Steamboat Project

Draft Environmental Impact Statement

Black Hills National Forest
Northern Hills Ranger District
Spearfish, South Dakota

August 2011
<table>
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<td>Code of Federal Regulations</td>
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Steamboat Project
Draft Environmental Impact Statement
Lawrence, Meade and Pennington Counties
South Dakota

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Abstract: The Northern Hills Ranger District of the Black Hills National Forest has prepared a Draft Environmental Impact Statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The Northern Hills Ranger District proposes to implement multiple resource management actions within the Steamboat project area as guided by the Black Hills National Forest Land and Resource Management Plan as amended. The focus of the proposed actions is modification of stand structure across the planning area to improve structural diversity in big game winter range, reduce the risk of mountain pine beetle infestation and reduce the fire hazard. Actions used to achieve these goals include prescribed burning, non-commercial thinning, and commercial timber harvest. The District also proposes to additions and improvements to the Forest’s transportation system to facilitate vegetation management activities. Four alternatives are considered in detail. Alternative A is the no action alternative; under this alternative, no management actions associated with this project would occur. Alternative B is the modified proposed action and includes silvicultural treatments designed to increase structural diversity, limit the potential of mountain pine beetle infestations, and reduce fire hazard. Alternative C expands upon the treatments proposed under Alternative B to treat a higher percentage of the project area, affecting a greater change to mountain pine beetle risk and fire hazard. Alternative D limits the treatments to stands that are accessible from the existing road network, removing the potential impact of new road construction on wildlife, soil and water resources. This DEIS discloses the direct, indirect, and cumulative environmental impacts expected from each of the four alternatives.
Summary

The Northern Hills Ranger District (NHRD) of the Black Hills National Forest (BHNF) proposes to implement multiple resource management actions within the Steamboat project area as guided by the Black Hills National Forest Land and Resource Management Plan and Phase II Amendment (Forest Plan). The Steamboat project area covers a total of 24,596 acres including approximately 21,833 acres of National Forest System (NFS) land and approximately 2,713 acres of interspersed private land immediately east of Nemo, South Dakota, and immediately west of Piedmont, South Dakota (see Appendix A, Map 1). The proposed resource management actions apply to NFS land only and do not involve private land except where rights-of-way are established to allow Forest Service access to NFS land across private property.

The focus of the modified proposed action (Alternative B) is to modify stand structure across the project area to increase structural diversity in big game winter range, reduce the risk of mountain pine beetle infestation and reduce the fire hazard. Alternative B would treat a total of 12,336 acres through commercial and non-commercial timber harvest. This alternative could include a maximum of 10,608 acres of prescribed fire. Alternative C was developed in response to the issue of mountain pine beetle risk. Under Alternative C, a total of 18,049 acres would experience commercial or non-commercial harvest. Alternative C would also include 10,608 acres of potential prescribed burns. Alternative D was developed in response to the issue of new road construction. The treatments in this alternative were limited to the existing road network, eliminating the impact that new road construction could have on wildlife, soil and water resources in the project area. Alternative D includes 9,394 acres of commercial and non-commercial harvest and up to 10,608 acres of prescribed burning. The alternatives are described in detail in Chapter 2.

Comments on the proposed action, potential concerns, and opportunities for managing the Steamboat project area were solicited from members of the public, other government agencies, adjacent property owners, and organizations. Methods used to request comments included publishing a Notice of Intent (NOI) to prepare an EIS in the Federal Register on December 15, 2010. A scoping letter was mailed on December 10, 2010 to approximately 423 interested parties. A public open house was held on January 12, 2011, at the Fire Hall in Piedmont, South Dakota.

Comments received during the scoping process were used to help define issues and to develop alternatives and design criteria. Through review and analysis of the scoping comments and input, the Responsible Official identified three significant issues related to the proposed activities. These issues led to the development of two action alternatives.

The alternatives analyzed in detail in this EIS are summarized below:

**Alternative A (No Action)** – The National Environmental Policy Act (NEPA) requires study and use of the no action alternative as a basis for comparing the effects of the proposed action and other alternatives. This alternative assumes no implementation of any elements of the proposed action or other action alternatives. Alternative A does not attempt to actively respond to the purpose of and need for action or the issues brought forth during scoping for this project. Under the no action alternative, no effort to modify existing vegetation or related fuels and habitat conditions in the project area would occur. None
of the actions associated with this EIS would occur. Actions such as ongoing Forest protection efforts, recurring road maintenance on system roads and wildfire suppression would continue as directed by the Forest Plan. Actions analyzed under past projects or proposed by future projects, including prescribed burns and ongoing timber harvest, may still occur.

