habitat that was available. This habitat would have persisted for some decades, but the reduction in timber harvest and the initiation of effective fire control resulted in an end to such widespread disturbances. Since that time canopy closure and the self-pruning process have greatly reduced snowshoe hare cover and forage availability during winter. Much of the aspen component is in late seral condition. Aspen is being lost though natural succession to conifers on a wide scale. Mixed aspen and conifers stands are productive for wildlife, including snowshoe hares, but where there has been a lack of disturbance for an extended period of time the aspen component is being lost.

Information provided by the FWS (see Appendix B) for lynx in Wyoming describes similar habitat requirements: subalpine or coniferous forests of mixed ages and structural classes. Mixed age classes provide both mature forests with downed logs, and windfalls provide cover for denning, escape, and protection from severe weather and early successional forest stages that provide habitat for the snowshoe hare. Snowshoe hare require structured and regenerating forests that provide an abundance of cover and food at ground level in summer and at snow level in winter. It is likely that forest structure and composition during winter is a limiting factor. Dense, low-hanging conifer branches are essential for thermal cover. The FWS recommends that habitats that are most beneficial to lynx are areas that retain an overstory for concealment and forested connectivity between feeding, security, and denning habitats.

Lynx and suitable habitat occur in the analysis area (Wyoming Natural Diversity Database 2004). Wyoming Gap Analysis results show suitable habitat for lynx and specific areas that are apparently suitable for denning and for foraging. The Lynx Conservation Agreement (Lynx CA) between the FWS and the Forest Service specifies that recommendations found in the Lynx CA (Ruediger et al. 2000) will be reviewed and considered prior to making any new decision to undertake actions in lynx habitat. The analysis area falls within lynx analysis unit (LAU) 1404010120, Cottonwood (5^{th} level hydrologic unit code). Potential suitable lynx habitat (Table 3-27) has been mapped following criteria in the LCAS (Ruediger et al. 2000).

TABLE 3-27
Lynx Habitat

LAU	Acres	Percent of LAU	Acres and Percent Suitable Lynx Habitat
Cottonwood Creek	48,541	100	24,327 (50%)

Yellow-billed Cuckoos

Yellow-billed cuckoos are a candidate species for listing under the ESA. This neotropical migrant may go unnoticed because it is slow-moving and prefers dense vegetation. It breeds in North America and winters primarily south of the U.S.-Mexico border. It once flourished in western cottonwood and willow riparian forests and thickets, but is now nearly extinct west of the Continental Divide, where it has disappeared from large portions of its former range and is extremely rare in the interior West.

In the West, yellow-billed cuckoos prefer sites with a dense understory of willow (*Salix* spp.) combined with mature cottonwoods (*Populus* spp.) and generally within 100 meters of slow or standing water (Gaines and Laymon 1984). The yellow-billed cuckoo is also known to use non-riparian, dense vegetation such as wooded parks, cemeteries, farmsteads, tree islands, Great Basin shrub-steppe, and high elevation willow thickets (DeGraff et al. 1991). It feeds on insects (mostly caterpillars), but also beetles, fall webworms, cicadas, and fruit (especially berries).

Population densities based on long-term data may be underestimates because of this bird's quiet demeanor and furtive behavior, which make this species relatively easy to overlook when it is not singing. They apparently need large blocks of riparian habitat for nesting, particularly riparian woodlands with cottonwood and willows (FWS 2002). No known occurrences of yellow-billed cuckoos exist within the analysis area (Wyoming Natural Diversity Database 2004). This proposed project would not impact large blocks of riparian willow habitat. Therefore, this species will be dropped from further analysis.

3.6.3.2 Forest Service Sensitive Species

The Forest Service Manual in Section 2670.5 defines sensitive species as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers, density, or habitat capability that reduce a species/existing distribution." In Section 2670.22, management direction for sensitive species is, in part, to ensure that species do not become threatened or endangered because of Forest Service actions, and to maintain viable populations of all native 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:

- Significant current or predicted downward trends in population numbers or density, or

- Significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670.5).

Only those species that are known or likely to occur within the analysis area and/or that may be impacted by at least one of the alternatives of this project are included here. A Biological Evaluation (BE) has been prepared that analyzes the broader suite of sensitive species for this project. It is located in Appendix C.

Sensitive Plant Species

Forest Service sensitive plant species with populations that are known to occur on the Big Piney Ranger District are listed in the BE in Appendix C along with suitable habitat. Those species that are likely to occur within the project analysis area are listed in Table 3-28. The B-TNF is located within Forest Service Region 4 (FSR4), but it is adjacent to Forest Service Region 2 (FSR2). Some of the sensitive species listed for FSR2 also occur on the B-TNF. Only those FSR2 sensitive species that are also listed as sensitive for FSR4 are considered in this EIS.

TABLE 3-28
Sensitive Plants That Are Known or Expected to Occur Within the Project Analysis Area

Common Name	Scientific Name	Federal Status*	Potential to Be Impacted by Project Treatments	Habitat
Soft aster	*Aster mollis / Symphyotrichum molle*	USFS Region 2 and Region 4 Sensitive	No	Sagebrush grasslands and mountain meadows on deep, calcareous soils at the edge of aspen or pine woodlands (6400-8500 feet).
Payson's milkvetch	*Astragalus paysonii*	USFS Region 4 Sensitive	Possibly	Disturbed areas and recovering burns, clear cuts, and road cuts on sandy soils with low cover of herbs and grasses (6700 to 9600). Early succession.
Payson's bladderpod	*Lesquerella paysonii*	USFS Region 4 Sensitive	No	Rocky, sparsely-vegetated slopes, often with calcareous soils (6000 to 10300 feet).
Creeping twinpod	*Physaria integrifolia* var. *monticola*	USFS Region 4 Sensitive	No	Barren, rocky, calcareous hills and slopes (6500 to 8600 feet).

Payson's Milkvetch

Payson's milkvetch belongs to the Fabaceae or Pea Family. There are 36 known occurrences of this perennial milkvetch in Wyoming, with 30 observed as late as 1992. Payson's milkvetch is an early succession perennial plant that primarily occurs on disturbed sites such as burned areas, road cuts, blow downs, and clear cuts. It prefers sandy soils with low cover of forbs and grasses at mid-elevation (Fertig and Marriot 1993). Payson's milkvetch is a regional endemic to east-central Idaho and Western Wyoming. Known occurrences in Wyoming are restricted to the B-TNF on the Big Piney, Kemmerer, Grey's River, and Jackson Ranger Districts. Most populations are

small and are unlikely to persist for long periods of time without some form of disturbance. Declines in populations of this species are likely a result of fire suppression in western National Forests (Fertig 2000a).

No occurrences are currently found within designated special management areas, although one population occurs within the proposed Fall Creek Special Botanical Area on the B-TNF. All other occurrences are on National Forest lands that receive no special management (Fertig 2000a).

Payson's milkvetch is threatened primarily by succession, which makes habitats unsuitable for long-term persistence. The loss of populations originally surveyed in the 1950s are a result of forest succession (Lorain 1990). This species requires periodic disturbances to create new habitat and to keep competing late-seral species or weeds under control. Most populations are very small and probably are unable to persist over long periods of time without some form of disturbance. With long-term fire-suppression on federal lands, this species currently is found to be doing best in human-disturbed sites, such as road cuts and recovering clear-cuts (Fertig 2000a). Although Payson's milkvetch is a seral species that tolerates and seems to require a certain amount of disturbance, plants apparently need a minimum of 15 years following disturbance to enter and become established in a disturbed area. Old skid trails, grown-over logging roads, and clearcuts that were broadcast burned are where the majority of new sightings have been found (Lorain 2000). This species occurs within the analysis area along Deadline Ridge.

Sensitive Wildlife Species

Wildlife species have been designated as Sensitive by the Intermountain Region of the Forest Service (Region 4) and could possibly occur in the Big Piney Ranger District. Appendix C provides the BE for Sensitive Wildlife Species. Region 4 sensitive wildlife species, their general habitat preferences, and their known or expected occurrence within the analysis area are listed in Table 3-29. Species that are not known or expected to occur in the analysis area and for which suitable habitat is not present are not discussed in the following section.

TABLE 3-29
Forest Service, Region 4 Sensitive Species, Suitable Habitat, and Known or Expected Presence in the Analysis Area

Common Name ***Scientific Name***	**General Habitat Requirements**	**Known or Expected Presence in the Analysis Area**
Spotted Frog *Rana pretiosa*	Fish-free, spring fed creeks and ponds.	Habitat and individuals are present in the analysis area.
Peregrine falcon *Falco peregrinus*	Far ranging flier, lives, roosts in /on cliffs.	Habitat is not present in the analysis area.
Common Loon *Gavia immer*	Breeds in lakes greater than 9 acres.	Habitat is not present in the analysis area.
Trumpeter Swan *Cygnus buccinator*	Breeds in remote marshes, lakes, and ponds 5-10 acres or larger.	Habitat is not present in the analysis area.

TABLE 3-29
Forest Service, Region 4 Sensitive Species, Suitable Habitat, and Known or Expected Presence in the Analysis Area

Common Name ***Scientific Name***	**General Habitat Requirements**	**Known or Expected Presence in the Analysis Area**
Harelequin Duck *Histrionicus histrionicus*	Undisturbed, low gradient, meandering mountain streams.	Habitat is not present in the analysis area.
Boreal Owl *Aegolius funereus*	High elevation spruce-fir forests.	Habitat is present within the analysis area.
Flammulated Owl *Otus flammeolus*	Breeds in mature open canopied aspen and Douglas-fir or mixed coniferous/deciduous forests.	Habitat is present within analysis area.
Great Gray Owl *Strix nebulosa*	Mature coniferous and mixed coniferous forests interspersed with small clearings.	Foraging habitat is present within the analysis area.
Northern Goshawk *Accipiter gentilis*	Mature coniferous and mixed coniferous and aspen forests interspersed with small clearings.	Foraging and probably nesting habitat is present within the analysis area. No observations during two-year survey.
Three-Toed Woodpecker *Picoides tridactylus*	Mature conifer and mixed conifer forests; capitalizes on dead standing timber left by stand replacing fires.	Habitat is present within the analysis area.
Spotted Bat *Euderma maculatum*	Caves, roosts in rock crevices on steep cliff faces.	Habitat is not present in analysis area
Western Big-Eared Bat *Plecotus townsendii*	Hibernates in caves, rock outcrops, and mine shafts; roosts in hollow trees and snags.	Potential roosting habitat is present; no known hibernacula present; no observations
Wolverine *Gulo gulo*	Generalist, utilizes a variety of habitats spanning all elevations; needs large roadless areas (36 to 250 square miles).	Habitat is present in analysis area. Species is not known to be present in the 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 present in analysis area. Species is not present and no historical accounts for the area.

Suitable habitat is known or likely to exist within the analysis area for spotted frog, boreal owl, flammulated owl, great gray owl, northern goshawk, three-toed woodpecker, western big-eared bat, wolverine, and fisher (see Table 3-29). However, the proposed project treatments are limited to specific types of habitats. Other types of habitat would not be impacted by any of the alternatives. Only those species with the potential to be directly or indirectly impacted by the project treatments will be discussed further. Therefore, the spotted bats, western big-eared bats, wolverine, and fisher are dropped from further analysis.

Spotted Frog

Potential habitat exists within the analysis area for spotted frogs and spotted frogs have been documented at several locations. Spotted frog habitat primarily includes oxbow ponds (without fish) with emergent sedges (*Carex* sp.) located in wet meadows at the edge of lodgepole pine forest. Spotted frogs can move considerable distances from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and shrub lands of sagebrush and rabbitbrush.

Riparian areas provide critical breeding, foraging, and over-wintering habitats for amphibians such as spotted frogs. These areas also provide migratory or dispersal corridors. 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-foot-wide buffer should be protected from management impacts. Larger buffers may be necessary depending on adjacent habitat and magnitude of threats (Patla 2000 in Forest Service 2003e).

In addition to spotted frogs, boreal toads and leopard frogs may be 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 foot buffer from management impacts should also protect boreal toads (Found on B-TNF and on adjacent BLM land) and leopard frogs and their habitat.

Boreal Owl

This species has been documented in the analysis area (Wyoming Natural Diversity Database 2004). All breeding sites were between 6900 and 8500 feet elevation (Clark 1994 in Forest Service. 2003e). 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 Ranger 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 forests 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. Owls were detected in multi-layered stands with high structural complexity, usually close to small wet meadows with complex perimeters (Clark 1994 in Forest Service. 2003e). Boreal owls primarily prey on small mammals, particular red-backed voles. These species inhabit montane 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.

Flammulated Owl

This owl prefers ponderosa pine habitat, but will also utilize Douglas-fir, aspen, and/or limber pine. Douglas-fir, aspen, and limber pine are present within the analysis area. Flammulated owls are secondary cavity nesters that primarily feed on nocturnal lepidopteron moths, which they glean from the foliage. Two key habitat features that are likely to limit flammulated owl populations are availability of nest cavities and prey availability/foraging habitat; preferred species are beetles, grasshoppers, and moths (McCallum 1994a). Nesting territory occupancy has been highly correlated with high percentages of old growth ponderosa pine and Douglas-fir (Linkhart and Reynolds 1997). In other areas, nesting territories were highly correlated with aspen stands (Marti 1997).

Threats to this species are mostly from habitat modifications such as timber or fuel wood removal and fire suppression (McCallum 1994b). Snag and other dead timber removal such as sawtimber and fuelwood will reduce available habitat.

Flammulated owls have not been documented on the Big Piney Ranger District, but no survey work has been done. Although no surveys have been done, they are suspected to occur within the analysis area. Forest Plan snag management guidelines should be followed to minimize potential impacts to this species. Douglas-fir and aspen stands in the project area are proposed for treatment.

Great Gray Owl

This species has been documented in the analysis area (Wyoming Natural Diversity Database 2004). In the adjacent Greys River drainage, great gray owls were mainly found between 6500 and 7800 feet 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 used 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 used for nesting. Great gray owls are likely present in the analysis area.

Northern goshawk

In the 1980s this species was documented in the analysis area but recent surveys have not found it (Wyoming Natural Diversity Database 2004). Goshawks tend to select stands with relatively large-diameter trees and high canopy closure for nesting (Siders and Kennedy, Daw et al.1998 in Forest Service 2003e). 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, Forest Service unpublished data). Goshawks selected moderate slopes (1 to 34 percent) for nesting, but showed no preference for aspect (Squires and Ruggiero 1996). 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 (for example, red squirrels, snowshoe hares) and birds (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 analysis area. Minimal survey work has occurred for northern goshawks.

Three-Toed Woodpecker

This species has been documented in the analysis area (Wyoming Natural Diversity Database 2004). These woodpeckers require snags in coniferous forests for nesting, feeding, perching, and roosting. In Wyoming forests, the three-toed woodpecker is only found in large, unbroken stands of mature spruce-fir and lodgepole pine. Snags with DBH of 12 to 16 inches and heights of 19.6 to 39.4 feet are preferred (Forest Service 1991 in Forest Service 2003e). This woodpecker forages on insects (primarily bark beetles), 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 Greater Yellowstone Ecosystem, Hoffman (1997) found that three-toed woodpeckers preferred to nest in moist, coniferous forests in relatively gentle terrain. Minimal survey work has occurred for three-toed woodpeckers, but they are known to be present within the analysis area.

3.6.3.3 Management Indicator Species

Management indicator species (MIS) are specific species chosen to indicate the effects of habitat changes associated with forest management activities (Bridger-Teton Land and Resource Management Plan 1990). MIS are considered to be key species that represent a set of life forms or habitat requirements similar to other groups. They are species for which populations and habitat objectives can be established so they can be tracked as indicators of habitat capability. In this way, they can be used to assess ecological conditions and trends after management changes. Species with narrow ecological tolerance to environmental changes in a given environment (either positive or negative) make the best indicators of environmental conditions and are most useful at evaluating the health of the ecosystems. MIS include harvested species, ecological indicator species, Forest Service sensitive species, and federally listed threatened and endangered species.

MIS Plant Species

The Bridger-Teton National Forest has chosen six plant species for the MIS list (Table 3-30). Under the Forest Plan these species are indicators of vegetative diversity that can support a range of both native plant communities and varied wildlife habitats. All but one of these species are also listed as Forest Service sensitive species for Region 4 (see the following subsection). These MIS are all indicators of satisfactory conditions across different types of habitats and different vegetation succession stages. None of these are indicators of unsatisfactory conditions, although some are indicators of early succession, which indicates a dependence on some type of disturbance regime. Shultz's milkvetch occurs within the analysis area but not within treatment areas. It will be dropped from further analysis. Payson's milkvetch is an early succession indicator species. It occurs within the analysis area and may occur within treatment areas. It is the only MIS plant species analyzed for this EIS. It is also listed as a Forest Service Region 4

sensitive species, so detailed analysis for Payson's milkvetch was provided in *Section 3.6.3.2, Forest Service Sensitive Species* under Sensitive Plant Species.

TABLE 3-30
Plant Management Indicator Species on the Bridger-Teton National Forest with Habitat Description

Common Name	Scientific Name	Occurs in Project Area	Habitat
Sweet-flowered rock jasmine	*Androsace chamaejasme* ssp. *carinata* (*A. lehmanniana*)	No	Montane rock crevices and rocky soils derived from limestone or dolomite. May occur in clearings or beneath shrub cover in leaf litter. Mid to late succession.
Payson's milkvetch	*Astragalus paysonii*	Yes	Disturbed areas and recovering burns, clear cuts, and road cuts on sandy soils with low cover of herbs and grasses. Early succession.
Shultz's milkvetch	*Astragalus shultziorum* (*Astragalus molybdenus*)	Yes	Steep, rocky, sparsely-vegetated slopes and stony hilltops above timberline. Usually on limestone soils.
Wyoming tansymustard	*Descurainia torulosa*	No	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone. Early to mid succession.
Boreal draba	*Draba borealis*	No	Moist, north-facing limestone slopes and cliffs and along shady streambanks. Mid succession.
Weber's saw-wort	*Saussurea weberi*	No	Alpine talus and gravel fields, often on limestone.

MIS Fish Species

The Bridger-Teton National Forest MIS lists two species of fish: Colorado River cutthroat trout (*Oncorhynchus mykiss*) and rainbow trout. However, rainbow trout are a non-native introduced species within the Green River system (Trotter 1987) so the focus of this analysis is on CRCT. Further, CRCT are designated as a species of special status by the states of Colorado, Utah, and Wyoming and are classified as a sensitive species by Region 2 and 4 of the Forest Service (CRCT Task Force 2001).

CRCT were historically distributed throughout the headwaters of the Green and Colorado Rivers as far south as the San Juan River; they perhaps occupied portions of the lower reaches of large rivers in winter (Trotter 1987). They are currently limited to a few small headwater streams of the Green and upper Colorado Rivers in Colorado, Utah, and Wyoming. In Wyoming it is estimated that only 70 populations of CRCT remain and they occupy less than 280 miles of streams (CRCT Task Force 2001). CRCT population decline is related to hybridization with introduced rainbow trout, displacement by introduced brook trout, competition with other established populations of non-native salmonids, and habitat alteration/fragmentation from overgrazing by livestock, logging, roads, and water diversion for irrigation (CRCT Task Force 2001).

The WGFD has assigned the North Cottonwood Creek watershed as its third highest priority conservation population of CRCT within the Pinedale Region, with particular habitat concerns for stream, riparian, and aspen-beaver habitat alterations (WGFD 2003a). Several tributaries (Sjhoberg, Nylander, Maki, Irene, Hardin, and Ole Creeks) within the North Cottonwood Creek watershed provide important spawning and rearing habitat. WGFD has constructed several barriers within the North Cottonwood Creek drainage to prevent hybridization and competition with CRCT (WGFD 2003a).

CRCT seem to have adapted better to small streams, lakes, and ponds rather than large rivers. They tend to be most abundant in higher elevation streams with cobble-boulder substrates. They prefer cold, clean waters and can be found in higher gradient (> 4 percent) streams. A good balance of pools to riffles is important to CRCT persistence and the species appears to be well adapted to conditions created by active beaver colonies (Trotter 1987). Behnke (2002) supports the previous description by stating that habitat for CRCT generally include cool, clear streams (often headwaters), well-vegetated streambanks for cover and bank stability, and instream cover in the form of deep pools, boulders, and logs.

MIS Wildlife Species

MIS wildlife species are listed in Table 3-31 and occurrences are shown. The existing conditions and status of most of these species were discussed in previous sections of this EIS. The last column of the table and the footnotes indicate where previous discussions of existing conditions can be found. This column also indicates if the species has been dropped from further analysis because neither the species nor suitable habitat occur in the analysis area.

TABLE 3-31
Wildlife Management Indicator Species on the Bridger-Teton National Forest

Species	Scientific Name	Preferred Habitat	Occurs or Likely Occurs in Habitats Affected Within the Analysis Area	Dropped from Further Analysis
Grizzly bear	*Ursus arctos*	Forests and meadows	Possible	No[a]
Bald eagle	*Haliaeetus leucocephalus*	Lakes and marshes	Possible	No[a]
Elk	*Cervus elaphus*	Coniferous forest, aspen and meadows	Yes	No[b]
Mule deer	*Odocoileus hemionus*	Coniferous forest, aspen and meadows	Yes	No[b]
Moose	*Alces alces*	Coniferous forest, riparian, and wetlands	Yes	No[b]

TABLE 3-31
Wildlife Management Indicator Species on the Bridger-Teton National Forest

Species	Scientific Name	Preferred Habitat	Occurs or Likely Occurs in Habitats Affected Within the Analysis Area	Dropped from Further Analysis
Bighorn sheep	*Ovis canadensis*	Cliffs, mountainous areas, and meadows	No	Yes
Pronghorn	*Antilocapra americana*	Treeless areas, prairie, and sagebrush	No	Yes[b]
American marten	*Martes americana*	Mature coniferous forests, old growth	No	No (discussed below)
Brewer's sparrow	*Spizella breweri*	Sagebrush, willows, and prairie	Yes	Yes (see following text)

[a] See Section 3.6.3.1 for a description of existing conditions for this species
[b] See Section 3.2.3.2 for a description of existing conditions for this species

MIS are restricted to specific habitat or key habitat because it provides important life requirements. Impacts to most MIS species listed on Table 3-31 above are discussed in other sections.

Brewer's Sparrows

Brewer's sparrows inhabit sagebrush communities within the analysis area. Sagebrush habitat will not be affected by the treatments. Therefore, this species is dropped from further analysis.

American Marten

American martens inhabit old-growth forests. Figure 3-4, based on Wyoming GAP analysis data, indicates that suitable habitat for martens exists within the analysis area and within treatment areas. Pine martens are dependent on structural diversity associated with late successional or mature forest stands for denning, resting, foraging habitat, thermal and escape cover, as well as gaining access to subnivean sites for resting and foraging during winter. They have undergone major reductions in distribution in the western U.S. because of habitat fragmentation resulting from timber harvest (Buskirk and Ruggiero 1994).

3.6.4 Desired Future Conditions

The following management prescriptions generally relate to wildlife habitat conditions and wildlife disturbance rather than directly to Special Status Species because there are no specific prescriptions for Special Status Species.

3.6.4.1 Management Prescription 1B

Fisheries and Wildlife Prescription—Habitat is provided for existing populations of game and fish, but hunter-success and recreation-day objectives identified by the Wyoming Game and Fish Department may decrease. A use-attainability study may be needed for a specific stream segment to determine if fishery-beneficial use is being protected to an adequate level.

3.6.4.2 Management Prescription 10

Fisheries and Wildlife Prescription—Groups of species are emphasized, such as early- or late-succession-dependent species, in order to increase species richness or diversity. Habitat is managed to achieve the game and fish populations, harvest levels, success, and recreation-day objectives identified by the Wyoming Game and Fish Department and agreed to by the Forest Service.

Management Activity Guideline. All management activities should be concentrated to within the shortest period of time and to the smallest possible area at a time.

Dead and Down Large Woody Material Guideline. Dead-and-down spruce and fir material should be retained on logged sites to provide wildlife habitat.

Dead and Down Large Woody Material Standard. Where available on site, four or more decomposition Class 1 and 2 logs will be retained per acre on logged sites. Down logs will be at least 12 inches in diameter at the large end and 20 feet in length. Two or more brush piles about 10 feet across and 7 feet high per acre may be retained. Dead-and-down woody material will not exceed an average depth of 18 inches. An average of 2 dead or cull-leaning trees per acre during the mature stage will be sought. To be acceptable, leaning trees will be greater than 8 inches in diameter and 40 feet in length, and will be lodged in adjacent trees.

Created Opening Guideline. Created forest openings may adjoin meadows if no more than one-fifth of the periphery of the meadow edge is affected. Size, shape, and arrangement of created openings should vary to fit naturally into existing landscapes. Created openings should not exceed 1200 feet in width unless site-specific analysis identifies the need for larger openings for wildlife habitat management purposes. Created openings should be interspersed with cover patches at least 60 acres in size.

3.6.5 Environmental Consequences

3.6.5.1 Forest Service Sensitive and MIS Plant Species

The only Forest Service sensitive species or MIS that occur within the project analysis area is Payson's milkvetch. Environmental consequences to Payson's milkvetch are discussed in detail in the following section of this EIS.

Alternative A – (No Action)

Under this alternative, no action would take place. There would be no vegetation management to regenerate aspen stands and no action to improve roads and trails.

Direct Impacts

There are unlikely to be any direct effects to any MIS or Forest Service sensitive species under this alternative. The only species with habitat in potential treatment areas is Payson's milkvetch and the No Action Alternative would have no direct impacts to this species.

Indirect Impacts

Indirect effects may occur to Payson's milkvetch under this alternative. As discussed above, Payson's milkvetch is a species that requires occasional disturbance to survive long-term. The No Action Alternative would allow succession to proceed. Lack of management action is likely to indirectly contribute to the decline in Payson's milkvetch over time.

Cumulative Impacts

No cumulative effects are expected to occur to MIS or Forest Service sensitive plant species under this alternative.

Alternative B – (Proposed Action)

Under this alternative, 1,041 acres of coniferous forest would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct Impacts

The only MIS or Forest Service sensitive plant species that is likely to be affected by this alternative is Payson's milkvetch because it occurs in habitat that is likely to undergo treatment under the Proposed Action. Crushing by logging or road construction equipment is extremely unlikely, but possible under this alternative. No research data on the direct effects of fire to this species are available, but Payson's milkvetch is a perennial species with a deep taproot. In general, perennial plants with deep taproots can tolerate occasional fires, particularly if they are dormant at the time of the burn. Although it is possible that treatment could disturb some occurrences of this species, it is a species adapted to disturbance and early succession. Because of this, it should suffer no long term negative impacts from treatments proposed under this alternative. Therefore, although direct effects to the MIS and Forest Service sensitive plant Payson's milkvetch are likely to be greater under this alternative than under the No Action Alternative or Alternative C, these impacts are likely to be of limited extent and short duration.

Indirect Impacts

Indirect impacts to Payson's milkvetch are likely to be positive under the Proposed Action because treatments would set succession back to early status in some areas and open up areas for this milkvetch to colonize. Indirect impacts to Payson's milkvetch are

likely to be more positive under the Proposed Action compared to the No Action Alternative or Alternative C.

Cumulative Impacts

No cumulative effects are expected to occur to MIS or Forest Service sensitive plant species under the Proposed Action.

Alternative C – (Reduced Harvest and Temporary Roads)

Under this alternative, 974 acres of coniferous forests would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct Impacts

Direct impacts from logging and mechanical treatment would be less than under the Proposed Action because fewer acres of coniferous forest would undergo these treatments. Possible impacts to Payson's milkvetch from burning to regenerate aspen stands that may occur in or near this milkvetch would be the same as under the Proposed Action, but less than under the No Action Alternative.

Indirect Impacts

Alternative C would treat less forest lands through several types of harvest methods, so there would be less indirect beneficial impacts to habitat improvement for Payson's milkvetch. Other indirect beneficial impacts would be the same as under the Proposed Action. There would be less beneficial indirect beneficial impacts to Payson's milkvetch habitat improvement under this alternative than under the No Action Alternative.

Cumulative Impacts

No cumulative effects are expected to occur to MIS or Forest Service sensitive plant species under this alternative.

3.6.5.2 Federally Listed Wildlife Species

Alternative A – (No Action)

Under this alternative, no action would take place. There would be no vegetation management to regenerate aspen stands and no action to improve roads and trails.

Direct Impacts

There are unlikely to be any direct impacts to any federally listed threatened, endangered, or candidate species under this alternative. The No Action Alternative would have no direct impacts to this species.