**Alternative B (Proposed Action)** – Alternative B is the modified proposed action and was developed to address the purpose and need. This alternative would modify stand structure across the planning area to increase structural diversity in big game winter range, reduce the potential of mountain pine beetle infestations and reduce fire hazard. A variety of vegetation management tools, including uneven-aged and even-aged timber harvest, would create a mosaic of vegetative structure, providing both thermal cover and browsing areas. In addition, thinning of densely stocked ponderosa pine stands would reduce the risk of pine beetle outbreaks. By strategically locating vegetative treatments and prescribed burns across the landscape, the continuity and density of fuels would be modified to reduce the risk of large wildfires. A total of 12,336 acres of the project area would receive vegetation treatments under Alternative B with up to 10,608 acres of prescribed burning possible.

Implementation of Alternative B would require 20 miles of new road construction and 5 miles of new road conversion. Newly created roads do not currently exist on the ground; an entirely new route would be constructed. Converted roads already exist in some form, but are not part of the NFS road system. For the purposes of this project, those roads would be added to the NFS and maintained accordingly. All roads constructed or converted for this project would be closed following project activities, unless identified for inclusion on the motorized vehicle use map (MVUM). In addition, approximately 75 miles of existing NFS roads would require some level of pre-use maintenance, ranging from minimal maintenance to reconstruction of the road template. Roads where maintenance is conducted would be available for public use depending on the direction provided by the MVUM.

**Alternative C** – Alternative C was developed in response to the issue of mountain pine beetle infestation. Some comments raised concerns that the proposed action left too many stands untreated that have a medium or high mountain pine beetle risk. Alternative C responds to this issue by adding treatments to those stands where possible. This alternative would apply vegetative treatments to approximately 18,049 acres. The area analyzed for prescribed burning would remain the same as Alternative B at 10,608 acres.

Implementation of Alternative C would require 41 miles of new road construction and 10 miles of new road conversion. In addition, the alternative would require 81 miles of pre-use maintenance of existing NFS roads.

Alternative C would also require a project-specific amendment to the Forest Plan exempting the Steamboat Project from Forest Plan standard 3108 concerning vegetation management activities within goshawk nest areas.

**Alternative D** – Alternative D was developed in response to the issue of new road construction. Concerns were raised that construction of 20 miles of new roads, as proposed under Alternative B, would unnecessarily impact natural resources in the project area, such as wildlife, soil and water
resources, in an area that already contains a relatively high density of roads. Alternative D does not include any new road construction; however, the new road conversion would remain since those routes already exist on the ground and would only require addition to the NFS for use. The treatments proposed under Alternative D are identical to those in Alternative B except that any commercial treatments requiring new road construction were dropped from Alternative D. Alternative D includes a total of 9,394 acres of vegetation treatment. The level of prescribed burning would be identical to Alternatives B and C at 10,608 acres.

Implementation of Alternative D would not require any new road construction. Four miles of road conversion would be required along with 70 miles of pre-use maintenance.
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1 PROPOSED ACTION AND PURPOSE OF AND NEED FOR ACTION

1.1 Document Structure

The Northern Hills Ranger District (NHRD) of the Black Hills National Forest (BHNF) has prepared this Draft Environmental Impact Statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This DEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into eight chapters:

Chapter 1 - Proposed Action and Purpose of and Need for Action: The chapter includes information related to the background of the project proposal, the purpose of and need for the project and a description of the agency’s proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2 - Alternatives: This chapter provides a more detailed description of the proposed action and alternative methods for achieving the stated purpose and need. These alternatives were developed based on significant issues raised by public comments, by other agencies, and internally. This section also includes summary tables displaying the activities planned by alternative and a comparison of the alternatives’ response to the elements of the purpose and need.

Chapter 3 - Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing each alternative. The analysis is organized by resource area (Fire and Fuels, Recreation and Travel Management, Wildlife, Hydrology and Soils, etc.).