Indirect Impacts

Indirect impacts to bald eagles, grizzly bears, gray wolves, and yellow-billed cuckoos are unlikely under this alternative. Indirect effects may occur to Canada lynx under this alternative. As discussed above, lynx need snowshoe hares in order to survive the winter.

Snowshoe hairs need mixed age aspen, particularly young aspen stems to survive. The No Action Alternative would mean that conifer encroachment into aspen stands and decadent aspen stands would continue to decline. Lack of management action is likely to indirectly contribute to the decline in Canada lynx over time. DFCs for Canada lynx would not be met under this alternative.

Cumulative Impacts

No cumulative effects are expected to occur to federally listed species under this alternative.

Alternative B – (Proposed Action)

Under this alternative, 1,041 acres of coniferous forest would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct Impacts

During implementation of treatment to 1,041 acres of forest lands and to the 1,058 acres of aspen stands, grizzly bear, gray wolf, and Canada lynx may be disturbed. No research data on the direct effects of fire to these species are available, but they are likely to at least temporarily move out of the treatment areas if they are present. Because of the slightly larger treatment areas, potential direct disturbance impacts are likely to be somewhat greater under this alternative than under Alternative C. Any disturbance impacts are expected to be of limited extent and short duration.

Bald Eagle. There are no known bald eagle nests or sightings within the analysis area. Therefore, it is very unlikely that there would be any direct or indirect impacts on bald eagles.

Gray Wolf. The proposed vegetation treatments have the potential for incidental effects on dispersing transient wolves and their prey base. Because the project analysis area is not currently known to support a wolf pack, the proposed vegetation treatments and associated activities would not directly affect wolf recovery. Sufficient suitable security areas are present for wolves and big game.

Grizzly Bear. Grizzly bears may be present in the analysis area. Given the relatively small area that would be treated compared to the extent of grizzly bear habitat in the eastern Greater Yellowstone Ecosystem, it is unlikely that there would be any adverse population level effects. The only possible exception would be if a grizzly bear encounter during treatment activities resulted in a bear being killed. Although the likelihood of an encounter resulting in a bear death is low, this would be a significant adverse effect if it occurred. Individual bears or sows with cubs could be disturbed during treatment activities and be forced to move to nearby areas of similar habitat. Where grizzly bears occur, timber harvest and prescribed burning affect grizzly bears directly by altering the forest cover and displacement caused by human activities.

Yellow-billed Cuckoo. No suitable yellow-billed cuckoo habitat would be treated and there would be no adverse direct or indirect effects on this species.

Canada Lynx. There is some slight potential for displacement effect during project implementation. It is "slight" because of the very low population density of Canada lynx in the area of effect. Because of the small size and scattered locations of the treatment areas, any displacement effect would likely be incidental rather than chronic, and seasonal rather than year-round. Logging and hauling operations would start only after roads firm up in late spring and end prior to the need for snowplowing. The likelihood of a lynx being struck by logging related traffic is too slight to be a logical concern because few lynx are present in the treatment areas. In addition, the traffic patterns are very slow because of the condition of the roads and trails.

Slash treatments would for the most part involve a mix of piling and burning and broadcast burning. If there are any slash piles to be burned, such as accumulations at log landings, it would be done during the period of snow cover. This would avoid any risk of disturbing natal dens, although the likelihood of any being established in new slash piles is low. Current practice is to select and retain some slash piles with coarse woody structure for wildlife cover. As tree regeneration and overhead cover develop, potential for denning would increase, especially if there is a positive snowshoe hare response to treatments in the vicinity.

Although timber harvest and prescribed burning would result in a temporary reduction in snowshoe hare habitat, the effect would be slight. The harvest units are widely scattered and the snowshoe hare habitat that would be affected is not very productive in its current condition.

Indirect Impacts

Indirect impacts to federally listed wildlife include impacts to habitat values. These impacts are likely to be negative in the short-term for areas scheduled for prescribed burns, but over the long term, impacts to habitat values would likely be positive under this alternative because treatments would set succession back to early status in some areas and open up areas for these species. There would be no indirect impacts on bald eagles or yellow-billed cuckoos or their habitat. The effects determinations for the bald eagle and yellow-billed cuckoo are both "no effect".

Grizzly Bear. Habitat modification through timber harvest and prescribed burning indirectly impact grizzly bears by disturbing their social systems and reducing their foraging efficiency. The short-term increase in herbaceous growth might benefit grizzly bears by providing more early season forage a few years following treatment. The effects determination for grizzly bears is "may affect, not likely to adversely affect".

Gray Wolf. Vegetation treatment may lead to increases in big game populations. Wolf packs may establish in the area if game populations increase and if security areas remain available for protection of pups. The Proposed Action effects determination is "not likely to jeopardize the continued existence of the species or result in destruction or adverse modification of proposed critical habitat" of the gray wolf experimental population in the Greater Yellowstone Ecosystem. The analysis area does not support a wolf pack yet, and sufficient security areas are available for wolves and their prey. Any effects are expected to be incidental.

Canada Lynx. Additional details regarding the assessment of potential impacts on Canada lynx will be included in the Biological Assessment.

Treatments would be particularly beneficial for Canada lynx because management treatments for aspen would provide needed habitat for snowshoe hares, the main prey of lynx. Higher quality habitat for snowshoe hares means lynx in the area are more likely to survive the winter.

The proposed project would result in no change in the permanent road system or designated over-snow routes. Proposed clear cut treatments would occur in 46 scattered small units of 2 to 27 acres. There would be some short, temporary skid trails employed, but access would be over the existing road system. Skid trails would be closed and treated as needed to allow natural re-vegetation. In regards to habitat effectiveness, there would be no substantial alterations affecting potential for habitual presence of humans or competing predators.

Possible denning structure occurs only incidentally or not at all in the stands affected. These lodgepole pine and aspen stands generally occur within larger areas of the same forest types. If there is potential for denning in the vicinity, it would most likely occur in other stands that have a substantial spruce/subalpine fir and coarse woody debris components. Potential for proposed harvest activities to indirectly affect denning is very slight.

Short-term effects would be limited to possible incidental disturbance or displacement of individual lynx as a result of harvest activities and reduction of overhead cover. Harvest activities would occur in relatively small, scattered units, so the time period of disturbance at any location would be of relatively short duration. The effects determination for the Canada lynx is “may affect, not likely to adversely affect”.

Cumulative Impacts

Present. No active timber sales exist in the Maki or Cottonwood Creek drainages. Drainages. Noxious weed prevention and control is an on-going effort in Sublette County. As such, weed control efforts are likely to maintain or improve habitat over time for federally listed species addressed here. The Hoback Ranches Fire Plan, the Lower Valley Energy Natural Gas Pipeline, and the Monument Ridge Prescribed Burn projects are all located on the Big Piney Ranger District. They are approximately 20 miles north of the project area. These projects are not likely to contribute to adverse affects on any federally listed species for the project under analysis or to habitat within the project area.

The Maki Creek Vegetation Treatment and Wyopming Range (Taliaferro) Grazing Allotment Complex projects are adjacent to the proposed project. The Maki Creek Vegetation Treatment is similar to the current proposed treatment and would be expected to have similar impacts to those listed above for federally listed species. The Taliaferro Grazing project addresses the continuation of current grazing and would be expected to have no additional impacts. Neither of these are likely to contribute to adverse affects on any federally listed species for the project under analysis or to habitat within the project area.

Reasonably Foreseeable. Cumulative effects may be associated with the future harvest of timber in the North and South Cottonwood Creeks. Timber harvest would be within opportunity areas identified as part of the interdisciplinary CPIS and within areas identified in the Forest Plan as suitable. None of the planned harvests would exceed created opening standards. Any timber harvest would comply with silvicultural and reforestation standards. Together they are likely to constitute a relatively small portion of suitable habitat for these species.

Alternative C – (Reduced Harvest and Temporary Roads)

Under this alternative, 974 acres of coniferous forests would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct Impacts

Direct impacts of disturbance and displacement of federal species during logging and mechanical treatment would be somewhat less than under the Proposed Action because fewer acres of coniferous forest would undergo these treatments. Possible impacts to listed species from burning to regenerate aspen stands would be the same as under the Proposed Action, but less than under the No Action Alternative.

Indirect Impacts

Alternative C would treat slightly less forest lands through several types of harvest methods than the Proposed Action, so there would be less indirect beneficial impacts to habitat improvement for listed species. Beneficial impacts to Canada lynx from habitat improvement for snowshoe hares habitat in aspen stands would be the same. Other indirect impacts would be roughly the same as under the Proposed Action. There would be fewer long-term indirect beneficial impacts from habitat improvement under this alternative than under the Proposed Action. Short-term negative impacts to habitat would be slightly less severe than under the Proposed Action but more than under the No Action Alternative.

Cumulative Impacts

Present and reasonably foreseeable future cumulative impacts on grizzly bears, gray wolves, and Canada lynx under Alternative C would be similar to cumulative effects described for the Proposed Action.

3.6.5.3 Forest Service Sensitive Wildlife Species

Alternative A – (No Action)

Under this alternative, no action would take place. There would be no vegetation management to regenerate aspen stands and no action to improve roads and trails. There would be no direct, indirect, or cumulative impacts on sensitive wildlife species.

Alternative B – (Proposed Action)

Under this alternative 1,041 acres of coniferous forest would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct Impacts

Spotted Frog. A section of Nylander Creek would be moved out of the riparian zone as part of the proposed project. Sediment produced during this removal may impact spotted frogs if they inhabit downstream areas. This impact would be of relatively short duration. New suitable habitat might be created as the stream is rehabilitated following road removal.

Boreal Owl. Boreal owl habitat in aspen forests would be directly affected by the proposed treatments, resulting in habitat loss. The relatively small size of the treatment areas relative to other available habitat should limit potential impacts to a few individual owls rather than at the population level.

Flammulated Owl. Flammulated owl habitat in aspen forests would be directly affected by the proposed treatments, resulting in habitat loss. The relatively small size of the treatment areas relative to other available habitat should limit potential impacts to a few individual owls rather than at the population level.

Great Gray Owl. While there are no documented sightings of great gray owls in the Big Piney Ranger District, suitable habitat is apparently present throughout the analysis area. The Maki EA (Forest Service 2004b) notes that any removal of timber reduces potential nesting sites and foraging habitat for this species. While substantial areas of similar suitable habitat likely exist in the analysis area, some habitat loss would occur. Therefore, while it is likely that this habitat loss would affect individual birds or pairs, no adverse effects at the population level would be expected.

Northern Goshawk. Suitable, but apparently unoccupied, goshawk nest sites within aspen and conifer stands would likely be lost as a result of the proposed treatments. The Maki EA (Forest Service 2004b) notes that any removal of timber reduces potential nesting sites and foraging habitat for this species. While substantial areas of similar suitable habitat likely exist in the analysis area some habitat loss would occur. Therefore, while it is likely that this habitat loss would affect individual birds or pairs, no adverse effects at the population level would be expected.

Three-Toed Woodpecker. Habitat for this species is apparently widespread within the analysis area, including many of the treatment sites. The treatments would remove a relatively small proportion of this habitat from the analysis area.

Indirect Impacts

Except for the spotted frog, any of the other sensitive species that happen to be present in or near treatment areas would be disturbed by human activity and displaced from the immediate area around treated sites.

Spotted Frog. Temporary roads, timber harvest, and prescribed burns would all result in short-term increases in water temperature and sediment. Spotted frogs are present in

drainages downstream of treatment sites. Both of these factors could lead to degraded spotted frog habitat and reduced productivity for a period of 1 to 5 years following treatment.

Boreal Owl. No other indirect impacts are expected. As a secondary cavity nester, boreal owls may benefit if additional large diameter snags are created by the prescribed burns.

Flammulated Owl. Indirect effects would be similar to those described for boreal owls. The creation of smaller openings and thinned conifer stands may benefit foraging flammulated owls.

Great Gray Owl. No additional indirect effects are expected.

Northern Goshawk. No additional indirect effects are expected.

Three-Toed Woodpecker. No additional indirect effects are expected.

Cumulative Impacts

Present. There are no active timber sales on the Maki or Cottonwood Creeks drainages. Noxious weed prevention and control is an on-going effort in Sublette County, but is likely to maintain or improve habitat over time for species addressed here. The Hoback Ranches Fire Plan, the Lower Valley Energy Natural Gas Pipeline, and the Monument Ridge Prescribed Burn projects are all located on the Big Piney Ranger District. They are approximately 20 miles north of the project area. These projects are unlikely to adversely affect any sensitive species on this project area.

The Maki Creek Vegetation Treatment and Wyoming Range (Taliaferro) Grazing Allotment Complex projects are adjacent to the proposed project. The Maki Creek Vegetation Treatment is similar to the current proposed treatment and would be expected to have similar impacts to those listed above for sensitive species. The Taliaferro Grazing project is continuation of current grazing and would be expected to have no additional impacts. Together they constitute a relatively small portion of suitable habitat for these species.

Reasonably Foreseeable. Cumulative effects may be associated with the future harvest of timber in the North and South Cottonwood Creeks. Timber harvest would be within opportunity areas identified as part of the interdisciplinary CPIS and within areas identified in the Forest Plan as suitable. None of the planned harvests would exceed created opening standards. Any timber harvest would comply with silvicultural and reforestation standards. Together they are likely to constitute a relatively small portion of suitable habitat for these species.

Sensitive Species Conclusion. The conclusion for all sensitive species discussed above is that the proposed activities “may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to population or species.”

Alternative C – (Reduced Harvest and Temporary Roads)

Under this alternative, 974 acres of coniferous forests would be treated and 1,058 acres of aspen would be prescribe burned to regenerate aspen stands.

Direct, Indirect, and Cumulative Impacts

Direct, indirect, and cumulative impacts on sensitive species would be very similar, though slightly less than those of the Proposed Action because of the slightly smaller treatment area.

Sensitive Species Conclusion. The conclusion for all sensitive species would be the same as for the Proposed Action.

3.6.5.4 Wildlife and Fish Management Indicator Species (MIS)

Individual species are considered in other sections of this EIS and those analyses are not repeated here. Direct and indirect effects on bald eagle and grizzly bear were discussed in the previous threatened and endangered species section. Direct, indirect, and cumulative effects on elk, mule deer, and moose were discussed in Section 3.2.5. Other wildlife MIS would not be impacted, as previously indicated. Direct, indirect and cumulative effects on Colorado River cutthroat trout were discussed in Section 3.5.5.