Chapter 4 - Index: The index provides page numbers by document topic.

Chapter 5 - Bibliography: The bibliography provides a list of references supporting the documentation in the DEIS.

Chapter 6 - Glossary: The glossary provides a list of key words, acronyms and terminology used throughout the DEIS.

Chapter 7 - List of Preparers: This chapter provides information on those who conducted the analysis documented in this DEIS.

Chapter 8 - Recipients of Planning Documents: This chapter provides a list of those to whom the DEIS will be sent.

Appendices: The appendices provide more detailed information to support the documentation and analysis presented in the DEIS.

Additional documentation, including more detailed analyses of project area resources, is located in the project file at the NHRD office in Spearfish, South Dakota. These documents are available upon request.
1.2 Introduction

This DEIS discloses the environmental effects of vegetation management activities and associated additions to and maintenance of the transportation system proposed in the Steamboat project area. These activities are proposed by the NHRD of the BHNF to improve project area forest conditions to increase structural diversity in big game winter range, reduce the risk of mountain pine beetle infestation and reduce the fire hazard across the project area. This DEIS will be subject to a 45-day review and comment period. All comments received on the DEIS will be reviewed and addressed in a Final Environmental Impact Statement (FEIS).

The environmental analysis documented here is tiered to:

3) The Record of Decision for the 2005 Phase II Amendment (Phase II ROD) (USDA-Forest Service 2005b).

1.2.1 The Project Area

The Steamboat project area is located in Lawrence, Meade and Pennington Counties, South Dakota, in the northern Black Hills. The project area covers a total of 24,596 acres including approximately 21,833 acres of National Forest System (NFS) land and approximately 2,713 acres of interspersed private land immediately east of Nemo, South Dakota and west of Piedmont, South Dakota and the Interstate 90 corridor. Landmarks within the project area include Steamboat Rock, Dalton Lake and Stagebarn Canyon. Ponderosa pine is the dominant cover type in the project area, covering 21,060 acres. Other cover types include aspen (320 acres), grassland (229 acres), white spruce (138 acres), and bur oak (136 acres).

Approximately 121 miles of existing NFS roads are located in the Steamboat project area. Forest Highway 26 (Vanocker Canyon Road) and Forest System Road (FSR) 144 (Nemo Road) are the primary travel routes that access the project area. Approximately 9.5 miles of the Centennial trail crosses the project area. Recreation features located in the project area include the Steamboat Rock picnic area and the Dalton Lake campground and adjacent trailhead, which provide access to the Centennial trail.

The project area includes all or portions of the legal descriptions shown in Table 1-1.
Table 1-1. Steamboat Project Area Legal Description

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Black Hills Meridian

1.3 Background

1.3.1 Agency Direction

The Forest Plan was revised in 1997 and amended in 2001 by the Phase I Amendment, which provided interim direction until the Phase II Amendment was completed and took effect in March of 2006. The Phase II Amendment directs multiple-use land management with an emphasis on two key factors that are affecting the Black Hills today: the threat of high severity wildfires and epidemic mountain pine beetle infestations.

1.3.2 Historical Perspective

Euro-American settlement of the Black Hills began shortly after the Custer Expedition confirmed the presence of gold in 1874. The subsequent gold rush led to rapid settlement of the area, which brought with it mining, logging, road construction, grazing, non-native plants and animals, human-caused fires, suppression of natural fires, and many other activities. All of these actions contributed to altering the natural disturbance regime of the forest.

The Black Hills Forest Reserve was created in 1897 and transferred to the Forest Service upon its creation in 1905. In 1907, it was renamed the Black Hills National Forest. Case 1, the first commercial timber sale on federal land, occurred in 1898 near Nemo, South Dakota in what is now the Northern Hills Ranger District. A portion of the Case 1 sale area is within the Steamboat project area boundary.

As a result of the gold rush-era settlement, the BHNF contains a significant number of private in-holdings, creating a checkerboard land ownership pattern. Historically, these in-holdings were most often mining claims or ranches. In recent years, many of these private land inclusions have been developed by real estate investors and private individuals. The result is that the forest is currently scattered with numerous homes, businesses and other developments, creating a substantial amount of wildland urban interface (WUI).

Mountain Pine Beetles

One of the primary forest health issues affecting the Black Hills is the mountain pine beetle epidemic. Mountain pine beetles are native to western ponderosa pine forests. They are a natural part of the Black Hills ecosystem and were at one time known as the “Black Hills beetle”. Large infestations occur in the Black Hills on a cyclical basis, usually in association with drought conditions, which lessen the ability of individual ponderosa pine trees to produce enough sap to expel invading beetles. Southwestern South Dakota is recently removed from a prolonged drought. Beetle infestations are currently widespread across the BHNF with epidemic populations located in several areas of the Black Hills. The
highest levels of beetle activity are near Deerfield Lake in the central Hills, the Black Elk Wilderness in the southern Hills, and near Custer Peak in the northern Hills. The Steamboat project area lies directly east of the Custer Peak area.

Beetles generally attack ponderosa pine trees that are located in dense stands (Shepperd and Battaglia 2002). Studies by Schmid and Mata (1992) indicate that ponderosa pine stands with a basal area (BA) of 120 or higher may be at the highest risk for beetle attack. Research has shown that stands with a BA less than 80 are at low risk for infestation (Schmid and others 1994). Stressed trees, such as those in drought areas, are more susceptible to attack (Schmid and others 1991). The likelihood of infestations in healthier trees and less dense stands increases as the beetle population increases.

Beetles infect trees by boring through the sapwood to lay their eggs. The beetles carry spores of the blue-stain fungus which is transmitted to the tree (Amman and others 1989). This fungus restricts the tree’s sap flow and eventually causes mortality. Healthy, unstressed trees are sometimes able to “pitch out” invading beetles by increasing their sap flow and pushing beetles out their bore holes (Shepperd and Battaglia 2002). Stress conditions caused by drought or large numbers of invading beetles reduce the effectiveness of the “pitch out” tactic (Shepperd and Battaglia 2002).

Epidemic pine beetle populations can kill large patches of ponderosa pine and have multiple effects on the associated ecosystem. Large patches of dead trees increases the amount of available foraging and nesting habitat for woodpeckers, provides open forage areas for big game, and allows aspen and birch to propagate in new openings. On the other hand, species that depend on dense pine forests for roosting or nesting habitat, such as American marten or northern goshawks, are negatively affected. Large patches of dead trees create an accumulation of fuels on the forest floor when they eventually fall. Large infestations decrease scenic values as the dead trees support red needles for two or three years. Particularly large infestations can create areas of dead trees thousands of acres in size.

**Wildfires**

One of the greatest impacts that Euro-American settlement has had on the Black Hills is widespread fire suppression. Researchers have come to different conclusions regarding the historic fire regime of the Black Hills. Shinneman and Baker (1997) introduced the idea that prior to Euro-American settlement the northern Black Hills, with its relatively wetter climate, was more susceptible to infrequent, high-intensity fires than the drier southern Black Hills, which they suggest experienced more regular, low-intensity fires. Brown and others (2003) contend that crown fires did not play a role in the historical fire regime and that frequent, low-intensity fires kept the fuel load low and prevented the development of high-intensity crown fires across the forest. In either case, it is agreed that human settlement has altered the fire regime of the Black Hills significantly. Brown and Sieg (1996) found that the longest “fire free interval” on Jewel Cave National Park, which is within the BHNF, prior to Euro-American settlement was 79 years. The longest fire free interval in the post-settlement area was 104 years (Brown and Sieg 1996). On some sample sites, the current fire free interval was more than twice as long as the longest pre-settlement interval, indicating that widespread settlement of the area has resulted in fires occurring less frequently across the landscape than they did prior to settlement (Brown and Sieg 1996).

Historical photos taken during the 1874 Custer Expedition, when compared to present-day photos taken at the same locations, clearly show that the ponderosa pine forest is much denser now and has encroached upon many areas that were once open meadows or hardwood stands. In the interest of
protecting homes, timber and other assets, the Forest Service adopted a national policy of suppressing all wildfires as quickly as possible following a particularly severe fire season, known as the “Big Burn”, which burned approximately three million acres over a two day period in Washington, Montana and Idaho in 1910. This practice continued for several decades and has resulted in many forests, including the Black Hills, accumulating a large fuel load that would have historically been reduced by frequent, low-intensity fires.