3.7 Roads and Transportation

3.7.1 Introduction

All significant issues identified in Section 1.9.1 and listed in Table 1-1 of this EIS depend to some degree on the design, location, and number of roads in the analysis area. Roads are important in achieving management objectives and many of the management activities in the analysis area require roads. Users of the transportation system include administrative, commercial, and recreational users. Commercial users include timber harvesters, outfitters, and firewood collectors. Hikers, horse riders, anglers, and hunters are the major recreational user groups.

Improving or rehabilitating roads would reduce sedimentation and improve water quality (Issue 4). The density, use, and location of roads also affect wildlife habitat and habitat for Colorado River cutthroat trout (CRCT) and other aquatic organisms (Issues 1, 2, and 3). Most roads are accessible to high-clearance vehicles, but some are closed during certain times of the year. Road closures are to protect wildlife habitat, preserve the road surface, protect water quality, and provide non-motorized recreation opportunities. There are 26 miles of open classified roads and 25 miles of restrictive access classified roads in the analysis area. All roads are gated where access changes.

No new roads would be constructed, therefore the Roads and Transportation analyses will focus on three areas: 1) roadless areas, 2) temporary roads, and 3) replacement of two bridges and replacement of one culvert with a bridge. Although part of the road system, replacement of the eleven remaining culverts is addressed in *Section 3.4 Fisheries*. The

relocation of a portion of Nylander Road from the riparian area to uplands is addressed in *Sections 3.3.5.2 Hydrology* and *3.3.5.3 Water Quality*.

3.7.2 Existing Conditions

3.7.2.1 Roadless Areas

On July 16, 2004, the Chief of the Forest Service issued an Interim Directive on roadless areas (Interim Directive No. 1920-2004-1). The new policy states:

> "Inventoried roadless areas contain important environmental values that warrant protection. Accordingly, until a forest-scale roads analysis (FSM 7712.13b) is completed and incorporated into a forest plan, inventoried roadless areas shall, as a general rule, be managed to preserve their roadless characteristics. However, where a line officer determines that an exception may be warranted, the decision to approve a road management activity or timber harvest in these areas is reserved to the Chief or the Regional Forester as provided in FSM 1925.04a and 1925.04b. On a project-specific basis, the Chief, for good cause, may grant exceptions to the reservations of authority set out in this interim directive, upon the written request of a Regional Forester or Forest Supervisor."

An Inventoried Roadless Area is defined in the new directive as "Those areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters of the Forest Service, or any update, correction, or revision of those maps."

There are three inventoried Roadless Areas in the treatment areas.

3.7.2.2 Temporary Roads

Temporary roads are required to access certain areas identified for vegetation management that do not have adequate access on existing roads. All temporary roads are restored to their pre-disturbance contours and revegetated with native vegetation comparable to existing vegetation types. Temporary roads are constructed in such a manner to comply with R1/R4 Soil Management Practices (Forest Service 1988).

3.7.2.3 Bridge Crossings

As shown Figure 2-2, two bridges would be replaced and one culvert would be replaced with a bridge. These actions would occur on North Cottonwood Road (#10125) and include the bridges over Ole Creek and North Cottonwood Creek and the culvert crossing at upper North Cottonwood Creek.

The bridge over Ole Creek is designed to provide fish passage, which would be maintained after replacement. Wing walls to channel water through the bridge would be included in the design, because road material is currently being pushed into the creek when bladed. The addition of sediment to drainages is detrimental to the survival of CRCT and other aquatic organisms. The replacement bridge would be wide enough to

provide for snowmobile grooming equipment, as this is part of the groomed snowmobile trail system.

The bridge over North Cottonwood Creek has also been designed to promote fish passage. The existing bridge would be replaced with a wider bridge to accommodate snowmobile trail grooming equipment. Fish passage would continue to be provided. A new over-flow culvert would be installed under the road about 100 feet upstream of the bridge to provide an outlet for waters being backed-up because of beaver activity.

The culvert in upper North Cottonwood Creek would be replaced with a bridge to reduce sediment input into the stream during blading. Wing walls to channel water through the bridge would be included in the design. The new bridge would be wider to accommodate snowmobile trail grooming equipment.

3.7.3 Desired Future Conditions

The DFC in inventoried roadless areas is to manage them to preserve their roadless characteristics, unless the Chief or the Regional Forester recommends that an exception is warranted. No exception has been recommended for the proposed project. DFCs do not exist for temporary roads and bridges, but there are DFCs related to recreation and habitat. Recreation and fish habitat require clean water, which indirectly indicates that temporary roads and stream crossings should not contribute to the sediment load in streams.

3.7.4 Environmental Consequences

3.7.4.1 Roadless Areas

There would be no direct, indirect, or cumulative impacts to roadless character of inventoried roadless areas from any alternative, as there are no proposed treatments, other than some prescribed fire, nor road building in inventoried roadless areas or synergistic effects with other identified projects in the area.

3.7.4.2 Temporary Roads

Alternative A – No Action

There would be no direct, indirect, or cumulative impacts from temporary roads, as there would be no temporary roads constructed with this alternative.

Alternative B – Proposed Action

Direct Impacts

The construction of 13.8 miles of temporary road has the potential to contribute small amounts of sediment into streams when they are located up slope of the stream or where they cross a stream. Application of R1/R4 soil management measures (Forest Service 1988) and Wyoming BMPs would prevent significant quantities of sediment from

entering streams. Temporary roads would be restored to the original contour and vegetation type after vegetation management activities supported by a particular temporary road are completed. Therefore, any impact would be short-term.

Indirect Impacts

There would be no indirect impacts, because implementation of erosion control measures and eventual restoration of the temporary roadway would prevent sediment from entering streams.

Cumulative Impacts

There would be no cumulative impacts from implementation of this alternative.

Alternative C – Reduced Harvest and Temporary Roads

Alternative C would have 9.3 miles of temporary road constructed to support project activities. All temporary roads would be restored to the original contour and vegetation type. Direct impacts as discussed for Alternative B, the Proposed Action, would also occur with this alternative, however, the impact would be less as there are fewer miles of temporary roads being constructed. Indirect and cumulative impacts (none of either) would be the same as described above for the Proposed Action.

3.7.4.3 Bridge Crossings

Alternative A – No Action

No bridge improvements would be implemented under the No Action Alternative. Sediment would continue to enter Ole and North Cottonwood Creeks from road maintenance activities. Snowmobile groomers would continue to have difficulty crossing the existing bridges.

Alternative B – Proposed Action

Direct Impacts

Direct impacts associated with bridge replacement or construction include disruption of traffic and potential sediment deposition into the stream during and immediately after construction. North Cottonwood Road (#10125) would be closed for during construction, and recreation and commercial users desiring to conduct activities in the upper North Cottonwood Creek drainage would not be able to do so. All R1/R4 soil management measures recommended for bridge construction would be followed (Forest Service 1988), as would Wyoming BMPs. No construction activities would occur directly in the stream. Erosion control measures such as silt fencing, sediment catchments, and in-stream sediment barriers would be employed to protect aquatic habitat. Even with precautions however, some minor amount of sediment may enter the stream during and immediately after construction. The small quantities involved would not likely result in adverse impacts to aquatic organisms. Native riparian vegetation would be established on all bare slopes as soon as construction activities allow.

The long-term benefits of keeping maintenance-derived sediment from entering the stream and providing for more efficient snow-grooming would outweigh the minimal short-term impacts from the Proposed Action.

Indirect Impacts

Indirect impacts would be beneficial and include removal of a stream-sediment source at each bridge crossing and improved maintenance of the snowmobile system.

Cumulative Impacts

Removal of three sources of sediment into North Cottonwood Creek would give the stream greater capacity to absorb sediment from other sources until those sources can be removed, also.

Alternative C – Reduced Harvest and Temporary Roads

All direct, indirect, and cumulative impacts would be the same as described for Alternative B, the Proposed Action.

3.8 Heritage Resources

3.8.1 Introduction

Prehistoric sites, historic sites, and traditional cultural properties (TCP) are examples of heritage resources. The Forest Services's Heritage Resource Project, Site Atlas, historic files, and survey data were reviewed for the analysis area. A brief heritage resources history of the analysis area and an overview of the number of acres surveyed and the number and type of prehistoric and historic properties recorded is presented below. There were no significant issues or indicators identified for heritage resources during public scoping.

3.8.2 Existing Conditions

3.8.2.1 Prehistoric Period

Evidence of prehistoric use of the study area is limited. Previous archaeological investigations were project driven block inventories and are primarily undertaken in the more heavily forested and steeply sloped areas that generally do not contain concentrations of prehistoric materials. Archaeological evidence gathered from the Cottonwood Drainages and adjacent areas suggest that prehistoric inhabitants utilized the area for short-term events such as small temporary camps or specialized hunting and gathering areas. The Old Indian Trail, which shows up on some of the earliest maps for this area, is within the study area and was used in the past, possibly for centuries. Local long-time residents report that local Indians used the trail in the 1880s. Indians from the Wind River Reservation stated that the trail was used, in part, as a migration route to the Fort Hall Reservation. Seasonal migrations of Native Americans through the Green River Basin are also believed to have used the Old Indian Trail. Portions of the trail remain

visible today, however, much of it has been destroyed. It is believed that more prehistoric history will be documented as the less heavily wooded and more gently sloped drainage systems are inventoried (Forest Service 2002c).

3.8.2.2 Historic Period

The most significant historic event within the analysis area was the establishment of the tie hack industry in the early 1900s. Supplying railroad ties for the Union Pacific Railroad required vast quantities of lodgepole pine, and the forests in the Cottonwood drainages were an ideal location for this resource.

As early as 1914, the Wyoming National Forest (now part of the Bridger-Teton National Forest) began to conduct reconnaissance surveys in the Cottonwood drainages to assess how much timber was available, how marketable the timber was, and where the most productive stands were located. The Standard Timber Company was making plans to move into this area as early as 1915; however, the Union Pacific Railroad contracted for cheaper ties from Oregon, which forced the Standard Timber Company to abandon its plans. These plans were revitalized in 1917 when the price for lumber rose as a result of the war. In 1919, the Standard Timber Company began operations in the North and South Cottonwood Creeks with an estimated yield of over 2 million hewn ties, 39 million board feet of saw lumber and 12 million linear feet of mine props (Rosenberg 1990). Tie hack operations were to continue in the Cottonwood Creeks through the 1920s and into the 1930s. Gradually, the Standard Timber Company moved its operations north into the Horse Creek drainages.

The forested areas of the Cottonwood drainages continued to attract lumbermen from the Big Piney area. In 1950, two individuals were permitted by the Forest Service to operate sawmills the area. Walter Bird operated a couple of mills in South Cottonwood Creek, while Theodore Duthie operated mills in the Nylander Creek drainage—a tributary of North Cottonwood Creek. The presence of saw mills on National Forest lands resulted in large piles of milled lumber, or slash/saw dust piles.

The tie hack industry in the study area is considered a significant event in local history. This industry supported the development of the transportation network for the Forest that allowed greater access to this portion of the Wyoming Mountain Range (Forest Service 2002c). At the present time, the majority of the archaeological sites recorded in the study area are related to the logging industry of the historic period.

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 can be found at 36 CFR 800. Other legislation to be considered includes the Native American Graves Protection and Repatriation Act (NAGPRA) and the American Indian Religious Freedom Act (AIRFA). These laws protect American Indian access to religious sites and address treatment of Native American remains.

3.8.2.3 Heritage Resources

Prior to 2001, 1,826 acres had been surveyed within the Cottonwood II analysis area. Additional surveys in 2001, 2002, and 2003 for proposed treatment areas associated with this EIS inventoried an additional 1,649 acres for a total of 3,475 acres. Within the analysis area, a total of 27 sites have been identified, with 26 being historic and only one being prehistoric. The prehistoric site was determined to be not eligible for listing to the National Register of Historic Places (NRHP). In addition, only 2 isolated prehistoric artifacts have been located within the analysis area. One of the isolates was a Late Archaic projectile point (ca. 2000-3000 years b.p.). Almost all of the historic sites recorded in the analysis area are related to the tie hack industry with the exception of the Old Indian Trail. Of the 26 historic sites in the analysis area, 8 are considered eligible for the NRHP.

3.8.3 Desired Future Conditions

Continue the preservation and conservation management of Heritage Resources according to federal legislative guidelines and the FS management plan. Implementation of these guidelines would meet the desired future conditions.

3.8.4 Environmental Consequences

3.8.4.1 Alternative A -- No Action

Direct Impacts

There is no potential for direct impacts to heritage resources under the No Action Alternative. Management would continue as it has in the past. Cultural resources would be protected from loss of integrity and physical damage because of continuing ongoing resource management activities. Cultural resource sites would continue to be located and recorded, primarily in reaction to these resource management activities.

Indirect Impacts

There is no potential for indirect impacts to heritage resources under the No Action Alternative. If vegetation treatment projects are not implemented, then the increase in dead and dying trees and accumulation of fuels could lead to large stand replacing wildfires that could destroy the many historic tie hack cabins that are present throughout the North and South Cottonwood drainages.

Management would continue as it has in the past. Cultural resources would be protected from loss of integrity and physical damage resulting from continuing ongoing resource management activities.

Cumulative Impacts

There would be no cumulative impacts to heritage resources under this alternative.

3.8.4.2 Alternative B -- Proposed Action

Direct Impacts

Cultural resources would be protected from loss of integrity and physical damage resulting from undertaking resource management activities under the Proposed Action. Cultural resource sites would continue to be located and recorded, primarily in reaction to the proposed resource management activities. All of the historic sites eligible for the NRHP would be avoided by project related activities. The tie hack cabins on South Cottonwood Creek and Halverson Creek would be stabilized to protect their historic significance and interpretive value, through the use of Knutson–Vanderberg (KV) funds.

There is a potential for an adverse effect to the Old Indian Trail under the Proposed Action. Clear cutting on three units may result in a visual impact to the Old Indian Trail because these harvest units may be visible from the trail. Potential mitigation measures would have to be developed in consultation with the State Historic Preservation Office and American Indian Tribes in order to reduce or mitigate that impact.

Indirect Impacts

The Proposed Action may cause indirect impacts on cultural resources. Increased public use or activities in the analysis area because of the Proposed Action may result in increased damage to historic properties, such as the tie hack cabins. In addition, removal of vegetation through prescribed burns in the analysis area may expose and facilitate the discovery and removal of artifacts from sites that may not have been recorded.

Cumulative Impacts

No cumulative impacts on cultural resources in the analysis area are anticipated from the combined effects of the Proposed Action and the projects listed in Table 3-1. No impacts on heritage resources were identified in the Environmental Assessment for the proposed Maki Creek area projects, which are located adjacent to and north of the Cottonwood II project area.