Prior to the year 2000, wildfires burned an average of 2,400 acres annually on the BHNF (USDA-Forest Service 2005a). Since 2000, wildfires have burned over 35,000 acres annually (USDA-Forest Service 2005a). The number of fires has remained fairly constant over time at 65-130 starts per year and the number of wildfires escaping initial attack has also remained constant; however, fires that escape initial attack have recently become larger and more difficult to control. The average size of fires over 300 acres in size has increased from less than 1,000 acres per fire in the early 1900s to over 8,000 acres per fire in recent years (USDA-Forest Service 2005a). From 1900 to 1980, large fires (300 acres or more) burned about 147,900 acres in the Black Hills. Since 1980, a dramatic increase in acreage burned has occurred. Wildfires occurring since 1980 including Jasper, Battle Creek, Little Elk, Roger’s Shack, Elk Mountain II, Grizzly Gulch, Flaggpole, Galena, and Westberry Trails have burned approximately 238,500 acres (USDA-Forest Service 2005a). In addition, recent fires such as Ricco, Eastridge and Harbaugh have burned in the WUI, threatening or destroying multiple homes and other structures before they were brought under control. The Little Elk fire of 2002 burned approximately 600 acres of the Steamboat project area and the Ricco fire of 2005 burned approximately 4,000 acres within the project boundary.

**Human Use of the Forest**

The Steamboat project area is located near the cities of Sturgis and Rapid City, South Dakota and is immediately adjacent to the Interstate 90 corridor. Because of its location and the recreation opportunities present, it receives a significant amount of recreational use throughout the year. The Dalton Lake campground and trailhead receives heavy use during the summer, especially during holidays or on weekends. The Centennial Trail is a popular destination, primarily for non-motorized recreation. The project area is popular for big game hunting and experiences heavy hunter traffic in the spring and fall. Recreational use of the area continues to increase, as do conflicts between motorized and non-motorized users. Heavy use sometimes results in trash dumping, illegal fires, vandalism, and negative impacts on natural resources. Motorized travel restrictions are difficult to enforce. The main travel routes within the project area include are Vanocker Canyon Road and Nemo Road. Numerous unpaved roads provide access to a majority of the project area.

Approximately 2,713 acres of private land is scattered across the Steamboat project area. Much of this land remains undeveloped and is occupied by working ranches. An increasing amount of private land is being sub-divided and individual residences, as well as small sub-developments, are being constructed within the project area.

**Project History**

The Steamboat Project was originally set to be analyzed in 2009/2010 as a much larger project area of the same name encompassing over 60,000 acres. After reviewing the available data, considering timelines, and assessing conditions on the ground, the NHRD determined that it would be more efficient to split the Steamboat project area in two using Nemo Road and Vanocker Canyon Road as the dividing line. This division created the Nautilus project area to the west of the dividing line while the eastern half
retained the Steamboat name. The Nautilus Project was analyzed in 2009/2010 with a Record of Decision (ROD) signed on November 9, 2010.

The scoping period for the Steamboat Project began on December 10, 2010, when a letter describing the proposed action was sent out for public comment to landowners, organizations, local governments, state and federal agencies, and concerned citizens and groups. A public meeting to discuss the project and identify issues to be considered for alternative actions was held in Piedmont, South Dakota on January 12, 2011. The Notice of Intent (NOI) to produce an EIS appeared in the *Federal Register* on December 15, 2010.

### 1.4 Management Direction

#### 1.4.1 Forest Plan Direction

The Forest Plan, as amended, supported by the FEIS for the revision and the Phase II Amendment (USDA-Forest Service 1997, 2005a, 2005c), is the Forest programmatic document required by the rules implementing the Forest and Rangeland Renewable Resources Act of 1974 (RPA) as amended by the National Forest Management Act of 1976 (NFMA). The purpose of the Forest Plan is to provide direction for the multiple use and sustained yield of goods and services from NFS lands in an environmentally sound manner. The Forest Plan provides overall goals and objectives (Chapter 1), standards and guidelines (Chapter 2), and Management Area-specific goals, objectives, standards and guidelines (Chapter 3) that direct management of the BHNF.