3.8.4.3 Alternative C -- Reduced Harvest and Temporary Roads

Direct Impacts

Cultural resources would be protected from loss of integrity and physical damage resulting from undertaking resource management activities under Alternative C. Cultural resource sites would continue to be located and recorded, primarily in reaction to the proposed resource management activities. There would be no impact to the visual integrity of the Old Indian Trail because harvest unites in the vicinity of the trail would have only dead and dying trees removed. This would reduce the visual intrusion to the site, resulting in no impact on cultural resources. All of the sites eligible for the NRHP would be avoided by project-related activities. An assessment of impacts to heritage resources would be required for prescribed treatments once a specific plan has been developed.

Indirect Impacts

Potential indirect impacts on cultural resources under Alternative C would be the same as described for the Proposed Action.

Cumulative Impacts

No cumulative impacts on cultural resources in the analysis area are anticipated from the combined effects of the Proposed Action and the projects listed in Table 3-1. No impacts on heritage resources were identified in the Environmental Assessment for the proposed Maki Creek area projects, which are located adjacent to and north of the Cottonwood II project area.

3.9 Environmental Justice

3.9.1 Introduction

This section addresses whether or not implementation of the proposed project would result in environmental justice effects. On February 11, 1994, the President issued Executive Order 12898 on Environmental Justice in Minority Populations and Low Income Populations. This federal action and USDA Regulations 5600-2 direct federal agencies to integrate environmental justice considerations into federal programs and activities. Environmental justice means that, to the greatest extent practicable and permitted by law, all populations (including disadvantaged populations, such as minorities and low-income individuals) are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by, government programs and activities affecting human health or the environment.

3.9.2 Existing Conditions

The analysis area is in a completely rural setting and has no permanent human residents. The nearest communities (Big Piney and Marbleton, Wyoming) are approximately 40 miles to the southeast. Public involvement activities described in *Chapter 1, Purpose of and Need for Action (*see *Section 1.9, Public Involvement),* and *Chapter 4, Consultation and Coordination* document the efforts made to provide the public the opportunity to comment on the proposed project. *Section 1.9, Issues* summarizes significant issues by the public on the proposed project. There were no significant issues or indicators identified for environmental justice during public scoping.

Implementation of any project alternative would not cause disproportionate adverse human health or environmental effects to minority or low-income populations.

3.9.3 Desired Future Conditions

To meet the direction of Executive Order 12898, the Forest Service requires, where proposals have the potential to disproportionately adversely affect minority or low-

income populations, those effects must be considered and disclosed (and mitigated to the degree possible) through the NEPA analysis and documentation.

3.9.4 Environmental Consequences

3.9.4.1 Alternative A – No Action

Implementation of the No Action Alternative would not cause disproportionate adverse human health or environmental direct, indirect, or cumulative effects to minority or low-income populations.

3.9.4.2 Alternative B – Proposed Action

There would be the potential for employment for members of any minority groups during implementation of Proposed Action activities. There would be no disruption of minority groups from project implementation of the Proposed Action, since implementation would occur in a completely rural setting where there are no permanent human residents and the population in adjacent areas is very dispersed. No disproportionate negative direct, indirect, or cumulative impacts on minorities or low-income communities are expected.

3.9.4.3 Alternative C – Reduced Harvest and Temporary Roads

No environmental justice impacts would occur under this alternative, the same as described for the Proposed Action.

3.10 Recreation and Visual Resources

3.10.1 Introduction

3.10.1.1 Recreation

"Recreation Opportunities" are not identified as a significant issue in Table 1-1; however, treatment of the other significant issues will have impacts on the nature and quality of recreation opportunities that are available in the analysis area within Management Area 25 (MA 25). This section addresses the following:

- B-TNF-wide recreation opportunities
- The Recreation Opportunity Spectrum (ROS) classifications assigned to lands within the B-TNF; the Forest-Wide Management Prescriptions, Standards, and Guidelines
- The recreation opportunities and the Desired Future Conditions (DFCs) for MA 25, and the recreation prescriptions associated with those DFCs.

3.10.1.2 Visual Resources

"Visual Resources" are not identified as a significant issue in Table 1-1; however, treatment of the other significant issues will have impacts on the nature and quality of the visual resources that are available in the analysis area within Management Area 25 (MA 25). This section addresses the following:

- The B-TNF-wide visual resources
- The Visual Quality Objectives (VQOs) assigned to lands within the B-TNF
- The Forest-Wide Management Prescriptions, Standards, and Guidelines; the visual resources and the DFCs for MA 25, and the visual resource prescriptions associated with those DFCs.

3.10.2 Existing Conditions

3.10.2.1 Recreation

Forest-Wide Recreation

The northern end of the B-TNF is influenced by the tourism associated with Grand Teton National Park, the National Elk Refuge, and private and commercial recreation. The east side of the B-TNF is heavily used by wilderness visitors and others attracted to the Wind River Range and the upper Green River. The southern part of the B-TNF also receives significant visitation. Privately owned camping facilities are available near the B-TNF, as well as numerous resorts, hotels, and guest ranches. There were more than 1.7 million visitor days on the B-TNF annually as of 1990.

The B-TNF offers a wide range of dispersed recreation opportunities. Developed campgrounds and picnic areas total 572 acres on the B-TNF. Nearby private-sector developed recreation, particularly ski resorts, is of national importance.

Over 200 outfitters and guides offer services for day and overnight trips for river floating, hiking, hunting, and fishing. Commercial operators compete intensely with one another and also compete with private users for limited recreation resources on the B-TNF.

Some developed sites are crowded and overused. These sites are usually used to capacity on weekends, holidays, and on some weekends during July and August. No new developed sites have been built since 1970, and the total capacity of developed sites has remained the same. Emphasis has been on reconstruction and upgrading of existing facilities.

The trail system on the B-TNF consists largely of traditional routes that are decades old, most of which were constructed for purposes other than recreation. The trail system includes winter sports trails, many of which are located on summer roads. Ski and snowmobile trails may be groomed, marked, or both. Trails give access to most of the backcountry areas on the B-TNF, and most are maintained periodically. Because the location and design of many of the trails are not suited to the heavy traffic they receive, they are deteriorating. The damage resulting from heavy use is compounded by the lack of annual tread maintenance and adequate water drainage. B-TNF-wide, 2,959 miles of trails exist, of which 2,426 miles are constructed system trails and 533 miles are unconstructed trails.

Records of recreation use on the B-TNF show no particular trend. Use levels have been high, but have remained stable within a 10 percent range until 1990 (Forest Service 1990).

Forest-Wide Recreation Resource Management

National Forests provide a wide variety of settings for recreation experiences. Recreation settings vary from primitive—where there is little evidence of other people, more difficult access, and more opportunities for self reliance—to more developed areas that offer more facilities, better access, and opportunities to interact with other recreationists. A classification system called the Recreation Opportunity Spectrum (ROS) is used to help describe recreation settings and to guide management activities. The ROS has the following six classifications for Forest lands (described in Appendix A):

- Primitive
- Semi-Primitive Non-Motorized
- Semi-Primitive Motorized
- Roaded Natural
- Rural
- Urban

The B-TNF has assigned lands within the B-TNF to the ROS classifications.

Approximately 32 percent of the total recreation use reported on the B-TNF in 1986 took place in developed sites, within the Roaded Natural ROS setting. Reported use in developed sites on the B-TNF in 1986 was 519,240 recreation visitor days (RVDs). Recreation use on forest roads and scenic highways within the Roaded Natural setting accounted for 1,124,352 RVDs in 1986, including activities such as camping in developed sites, downhill skiing, staying at recreation residences and resorts on the B-TNF, scenic driving, and dispersed use on B-TNF roads. RVDs reported for recreation in the Roaded Natural setting is 59 percent of the B-TNF total.

Road access within the B-TNF has changed the recreational opportunities that were previously available on undeveloped and non-roaded land. Much of the B-TNF today contains Primitive and Semi-Primitive opportunities. However, as non-roaded areas have been developed, a change from the Primitive end of the ROS toward Roaded Natural has occurred.

Forest-Wide Management Prescriptions, Standards, and Guidelines

The Forest-wide Management Prescriptions, Standards, and Guidelines apply to all areas on the B-TNF outside of congressionally designated Wilderness. In many cases, they are more general than the DFCs.

Recreation Resource Management Prescriptions, Standards, and Guidelines

Table 3-32 presents the Recreation Prescriptions, Standards, and Guidelines.

TABLE 3-32
Recreation Prescriptions, Standards, and Guidelines

Prescription, Standard, or Guideline	Description
Recreation Prescription	The Recreation Opportunity Spectrum (ROS) classification system is used for facility planning and to direct management. Recreation on the B-TNF provides the full range of recreation opportunities, managed to create a balance of public and private uses responsive to local, regional, and national demand. Land and Resource Management Objectives substantially supported by B-TNF-wide Standards and Guidelines for recreation include: 1.1(f), 2.1(a,b), 2.2(a,b), 2.3(a), 2.8(a), 4.5(b), 4.7(c), and 4.8(a).
Winter Restrictions Standard	Over-snow vehicles and helicopters for skiing will avoid crucial winter ranges.
Dispersed Camp Site Condition Standard	Backcountry campsites will be managed according to the Frissell Condition Classification System. Actions – close, protect, or restore – will be taken to restore campsites that do not meet Class 3. In some areas, where it is desirable to establish minimally developed campsites, they will meet standards appropriate to the recreation setting in which they are constructed.
Developed Facility Standard	Appropriate facilities will be provided at developed sites to prevent resource damage, protect public health and safety, and meet the desires of people who use developed sites.
Dispersed Use Area Standard	Low-development-level facilities will be provided at undeveloped concentrated-use areas to prevent resource damage and protect public health and safety.
Recreation Information Standard	Information about recreation opportunities will be made available to the public. This will include recreation guides, brochures, and maps.
Recreation Riparian Area Standard	No new recreation sites will be built in riparian areas unless a clear public need can be demonstrated and no other reasonable alternative exists. Unless designed to be submerged, recreation development will not occur in wetlands and in 100-year floodplains.
Pack-in/Pack-out Standard	Where disposal facilities are not available, implement a “pack-in/pack-out” solid waste – garbage – removal policy.
Access to Recreation Sites Guideline	Sites should be chosen so that recreational facilities can be designed to be accessed by the physically challenged.
Outfitter and Guides Facilities Guideline	Outfitter and guide facilities in dispersed areas should be built in less-frequented areas. To prevent unacceptable resource damage or sanitation problems, facilities may be built at popular locations. Only essential facilities will be provided at commercial outfitter camps in accordance with camp standards agreed upon with the outfitter and guides.
Livestock Interference Guideline	Recreationists should be informed about their effects on cattle movements and behavior, emphasizing loss of market and other resource values such as riparian and water quality values. Recreation access or traffic flow may be controlled form time to time to reduce interference with livestock trucking or driving.

Access: Trails Management Prescriptions, Standards, and Guidelines

Table 3-33 presents the Access: Trails Prescriptions, Standards, and Guidelines.

TABLE 3-33
Trails Prescriptions, Standards, and Guidelines

Trails Prescription, Standard, or Guideline	Description
Access: Trails Prescription	Non-motorized and motorized trails are provided for a wide variety of uses and difficulty levels. Trails are maintained to appropriate levels or signed as closed with reasons stated. Driveways are maintained for stock movement. Land and Resource Management Objectives substantially supported by B-TNF-wide Standards and Guidelines for trails include: 1.2(c,d), 2.5(c,d), 4.5(a), 4.7(c), and 4.8(a).
Standard Level Maintenance Guideline	National Forest development trails should meet standard level maintenance criteria.
Trail Closure Guideline	Trails may be relocated, and seasonally or permanently closed.
Snow Trail Standard	A system of snow trails will be designated and marked.
Snow Trail Location Guideline	Snow trails should be located to avoid areas of high avalanche hazard and crucial wildlife winter ranges.
National Forest Development Trail Standard	National Forest development trails will be protected. Trails disrupted by resource development activities will be relocated or rebuilt.
Trail User Conflict Minimization Guideline	The trail system should be managed to minimize conflicts among users, including motorized and non-motorized recreation and livestock.
Dude Trail Guideline	Particularly in areas with potential for activities causing surface-disturbance or noise, sensitivity should be displayed towards the need to protect or help relocate trails used by dude ranches or other outfitters and guides.
Off-Highway Vehicle Standard	Motorized off-highway vehicles will be restricted to routes or open roads designated for that use. Vehicle use will be consistent with state law and federal regulations for both licensed and unlicensed vehicles and operators.
Trail Signing Guideline	Trails should be signed at all intersections and terminal points showing multiple destinations and distances. Signs for physical features may be appropriate. Trailheads may be signed to indicate the degree of trail difficulty. For further information, see *Trails Management Handbook, FSH 2309.18*.
Trail Condition Standard	Trail tread width will not exceed 24 inches. Multiple “braided” trails that develop will be obliterated and relocated so that there is only one tread.

Management Area 25 Recreation

Recreational use 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. The Cottonwood area is used during the summer, and is more heavily used during the fall hunting season.

The North and South Cottonwood areas provide opportunities for dispersed camping and day use, off-highway vehicle (OHV) use, fishing, hiking, picnicking, mountain biking,

driving, and special use activities. The area is open to winter sport use. In the remainder of the Cottonwood 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 area. Primitive hiking and camping experiences are found at higher elevations in areas designated DFC 12 and 2A (Forest Service 2004b).

Both Forest-system trails and non-Forest-system trails are located within the analysis area. The trails are used mainly by horseback riders and hikers, but are also open for mountain biking and non-motorized uses. The trails receive more use in the fall than in the summer (Forest Service 2004b). A portion of the Wyoming Range National Recreation Trail is located within MA 25 (Forest Service 1990; Forest Service 2002). An outfitter camp is located within the analysis area approximately 1 mile from the northern analysis area boundary along Nylander Creek (Marsh 2004).

Management Area 25 Recreation Resource Management

The B-TNF has designated ROS classifications to lands within MA 25. The vast majority of the MA is designated as Roaded Natural. A small portion on the west side of the MA is designated as Semi-Primitive Non-Motorized, and a smaller portion, also on the west side of the MA, is designated as Primitive (Marsh, 2004). The Semi-Primitive Non-Motorized area is a transition area between the Primitive and Roaded Natural settings in the MA. Semi-Primitive Non-Motorized areas exist in the northeast and west corners of the MA and in an area east of the Wyoming Range National Recreation Trail. Lands classified as Semi-Primitive Motorized exist along the southeastern boundary of the MA and in portions of Maki and Chase creeks (Forest Service 2004b).