The Phase II Amendment to the Forest Plan (USDA-Forest Service 2005c) was approved on October 31, 2005, and took effect on March 6, 2006. The amendment provides additional direction related to species viability, management of fire risk, and management of insect infestations.

The Forest Plan and Phase II Amendment establish 11 goals, each with associated objectives, for multiple-use management of the BHNF. Goals 1, 2, 4, and 10 address natural resource objectives for multiple-use management of the forest. Goal 3 and Goals 5 through 9 provide socio-economic emphasis for management of the forest. Goals and objectives, applicable to specific resource management issues needing resolution, provide the basic direction for defining the purpose and need and ultimately developing the proposed action (Alternative B). Forest Plan goals are discussed in Chapter 1 of the Forest Plan. Goals 1 through 4, 7 and 10 provide management emphasis and direction applicable to the Steamboat Project:

- **Goal 1.** Protect basic soil, air, water, and cave resources.
- **Goal 2.** Provide for a variety of life through management of biologically diverse ecosystems.
- **Goal 3.** Provide for sustained commodity uses in an environmentally acceptable manner.
- **Goal 4.** Provide for scenic quality, a range of recreational opportunities, and protection of heritage resources in response to the needs of the Black Hills National Forest visitors and local communities.
- **Goal 10.** Establish and maintain a mosaic of vegetative conditions to reduce the occurrences of stand replacing fire and insect-and-disease events, and to facilitate insect and disease
management and firefighting capability adjacent to at-risk communities, sensitive resources, and non-federal land and generally across the Forest.

Chapter 3 of the Forest Plan also sets management allocations for specific uses of Management Areas (MAs) within the forest to meet multiple-use objectives. The Steamboat project area is comprised of the following MA:

<table>
<thead>
<tr>
<th>Management Area</th>
<th>Emphasis</th>
<th>Acres in Project Area*</th>
<th>Percent of Project Area</th>
<th>Management Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4 FGR</td>
<td>Big Game Winter Range</td>
<td>21,833</td>
<td>100</td>
<td>These areas are managed to provide high-quality winter and transitional habitat for deer and elk, high-quality turkey habitat, habitat for other species, and a variety of multiple uses.</td>
</tr>
</tbody>
</table>

*Reflects NFS acres only.

MA 5.4 is managed according to its own set of standards and guidelines, in addition to those established for the overall Forest Plan. When general Forest Plan standards and guidelines conflict with those specific to a MA the more site-specific or stringent standard or guideline applies (USDA-Forest Service 2005c).

### 1.4.2 Forest Plan Objectives

The Responsible Official for the Steamboat Project has chosen to propose resource management actions that respond to amended Forest Plan goals 1, 2, 3, and 10. Associated with these goals are specific resource objectives. Comparing objectives to current conditions is integral to defining the purpose and need and developing the proposed action. Objectives providing management emphasis for this project are summarized below. Note that other amended Forest Plan goals and objectives not mentioned below also provide guidance and are achieved to varying degrees depending on project accomplishment (USDA-Forest Service 2005c).

**Goal 1: Protect basic soil, air, water, and cave resources.**

**Objective 103:** Maintain or improve long-term stream health. Achieve and maintain the integrity of aquatic ecosystems to provide stream channel stability and aquatic habitats for water quality in accordance with state standards.

Protection of stream channels and water quality is important to wildlife and plants within the Black Hills as well as humans, who reside, recreate, or work in or near the Black Hills. Healthy streams provide more and better habitat for plants and animals. Polluted or otherwise degraded streams could have a negative impact on wildlife, plant, and human usage both in the Black Hills and in areas downstream.
Eight out of the nine Hydrologic Unit Code (HUC) 7th level watersheds in the Steamboat project area are identified as Class 3, the most impaired and at-risk classification. Opportunities exist to improve watershed conditions by implementing projects that improve stream health, such as mitigating connected disturbed areas (CDA).

**Objective 105:** Prohibit motorized vehicle use in wetlands, wet meadows, and riparian areas, except at specified locations and times of the year.

Wetlands, wet meadows, and riparian areas represent valuable areas for a variety of plant and animal species in the Black Hills. In a region where water is relatively scarce, the areas of water that do exist are particularly important to the ecosystem. The Steamboat project area contains numerous riparian areas, all of which eventually drain eventually into the Missouri River via the Cheyenne River. Several of these riparian areas are crossed by roads, both NFS and non-NFS.