Table 3-34 provides a breakdown of the acreage within the analysis area assigned to the various ROS classifications.

TABLE 3-34
Acres of MA 25 Assigned to the ROS Classifications

Recreation Opportunity Spectrum Classification	Acres
Primitive	5,760
Semi-Primitive Non-Motorized	10,119
Semi-Primitive Motorized	6,263
Roaded Natural	26,400

Source: Forest Service 2004.

Total acres add to 48,542 in this table, compared to 48,541 as listed in Section 1.2 of this EIS. This difference in calculation is due to rounding.

3.10.2.2 Visual Resources

Forest-Wide Visual Resources

The B-TNF has many scenic areas including perennial snow fields on mountain peaks, lush green vegetation, and clear mountain lakes and streams.

Most of the Forest is in an undisturbed condition, with an essentially natural landscape. Some lands on the Forest have been altered by activities such as timber harvest, roads, and oil and gas development. Although these activities are done within the constraints of the Visual Quality Objectives (VQOs) assigned to the areas within the Forest, some changes to the forest landscape have occurred. Areas that are managed to meet VQOs of Retention and Partial Retention appear natural, even with the landscape altering activities. As timber harvest units, road cuts, and other disturbances revegetate, the degree of landscape change has decreased.

Forest-Wide Visual Management

The Forest Service has developed measurable standards or objectives for the visual management of National Forest lands. These standards are termed Visual Quality Objectives (VQOs). They are represented by five terms that can be defined as visual resource management goals. The VQOs are as follows (see Appendix B for descriptions):

- Preservation
- Retention
- Partial Retention
- Modification
- Maximum Modification (Forest Service 1974)

Table 3-35 lists the number of acres within the B-TNF assigned to the five VQOs.

TABLE 3-35
Acres and Percent of the B-TNF Assigned to the Visual Quality Objectives

	Bridger-Teton National Forest	
Visual Quality Objective	**Acres**	**Percent**
Preservation	1,300,500	9
Retention	893,800	27
Partial Retention	770,700	48
Modification	447,000	12
Maximum Modification	25,700	4
Total Acreage in Forest	3,437,700	100

Source: Forest Service 1990.

Forest-Wide Management Prescriptions, Standards, and Guidelines

The Forest-wide Management Prescriptions, Standards, and Guidelines apply to all areas on the B-TNF outside of Congressionally designated Wilderness. In many cases, they are more general than the DFCs.

Visual Quality Management Prescriptions, Standards, and Guidelines

Table 3-36 presents the Visual Quality Prescriptions, Standards, and Guidelines:

TABLE 3-36
Visual Quality Prescriptions, Standards, and Guidelines

Prescription, Standard, or Guideline	Description
Visual Quality Prescription	Visual quality objectives are defined in this plan and serve as a classification system used to set objectives for facility planning and resource management. Land and Resource Management Objectives substantially supported by B-TNF-wide Standards and Guidelines for visual quality: 2.5(a-d), and 4.1(b).
Sensitive Travel Route Standard	Along certain visually sensitive travel routes, the VQO will be Retention or Partial Retention. The Management Area narratives at the end of this chapter (in the LRMP) contain identifications of visually sensitive routes.
Slope Rounding Guideline	All permanent Service Level A and B roads will have top-of-cut rounding to blend the cut slope into the natural slope.

Management Area 25 Visual Resources

The analysis area is part of the Overthrust Belt in the Central Rocky Mountains. 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. Because of the variation in soil types and parent material, such features as stratified rock faces, landslides, alluvial fans, and talus slopes are dispersed along side slopes. Color variations created by the diverse geology and vegetation range from shades of gray and brown to deep shades of green, orange, yellow, and red.

Vegetation varies sharply because of dramatic changes in elevation, slope, aspect, and climate. North-facing slopes are densely forested, and 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 percent 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.

Evidence of current and past management activities in the watershed includes: transportation systems; mining, oil, and gas development; various types of vegetation treatments; domestic grazing; and recreation use.

The road system is the predominant constructed feature on the Roaded Natural ROS landscape, which makes up the majority of the Cottonwood area. In addition to the road system, other human-made elements include: historic cabins, fencing, clear cuts, tie hacked areas, evidence of grazing and recreation use (for example, soil compaction and changes in vegetation), 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 the western portion of the analysis area where it is assigned a primitive ROS setting, other than the trail system and associated signing, little human-caused alterations to the natural landscape are evident.

Critical viewpoints and corridors offer views of and to the area. They 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 because of its heavy concentration of recreation use. Non-motorized trails within the MA include: the Wyoming Range National Recreation Trail, Maki Creek Trail, Eagle Creek Trail, South Fork of Cottonwood Creek Trail, and South Cottonwood Creek Trail. Although relatively few people view the area from these routes, the scenic integrity is important to the recreation experience being sought.

Management Area 25 Visual Resource Management

The B-TNF has assigned VQOs to the MAs within the Forest. The majority of MA 25 is designated as Retention; lands are also designated as Partial Retention, and a smaller portion of the MA is designated as Modification (Martens 2004). However, most of the proposed cutting units are within partial retention or modification areas. 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. The remainder of the area is classified as Partial Retention (human activities are to remain subordinate to the surrounding natural landscape) (Forest Service, 2004b).

Table 3-37 provides a breakdown of the approximate acreage within the analysis area assigned to the various VQOs.

TABLE 3-37
Acres of MA 25 Assigned to the VQOs

Visual Quality Objective	Acres
Retention	25,262
Partial Retention	13,699
Modification	9,446

Source: Forest Service, 2004.

3.10.3 Desired Future Conditions

3.10.3.1 Recreation

Similar to the B-TNF-wide Management Prescriptions, Standards, and Guidelines, the DFCs describe land management direction intended to accomplish the Goals and Objectives. The DFCs are used as basic tools for land management; each DFC has a unique set of Prescriptions, Standards, and Guidelines.

MA 25 consists of the following 4 DFCs: 1B, 2A, 10, and 12. The ROS classifications that are associated with each of the DFCs are listed in Table 3-38. Because DFCs encompass large areas and prescribed activities may not occur everywhere within the area, other ROS classes may be present, particularly those tending toward the primitive end of the spectrum.

TABLE 3-38
ROS Classifications Associated with the DFCs of MA 25

	Recreation Opportunity Spectrum Classifications			
Desired Future Condition	Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural
1B	X	X	X	X
2A				
10		X	X	X
12			X	X

Source: Forest Service 1990

Table 3-39 shows Recreation Prescriptions associated with Management Prescriptions.

TABLE 3-39
Recreation Prescriptions Associated with Management Prescriptions

Prescription	Description
Management Prescription 1B	
Recreation Prescription	Recreation is managed to provide Roaded Natural appearing opportunities in roaded areas, and Semi-Primitive opportunities in other areas. Roaded recreation opportunities are compatible with timber, livestock grazing, and minerals development. Recreation activities suitable for this area include dispersed, road-oriented uses such as firewood gathering, roadside camping and day use, OHV use on open routes, hunting, and winter sports. Use of closed roads for semi-primitive forms of recreation such as horseback riding and hiking is suitable.
Management Prescription 2A	
Recreation Prescription	Manage the physical and social setting to provide Primitive and Semi-Primitive Non-Motorized opportunities.
Helicopter Use Guideline	Helicopters for skiing and geophysical exploration should use designated non-motorized areas.
Off-Highway Vehicle Standard	OHVs will not use the area. Over-snow, motorized vehicles will be allowed to use designated trials and dispersed-use areas.
Campsite Guideline	High-impact campsites should be restored to meet Frissell Condition Class 3. In some locations, designated campsites may be established, not to exceed Development Level 1.
Education Guideline	Visitor education and no-trace guidelines should be used to minimize social and physical impacts to the area.
Signing Guideline	Signing may be used for user safety, education, convenience, and interpretation.
Group Size Standard	Group sizes larger than those allowed in Wilderness areas will be allowed. The social setting will be managed as Semi-Primitive Non-Motorized.
Management Prescription 10	
Recreation Prescription	Existing roaded recreation opportunities continue where they do not interfere with the objectives for this area. Areas of both Semi-Primitive Motorized and Semi-Primitive Non-Motorized are provided.
Management Prescription 12	
Recreation Prescription	Recreation and other human activities are managed to meet needs of the big-game species.
Recreation Opportunity Guideline	Existing roaded recreation opportunities should be allowed to continue where they do not interfere with objectives for this area. Areas of Semi-Primitive recreation should be provided for both motorized and non-motorized use. Existing and future road systems should be managed to retain backcountry areas that are large and remote enough to provide Semi-Primitive recreation.

The common recreation activities that might be found after a DFC is applied to an area are shown in Table 3-40. Because DFCs are applied to large areas and every prescribed

activity may not occur everywhere within the area, the recreationist may find a considerable range of opportunities available.

TABLE 3-40
Common Recreation Activity Associated with the DFCs of MA 25

	Desired Future Condition			
Common Recreation Activity	**1B**	**2A**	**10**	**12**
Off-road motors	A	NA	A	A
Snow Vehicles/heli-skiing	A	AR	AR	A
Mountain biking	A	A	A	A
Christmas tree cutting	AR	AR	AR	A
Private firewood	A	NA	A	A
Developed recreation Facility	NA	NA	NA	NA
Concentrated recreation	NA	NA	A	A
Concession facility	NA	NA	NA	NA
4x4s on roads	A	NA	A	A
Scenic driving	A	NA	A	A
Hiking/pack trails	AR	A	A	A
Cross-country skiing	A	A	A	A
Hunting	A	A	A	A
Fishing	A	A	A	A

Source: Forest Service 1990

A = Appropriate
AR = Appropriate with area restrictions
NA = Not appropriate

3.10.3.2 Visual Resources

Similar to the B-TNF-wide Management Prescriptions, Standards, and Guidelines, the DFCs describe land management direction intended to accomplish the Goals and Objectives. The DFCs are used as basic tools for land management; each DFC has a unique set of Prescriptions, Standards, and Guidelines.

MA 25 consists of the following 4 DFCs: 1B, 2A, 10, and 12. The VQO classifications that are associated with each of the DFCs are listed in Table 3-41. Because DFCs are applied to large areas and every landscape-altering activity may not occur everywhere within the area, other VQOs may apply.

TABLE 3-41
VQO Classifications Associated with the DFCs of MA 25

Desired Future Condition	Visual Quality Objective Classifications			
	Preservation	Retention	Partial Retention	Modification
1B			X	X
2A		X		X
10			X	
12		X	X	X

Source: Forest Service, 1990.

Table 3-42 shows Visual Prescriptions associated with Management Prescriptions.

TABLE 3-42
Visual Prescriptions Associated with Management Prescriptions

Prescription	Description
Management Prescription 1B	
Visual Quality Prescription	The VQO is generally Partial Retention or Modification. In sensitive foreground areas, the VQO is Retention.
Management Prescription 2A	
Visual Quality Prescription	The VQO for this area is Retention. Structures, trails, and signs repeat the form, line, color, and texture found in the characteristic natural landscape.
Management Prescription 10	
Visual Quality Prescription	The VQOs are Retention, Partial Retention, and Modification.
Management Prescription 12	
Visual Quality Prescription	The VQOs are Retention and Partial Retention.

3.10.4 Environmental Consequences

This section addresses the potential direct and indirect impacts to recreation opportunities and visual resources from the implementation of Alternatives A, B, and C. Because of the difficulty in clearly distinguishing between direct and indirect effects on these two resource areas, they are discussed together under a single heading. This section also addresses the potential cumulative impacts on recreation opportunities and visual resources from implementing the project in combination with the following proposed projects, which were listed in Table 3-1. All of these projects would be located in Sublette County, and most would be located in the Big Piney Ranger District:

- Noxious weed prevention and control

- Hoback Ranches fire plan, approximately 20 miles northwest of the project
- Lower Valley Energy Natural Gas Pipeline, approximately 20 miles north of the project
- Maki Creek vegetation treatment, adjacent to the Cottonwood II project
- Monument Ridge prescribed burn, approximately 20 miles north of the project
- Wyoming Range Grazing Allotment Complex

3.10.4.1 Recreation

Alternative A – (No Action)

Direct and Indirect Impacts

Several dispersed recreation activities (including hunting, camping, day use, fishing, picnicking, mountain biking, and snowmobiling) occur throughout the analysis area in all seasons of the year.

Implementation of Alternative A (No Action) would result in no vegetation management occurring within the treatment area (30,894 acres) of the 48,541-acre analysis area over the next 5 to 10 years. Ongoing management activities (including routine maintenance of existing roads and trails, fire suppression, tree/firewood sales, oil and gas activities, outfitting, and range management) that currently occur within the analysis area would continue to occur on the same schedule that they currently are performed.

If Alternative A is implemented, the following effects on the recreation setting are expected:

- No change in existing recreation opportunities such as dispersed camping and day use, OHV use, hiking, picnicking, mountain biking, or winter sports would occur
- Adverse impacts to existing hunting opportunities are expected from the lack of vegetation management activities
- Adverse impacts to fishing opportunities are expected to continue from the ongoing sedimentation into Nylander Creek from Nylander Road, and no change from existing fishing opportunities along the creeks in the treatment areas from no culvert replacements and no stream crossing replacements
- Recreation traffic safety would continue to be less than desired on South Cottonwood Road due to the road's current width and configuration

These are discussed below.

Effects on Existing Dispersed Recreation Opportunities. Implementation of Alternative A would have no direct impact on existing recreation opportunities such as dispersed camping and day use, OHV use, hiking, picnicking, mountain biking, or winter sports within the 30,894-acre treatment area because no treatment activities would occur that could conflict with those recreational pursuits. No changes in access (road detours, road closures, closed areas, closed trails) to desired locations within the treatment area are expected with implementation of this alternative. However, the lack of treatment

activities in the treatment area could result in the quality of wildlife habitat in that area declining, which could result in wildlife species relocating to other areas in the B-TNF outside of the treatment area, thereby potentially changing the available hunting opportunities within the treatment area.

Implementation of Alternative A would have no direct impact on existing recreation opportunities such as dispersed camping and day use, OHV use, hiking, picnicking, mountain biking, or winter sports within the 17,647-acre area that is outside of the treatment area, but is within the analysis area. This is because no treatment activities would occur within that area that could conflict with those recreational pursuits. No changes in access (road detours, road closures, closed areas, closed trails) to desired locations within that area are expected with implementation of this alternative. However, the lack of treatment activities in the treatment area could result in the quality of wildlife habitat in that area declining, which could result in wildlife species relocating to the 17,647 acres outside of the treatment area, thereby potentially changing the available hunting opportunities within the 17,647-acre area.

- For example, aspen stands in the treatment area that are currently degrading would not be regenerated, resulting in a likely decline in habitat for elk, mule deer, and other wildlife that use aspen habitat. This decline in habitat within the treatment area may result in species relocating to other areas within the B-TNF, and therefore, may adversely affect big game hunting opportunities in the analysis area.
- Similarly, the lack of other vegetation management activities in the treatment area (for example, partial cuts, clear cuts, or salvages) associated with implementation of this alternative may also cause the decline of habitat used by other wildlife species. This decline in habitat within the treatment area may result in species relocating to other areas within the B-TNF, and therefore, may result in adverse impacts on hunting opportunities for other species in the analysis area.

It should be noted that this potential indirect effect on hunting opportunities within the analysis area could also be occurring now, so Alternative A would result in no change from existing conditions.

Effects on Existing Fishing Opportunities. The 1-mile portion of Nylander Road would not be relocated with implementation of Alternative A, therefore, road-related sediment delivery into Nylander Creek would continue. This may adversely affect existing fishing opportunities along this creek.

It should be noted that this potential indirect effect on fishing opportunities along Nylander Creek could also be occurring now, so Alternative A would result in no change from existing conditions.

With implementation of Alternative A, no culverts would be replaced and no improvements to stream crossings in the treatment area would occur. Therefore, fish passage would not be improved, fish barriers would not be created, and fishing opportunities would not change from existing conditions.

Effects on Recreation Traffic Safety. The 1-mile portion of South Cottonwood Road would not be reconstructed if this alternative is implemented, therefore, access to the area

by recreation traffic would not be improved (not made safer). Traffic safety would continue to be less than desired on South Cottonwood Road.

It should be noted that this reduced level of recreation traffic safety occurs now, so Alternative A would result in no change from existing conditions, unless recreation traffic levels along South Cottonwood Road increase. In that case, the recreation traffic safety level along that road would be expected to decline (become less safe).

Effects on Existing Recreation Facilities and Access to Existing Facilities. With implementation of this alternative, the 1-mile portion of Nylander Road would not be relocated to the dry ridge area to the east, ending at an existing dispersed camping area. Therefore, a new recreation facility access would not be provided, and the recreation benefit to recreationists would not be realized. This is no change from existing conditions.

- Implementation of this alternative would preclude the development of the end-of-Nylander Road trailhead improvements, so the recreation benefit to recreationists would not be realized. This is no change from existing conditions.

Cumulative Impacts

Implementation of Alternative A (No Action) would not contribute incrementally to cumulative impacts when considered in combination with the other projects that would be implemented in the area. This is because Alternative A consists of no change from existing vegetation management practices.

Alternative B – (Proposed Action)

Direct and Indirect Impacts

Implementation of Alternative B (Proposed Action) would result in a variety of vegetation management activities occurring within the treatment area (30,894 acres) of the 48,541-acre analysis area over the next 5 to 10 years, in addition to ongoing management activities that currently occur within the analysis area.

It is expected that a total of 2,099 acres (6.8 percent of the treatment area) would receive the proposed treatments during the spring (starting March 1), summer recreation season (Memorial Day through Labor Day), and into fall (through the end of October). Therefore, no impacts on winter recreation opportunities or recreationists engaging in recreation activities between November 1 and March 1 are expected.

Proposed activities would be consistent with the Primitive and Semi-Primitive Non-Motorized ROS designations of the area because no activities are proposed in those areas. Proposed activities would be consistent with the Semi-Primitive Motorized ROS designation because moderately dominant alterations are allowed. Proposed activities would also be consistent with the Roaded Natural ROS designation because the landscape modifications associated with this alternative may be evident and would harmonize with the natural setting.

If Alternative B is implemented, the following effects on the recreation setting are expected:

- Effects on existing recreation opportunities such as dispersed camping and day use, OHV use, hiking, picnicking, mountain biking, or winter sports would occur
- Potential improvement in existing hunting opportunities, and associated benefit to hunters from the vegetation management activities
- Potential improvement in fishing opportunities from the proposed relocation of Nylander Road and from replacement of culverts and improvements to stream crossings
- Potential improvement to recreation traffic safety on South Cottonwood Road, and associated benefit to recreationists traveling on that road

These are discussed below.

Effects on Existing Dispersed Recreation Opportunities. Implementation of Alternative B would result in some short-term disruption of spring, summer, and fall recreation opportunities and use in the treatment area through the closure of certain areas, trails, or roads, or required detours. This could be due to the presence of equipment or because of activities such as partial cuts, clear cuts, burns, road relocation and reconstruction activities, replacement of culverts, or installation of bridge improvements.

Closures would cause recreationists to avoid the area, displacing them from within the treatment area to other areas within the B-TNF. This would shift recreation use to other areas, putting additional use pressure on those areas, and possibly increase use levels in other areas to their capacities. Offsetting that impact are several circumstances: 1) proposed harvest activities are usually confined to June through October; 2) proposed harvest activities are seldom active on weekends when most recreational use would occur; 3) proposed activities are restricted from taking place on opening weekends of big game hunting season; 4) relatively small percentages of each individual treatment area would be treated; 5) proposed activities would not occur continuously for the entire 8 months of each year (for example, burning would take place during short time frames in the fall or spring; and 6) none of the proposed vegetation management activities would change the spectrum of recreation opportunities available in the treatment area.

With implementation of Alternative B, the habitat quality within the treatment area is expected to improve, which could result in more wildlife species inhabiting the area. Big game hunting opportunities may then improve, and an associated benefit to hunters in the area may occur. A long-term reduction in potential for large-scale wildfire in the area is expected as a result of implementation of Alternative B, which would be a benefit to recreationists.

Effects on Existing Fishing Opportunities. A 1-mile portion of Nylander Road would be relocated with implementation of Alternative B, which would reduce road-related sediment delivery into Nylander Creek. This may improve existing fishing opportunities along this creek, which would be a benefit to anglers.

With implementation of Alternative B, 12 culverts would be replaced and improvements to 2 stream crossings in the treatment area would occur. Although the replaced culverts and bridge improvements would be provided as part of this alternative to compensate for potential impacts to Colorado River cutthroat trout as a result of implementing the alternative, the replaced culverts and stream crossing improvements would improve fish passage in certain locations and create intended fish barriers in other locations. This may improve fishing opportunities in the area, resulting in a benefit to anglers.

Effects on Recreation Traffic Safety. A 1-mile portion of South Cottonwood Road would be reconstructed if this alternative is implemented, providing safer access to the area for recreation traffic and others. This would be a benefit to recreation traffic. As recreation use and associated recreation traffic in this area increases, the benefit of the widened and reconfigured roadway would continue.

Effects on Existing Recreation Facilities and Access to Existing Facilities. With implementation of this alternative, the 1-mile portion of Nylander Road would be relocated to the dry ridge area to the east, ending at an existing dispersed camping area. This would provide a new recreation facility access, which would be a benefit to recreationists.

- Implementation of this alternative would include the development of the end-of-Nylander Road trailhead improvements. This would also be a benefit to recreationists.

Cumulative Impacts

Implementation of Alternative B (Proposed Action) would not contribute incrementally to cumulative impacts when considered in combination with the other projects listed above and in Table 3-1 that would be implemented in the area. This is based on the following reasons: 1) three of the six projects would be located 20 miles away from the analysis area, resulting in no overlap in proposed activities within the analysis area; 2) all six projects, plus the Proposed Action, are relatively short-term projects; and 3) no significant impacts on recreation opportunities from implementation of Alternative B are expected.

Alternative C – (Reduced Harvest and Temporary Roads)

Direct and Indirect Impacts

Implementation of Alternative C would result in a variety of vegetation management activities (fewer acres harvested than Alternative B; fewer miles of temporary roads needed than Alternative B; increases the number of acres of aspen treated, when compared to Alternative B; same amount of acres burned as Alternative B; and same culvert replacements and bridge improvements as Alternative B). These activities would occur within the treatment area (30,894 acres) of the 48,541-acre analysis area over the next 5 to 10 years, in addition to ongoing management activities that currently occur within the analysis area.

It is expected that a total of 2,032 acres (6.6 percent of the treatment area) would receive the proposed treatments during the spring (starting March 1), summer recreation season (Memorial Day through Labor Day), and into fall (through the end of October).

Therefore, no impacts on winter recreation opportunities or recreationists engaging in recreation activities between November 1 and March 1 are expected.

Proposed activities would be consistent with the Primitive and Semi-Primitive Non-Motorized ROS designations of the area because no activities are proposed in those areas. Proposed activities would be consistent with the Semi-Primitive Motorized ROS designation because moderately dominant alterations are allowed. Proposed activities would also be consistent with the Roaded Natural ROS designation because the landscape modifications associated with this alternative may be evident and would harmonize with the natural setting.

If Alternative C is implemented, the following effects on the recreation setting are expected:

- Effects on existing recreation opportunities such as dispersed camping and day use, OHV use, hiking, picnicking, mountain biking, or winter sports would occur
- Potential improvement in existing hunting opportunities, and associated benefit to hunters from the vegetation management activities
- Potential improvement in fishing opportunities from the proposed replacement of culverts and improvements to stream crossings as well as Nylander Road rerouting

These are discussed below.

Effects on Existing Dispersed Recreation Opportunities. Similar to Alternative B, implementation of Alternative C would result in some short-term disruption of spring, summer, and fall recreation opportunities and use in the treatment area through the closure of certain areas, trails, or roads, or required detours. This could be due to the presence of equipment or because of activities such as partial cuts, clear cuts, burns, road relocation and reconstruction activities, replacement of culverts, or installation of bridge improvements. During timber harvest activities, main roads would remain open and recreation restrictions limited to areas of active falling and skidding operations.

The treatment mix associated with Alternative C would be the same as for Alternative B, while the acreages of each treatment type would differ from that associated with Alternative B. However, the total number of acres receiving treatment is similar (67 fewer acres to receive treatment with Alternative C). In addition, the areas to be treated by both alternatives are similar, and the same culverts would be replaced and the same stream crossings would be improved with both alternatives. These factors, when combined, would result in recreation impacts from implementation of Alternative C being similar to those that were discussed for Alternative B.

Closures would cause recreationists to avoid the area, displacing them from within the treatment area to other areas within the B-TNF. This would shift recreation use to other areas, putting additional use pressure on those areas, and possibly increase use levels in other areas to their capacities. Offsetting that impact are several circumstances: 1) proposed harvest activities are usually confined to the June through October time period; 2) proposed harvest activities are seldom active on weekends when most recreational use would occur; 3) proposed activities are restricted from taking place on opening weekends

of big game hunting season; 4) relatively small percentages of each individual treatment area would be treated; 5) proposed activities would not occur continuously for the entire 8 months of each year (for example, burning would take place during short timeframes in the fall or spring; and 6) none of the proposed vegetation management activities would change the spectrum of recreation opportunities available in the treatment area.

With implementation of Alternative C, habitat quality within the treatment area is expected to improve, which could result in more wildlife species inhabiting the area. Big game hunting opportunities may then improve, and an associated benefit to hunters in the area may occur. A long-term reduction in potential for large-scale wildfire in the area is expected as a result of implementation of Alternative C, which would be a benefit to recreationists.

Effects on Existing Fishing Opportunities. With implementation of Alternative C, 12 culverts would be replaced and improvements to two stream crossings in the treatment area would occur. Implementation of this alternative would improve fish passage in certain locations and create fish barriers in other locations, similar to that which is expected for Alternative B. This may improve fishing opportunities in the area, resulting in a benefit to anglers.

Cumulative Impacts

Implementation of Alternative C would not contribute incrementally to cumulative impacts when considered in combination with the other projects listed above and in Table 3-1 that would be implemented in the area. This is based on the following reasons: 1) three of the six projects would be located 20 miles away from the analysis area, resulting in no overlap in proposed activities within the analysis area; 2) all six projects, plus the Proposed Action, are relatively short-term projects; and 3) impacts on recreation opportunities associated with implementation of Alternative C would be similar to those discussed for Alternative B, and no significant impacts on recreation opportunities from implementation of Alternative B are expected.

Mitigation

Because no significant impacts were identified, no mitigation is necessary.

3.10.4.2 Visual Resources

Alternative A – (No Action)

Direct and Indirect Impacts

Alternative A implementation would result in no vegetation management occurring within the treatment area (30,984 acres) of the 48,541-acre analysis area over the next 5 to 10 years. Ongoing management activities (including routine maintenance of existing roads and trails, fire suppression, tree/firewood sales, oil and gas activities, outfitting, and range management) that currently occur within the analysis area would continue to occur on the same schedule that they currently are performed.

If Alternative A is implemented, no change to the landscape would occur, and no impact on visual resources would result.

Cumulative Impacts

Implementation of Alternative A (No Action) would not contribute incrementally to cumulative impacts when considered in combination with the other projects that would be implemented in the area. This is because Alternative A consists of no change from existing vegetation management practices.

Alternative B – (Proposed Action)

Direct and Indirect Impacts

Implementation of Alternative B (Proposed Action) would result in a variety of vegetation management activities occurring within the treatment area (30,894 acres) of the 48,541-acre analysis area over the next 5 to 10 years in addition to ongoing management activities that currently occur within the analysis area.

It is expected that a total of 2,099 acres (6.8 percent of the treatment area) would receive the proposed treatments during the spring (starting March 1st), throughout the summer, and into fall (through the end of October). Therefore, no impact on visual resources from treatment activities and equipment would occur during winter months.

The scenic quality of the treatment area may be affected by the proposed clearcutting (402 acres) that is included in this alternative. Offsetting this visual impact are: 1) there are many small areas to be clearcut in the treatment area, rather than few large expanses of clearcut areas; and 2) there are several existing clearcut areas within the treatment area, so new clearcuts would not be out of character with the natural environment.

The scenic quality of the treatment area may also be affected by the proposed burning of 1,058 acres of aspen. This impact is minimized by: 1) aspen and the sagebrush understory typically recovers quickly from burning; and 2) performing a prescribed burn reduces the potential for large-scale wildfires in the area (which could result in a much greater visual impact on the area).

The remaining treatment activities (thinning, shelterwood, salvage, and group selection) would blend with the existing landscape pattern because the areas to be treated are small and irregular in shape and significant numbers of trees will remain uncut.

Proposed activities would be consistent with the Retention VQO of the area because: 1) few or no activities are proposed in those areas; and 2) the areas that would be treated there would be small and irregular in shape, which would reduce how visually evident the treatments would be. Proposed activities would be consistent with the Partial Retention VQO because activities may be evident, but would remain visually subordinate to the landscape. Proposed activities would also be consistent with the Modification VQO because the landscape modifications associated with this alternative may visually dominate the landscape, but must be similar to the visual characteristics of the surrounding area.

Cumulative Impacts

Implementation of Alternative B (Proposed Action) would not contribute incrementally to cumulative impacts when considered in combination with the other projects listed above and in Table 3-1 that would be implemented in the area. This is based on the following reasons: 1) three of the six projects would be located 20 miles away from the analysis area (not in the same viewshed); 2) all six projects, plus the Proposed Action, are relatively short-term projects that would result in short-term visual impacts because the treated areas would recover quickly; and 3) no significant impacts on visual resources from implementation of Alternative B are expected.

Alternative C – (Reduced Harvest and Temporary Roads)

Direct and Indirect Impacts

Implementation of Alternative C (Reduced Harvest and Temporary Roads) would result in a variety of vegetation management activities (fewer acres harvested than Alternative B; fewer miles of temporary roads needed than Alternative B; increases the number of acres of aspen treated, when compared to Alternative B; same amount of acres burned as Alternative B; and same culvert replacements and bridge improvements as Alternative B). these activities would occur within the treatment area (30,894 acres) of the 48,541-acre analysis area over the next 5 to 10 years, in addition to ongoing management activities that currently occur within the analysis area.

It is expected that a total of 2,032 acres (6.6 percent of the treatment area) would receive the proposed treatments during the spring (starting March 1), throughout the summer, and into fall (through the end of October). Therefore, no impact on visual resources from treatment activities and equipment would occur during winter months.

The scenic quality of the treatment area may be affected by the proposed clearcutting (262 acres) that is included in this alternative. Offsetting this visual impact are: 1) there are many small areas to be clearcut in the treatment area, rather than few large expanses of clearcut areas; and 2) there are several existing clearcut areas within the treatment area, so new clearcuts would not be out of character with the natural environment. The visual impact associated with this alternative would be less than with Alternative B because: 1) the acreage of clearcuts is less with this alternative than with Alternative B; and 2) the locations of the clearcuts included in both alternatives would be similar.

The scenic quality of the treatment area may also be affected by the proposed burning of 1,058 acres of aspen. This impact is minimized by: 1) aspen and the sagebrush understory typically recovers quickly from burning; and 2) performing a prescribed burn reduces the potential for large-scale wildfires in the area (which could result in a much greater visual impact on the area). The prescribed burning associated with this alternative is the same as was described for Alternative B (same number of acres affected, and same location of acres); therefore, there is no difference in visual impacts between the two alternatives.

The remaining treatment activities (thinning, shelterwood, salvage, and group selection) would blend with the existing landscape pattern because the areas to be treated are small and irregular in shape and significant numbers of trees will remain uncut. Because the

acreages of these types of treatments associated with both alternatives would be similar, and in similar locations, there is no difference in visual impacts between the two alternatives.

The treatment mix associated with Alternative C would be the same as for Alternative B, while the acreages of each treatment type would differ from that associated with Alternative B. However, the total number of acres receiving treatment is similar (67 fewer acres to receive treatment with Alternative C). In addition, the areas to be treated by both alternatives are similar, and the same culverts would be replaced and the same stream crossings would be improved with both alternatives. These factors, when combined, result in visual resource impacts from implementation of Alternative C being similar to those that were discussed for Alternative B.

Similar to Alternative B, activities included in Alternative C would be consistent with the Retention VQO of the area because: 1) few or no activities are proposed in those areas; and 2) the areas that would be treated there would be small and irregular in shape, which would reduce how visually evident the treatments would be. Proposed activities would be consistent with the Partial Retention VQO because activities may be evident, but would remain visually subordinate to the landscape. Proposed activities would also be consistent with the Modification VQO because the landscape modifications associated with this alternative may visually dominate the landscape, but must be similar to the visual characteristics of the surrounding area.

Cumulative Impacts

Implementation of Alternative C would not contribute incrementally to cumulative impacts when considered in combination with the other projects listed above and in Table 3-1 that would be implemented in the area. This is based on the following reasons: 1) three of the six projects would be located 20 miles away from the analysis area (not in the same viewshed); 2) all six projects, plus the Proposed Action, are relatively short-term projects that would result in short-term visual impacts because the treated areas would recover quickly; and 3) impacts on visual resources associated with implementation of Alternative C would be similar to those discussed for Alternative B, and no significant impacts on visual resources from implementation of Alternative B are expected.

Mitigation

Because no significant impacts were identified, no mitigation is necessary.

3.11 Economics

3.11.1 Introduction

The section addresses economics associated with the proposed project. It is not a critical issue for this analysis and therefore only an effects analysis is presented. Presenting a comparative analysis of potential economic effects is useful in evaluating alternatives of the proposed project.

3.11.2 Environmental Consequences

There would be many non-market benefits from the proposed project, in addition to the market costs and benefits. The most important non-market benefit would be improvements in aspen stands, which would benefit wildlife and livestock. The number of aspen acres that would be treated under each alternative is shown in Table 3-43. The NEPA costs shown in Table 3-43 are only assessed to the economic benefit of timber removal. In reality, the NEPA costs would be allocated over all market and non-market benefits. Harvest volumes used in this analysis are 11,500 thousand board feet (MBF) for Alternative B (Proposed Action) and 10,000 MBF for Alternative C (Reduced Harvest and Temporary Roads).

TABLE 3-43
Economic Comparison of Alternatives A, B, and C for the Cottonwood II Management Project

	Alternative A No Action	**Alternative B Proposed Action**	**Alternative C Reduced Harvest and Temporary Roads**
Net Volume (MBF)	0	11,500	10,000
Gross Revenue (Sawlog Standard Rate Value)	$0	$1,016,600	$884,000
Gross Revenue (Sawlog Appraised Value)	$0	$973,130	$846,200
Gross Revenue (Sawlog Bid Value)	$0	$1,570,670	$1,365,800
Gross Revenue (Average of bid value and standard rate)	$0	$1,293,635	$1,124,900
Projected NEPA Costs	$238,852	$238,852	$238,852
Projected Timber Sale Preparation and timber Sale Administration Costs	$0	$770,500	$670,000
Net Revenue (Gross Revenue – Costs)	- $238,852	$284,283	$216,048
Aspen Acres Treated	0	1,115	1,153

3.11.2.1 Revenues

The standard rate for 2003-2004 for live mixed conifer sawlogs had an average value of $88.40 /MBF, which was used in this analysis. Dead sawtimber is evaluated the same as live sawtimber for this analysis. Advertised rates for mixed conifer based on 2003-2004 timber sales on the B-TNF averaged $84.62/MBF. Actual sale bid rates for the 2003-2004 sales averaged $136.58/MBF.

3.11.2.2. Costs

Cost estimates used in this analysis were based on B-TNF 3-year historical average costs (FY 2001-FY 2003) adjusted for inflation. The *Sale Preparation Cost*, or the cost to implement sales in Alternatives B and C, is estimated to be $37/MBF. This includes sale planning and layout, tree marking, cruising, contract preparation, other resource support, and associated Forest Service costs for brush disposal, road work, and road maintenance.

The *Timber Sale Administration Cost*, based on a 3-year historical average (FY 2001-FY 2003) adjusted for inflation is $30/MBF. Reforestation costs would include tree planting, plantation protection, and regeneration surveys. However, not all areas would be planted, as some would rely on natural regeneration. Areas not to be planted might include aspen regeneration areas and areas having partial-cut treatments.

3.11.2.3 Economic Effects of Alternatives on Local Communities

Table 3-44 summarizes the number of employment years, value to the community, and taxes generated from the timber harvest activities of the proposed project. Employment estimates do not reflect new jobs and income, but jobs and income that could be sustained by harvesting timber at the level proposed in each alternative. This value is calculated as the amount of timber in MMBF times 10.4 person years (Timber Sale Project Information Reporting System [TSPIRS]). Multiplying the timber volume harvest (MMBF) by $519,000 generates the economic value of the proposed projects to local communities (TSPIRS). And finally, taxes were generated by multiplying the economic value to the community by 15 percent (TSPIRS). The values shown in this analysis are not absolute, but provide reasonable estimates for comparison purposes.

TABLE 3-44
Economic Effects on Local Communities of Alternatives A, B, and C for the Cottonwood II Management Project

Effect	Alternative A No Action	Alternative B Proposed Action	Alternative C Reduced Harvest and Temporary Roads
Employment Years	0	119.6	104
Value to Community	$0	$5,968,500	$5,190,000
Taxes Generated	$0	$895,275	$778,500

In summary, there would be many non-market benefits from implementing the proposed project (Alternatives B and C), in addition to the market costs and benefits. The most important non-market benefit would be improvements in aspen stands, which would benefit wildlife and livestock. Estimated net revenue for the three alternatives is minus $238,852 for Alternative A, plus $284,283 for Alternative B, and plus $216,048 for Alternative C. The estimated value to the community and taxes generated for the proposed project would be $5,968,500 and $895,275, respectively, under Alternative B, and $5,190,000 and $778,500, respectively, under Alternative C.

3.12 Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

The action alternatives (Alternative A – Proposed Action, Alternative B – Reduced Harvest and Temporary Roads) 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 ensure that long-term productivity is not impaired by short-term uses and management practices.

3.13 Unavoidable Adverse Effects

Some minor adverse effects on components of the ecosystem cannot be avoided even with selection of the No Action Alternative. Alternative designs, mitigation measures, and management requirements would avoid or reduce most environmental effects from implementation of action alternatives. A summary of specific adverse effects for each alternative is presented below. The various resource sections in Chapter 3 provide more information on the type, duration, and scope of impacts, as well as resource benefits.

3.13.1 Alternative A - No Action

Vegetation. Vegetation would remain outside desired conditions and aspen stands would continue to decline. The risk of stand replacement fires, particularly in older stands, would continue and increase.

Wildlife. The gradual decline of aspen stands over time would indirectly reduce habitat values for elk and migratory birds.

Fire. Fire would be excluded from playing its historical ecological role under No Action.

Recreation. Big game populations would not benefit from improved habitat and habitat, particularly aspen, would continue to decline. This would adversely affect hunting opportunities. Fishing would be adversely affected, as Nylander Creek would continue to receive sediment input from Nylander Road. Fishing would not improve in stream segments upstream of culverts that do not pass fish.

3.13.2 Alternative B – Proposed Action

Vegetation. There would be a short-term loss of forested habitat within the 13.8 miles of temporary road footprints.

Wildlife. There would likely be some short-term adverse population and individual effects, due to displacement of wildlife from treatment areas during treatment activities. This effect would decrease over time.

Water Quality. There would be a short-term increase in sediment input into streams during replacement of culverts and bridges and road improvement activities.

Stream Channels. There would be short-term disturbance of stream channels during replacement of culverts and bridges.

Fisheries. CRCT would be temporarily affected due to increased stream sediment loads from culvert and bridge replacements.

Sensitive Species. There may be short-term effects to individual Payson's milkvetch during vegetation treatments, but there would be no long-term effects.

Threatened and Endangered Species. Grizzly bear, gray wolf, and Canada lynx may be temporarily displaced during treatment activities, but would be expected to return to the area after treatments are complete.

Cultural Resources. There would be a visual impact to the Old Indian Trail due to clearcutting of three units.

Recreation. Some short-term disturbance of dispersed recreation would be expected due to area closures during treatment.

3.13.3 Alternative C – Reduced Harvest and Temporary Roads

Vegetation. There would be a short-term loss of forested habitat within the 9.3 miles of temporary road footprints.

Wildlife. Effects would be the same as discussed above for Alternative B, but at a lower intensity due to the reduced level of treatment.

Water Quality. There would be a short-term increase in sediment input into streams during replacement of culverts and bridges and road improvement activities.

Stream Channels. There would be a short-term disturbance of stream channels during replacement of culverts and bridges.

Fisheries. CRCT would be temporarily affected due to increased stream sediment loads from culvert and bridge replacements.

Sensitive Species. There may be short-term effects to individual Payson's milkvetch during vegetation treatments, but there would be no long-term effects.

Threatened and Endangered Species. Grizzly bear, gray wolf, and Canada lynx may be temporarily displaced during treatment activities, but would be expected to return to the area after treatments are complete.

Recreation. Some short-term disturbance of dispersed recreation would be expected due to area closures during treatment.

3.14 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those

that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

There would be no irreversible commitment of resources with the proposed project. A very small irretrievable commitment would be made in those areas where roads are improved.

3.15 Cumulative Effects

No adverse cumulative effects would result from implementation of the proposed project. The various resource sections in Chapter 3 provide more information on the type, duration, and scope of cumulative effects.

3.16 Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." 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 Section 3.6.5.2 of this EIS.

Clean Air Act. Prescribed burning on up to 1,058 acres of aspen is planned for Alternatives B and C. This burning would take place in fire-dependent ecosystems in which periodic fires burned on an average of every 50 to 150 years. Burning of fuels from slash associated with timber harvest (mostly slash pile burning) would take place on an additional 566 acres (Alternative B) to 495 acres (Alternative C). Any prescribed burning undertaken as part of this project would be managed to comply with state and federal air quality regulations and control.

National Historic Preservation Act. See Section 3.8, Heritage Resources for discussion.

Clean Water Act. Section 313 of the CWA 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 would comply. Timber sale contract provisions regarding prevention and containment of oil and fuel spills would be included. No harvesting operations would 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 would 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 A, No Action, would require no energy directly to implement. The energy required to implement the action Alternatives B and C, in terms of petroleum products, is negligible when compared to national and worldwide petroleum reserves. Prescribed burning on up to 1,058 acres as proposed in Alternatives B and C 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 under the action alternatives may cause minor, mitigatable effects to riparian areas, wetlands, and floodplains. No new crossings of streams are planned. Mitigation work to improve existing crossings would be implemented as described for the action alternatives. No timber harvest activities or lighting of prescribed burns would take place within 300 feet of streams. No net loss of wetlands is anticipated.

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 WGFD personnel to achieve conditions beneficial to big game populations and management in the area. Coordination with the BLM and adjacent private landowners would be required during proposed prescribed burning planning and operations. Coordination would also take place for use of project access roads crossing private and BLM lands.