The opportunity exists to meet this objective by minimizing the number of new roads that cross riparian areas, closing new roads after timber harvest, and repairing existing CDA.

**Objective 108:** Manage for sustained or improved water flows.

Sustained water flows are important to the cycling of nutrients through a stream and the preservation of habitat for certain aquatic plant and animal species. Many streams in the Steamboat project area are ephemeral or intermittent and have been impacted by an increase in compacted area and loss of floodplain areas.

Opportunities exist to sustain water flows through management of upland vegetation and mitigation of the impacts of roads and off-road motorized vehicles, as mentioned for Objective 105 above.

**Goal 2:** Provide for a variety of life through management of biologically diverse ecosystems.

**Objective 201:** Manage for a minimum of 92,000 acres of aspen (double current aspen acres), and 16,000 acres of bur oak (approximately 33 percent increase) during the life of the Plan. The highest priority for hardwood restoration is where conifers (e.g., spruce and pine) have out-competed aspen adjacent to riparian systems that once supported beaver. Increases in bur oak will be focused away from the Bear Lodge Mountains.

National Forest System lands in the Steamboat project area include approximately 320 acres of aspen/birch and 136 acres of bur oak. Ponderosa pine encroachment into hardwood stands is occurring forest-wide. Pine is able to out-compete hardwood regeneration, eventually taking over the stand and reducing total hardwood acreage. Hardwood stands, particularly aspen and birch stands, provide important cover, browse, or nesting habitat for a variety of wildlife species. Loss of these stands has a negative impact on the overall diversity of wildlife habitat.

The opportunity exists to remove pine from hardwood stands to reduce competition and rejuvenate the hardwood component. This would allow current aspen, bur oak, and paper birch stands to persist and eventually expand in the absence of pine competition.
**Objective 203:** Manage 30 to 50 percent of each bur oak stand for 100-plus year old trees.

Bur oak is located on approximately 136 acres in the project area. These stands, along with other areas across the project area, could contain some component of bur oak in the understory.

An opportunity exists to open bur oak stands by selecting for tree-form oak and opening the understory to allow stands to develop fully. Doing so would create more diversity of potential wildlife habitat and reduce overall fire hazard.

**Objective 204:** Conserve and manage birch/hazelnut, lodgepole pine, limber pine, and Douglas fir.

Paper birch represents a unique habitat within the ponderosa pine-dominated Black Hills and is therefore valuable to certain wildlife and plant species. Paper birch is often associated with hazelnut, which provides another unique habitat component. The birch/hazelnut habitat type is often associated with suitable botanical habitat for Sensitive Species (SS) or Species of Local Concern (SOLC).

The Steamboat project area includes scattered pockets of birch, often associated with aspen. The opportunity exists to conserve these stands by thinning competing vegetation and leaving behind hazelnut. Removing competing pine regeneration will allow paper birch to develop as the dominant overstory species, will help hazelnut expand in the understory, and will preserve suitable botanical habitat in the understory.

Limber pine, lodgepole pine and Douglas fir are not known to occur in the Steamboat project area.

**Objective 205:** Manage for 122,000 acres of prairie grassland and 3,600 acres of meadow during the life of the Plan. Restored areas will not be considered suitable for timber production.

The project area includes 229 acres of grasslands. These are an important aspect of the Black Hills ecosystem as they provide critical habitat for a variety of plant and animal species. Many grassland areas are being overtaken by encroaching ponderosa pine. Preservation of grassland areas is desirable in maintaining a diversity of habitat types across the project area.

The opportunity exists to remove ponderosa pine regeneration from grasslands. Doing so will preserve and enhance this important habitat component.

**Objective 211:** Within a management area in conifer forested portions of the Forest, provide an average of 3 hard snags greater than 9-inch dbh and 25 feet high per acre, well dispersed across the forest, 25 percent of which are greater than 14” dbh.

Snags provide important nesting and foraging habitat for several bird and mammals species, including several SOLC and Management Indicator Species (MIS), in the Black Hills (USDA-Forest Service 2005a). Woodpeckers, especially, are highly dependent on snags. Snags take many years to develop so are not quickly replaced once they are lost. Field visits suggest numerous snags of various sizes are distributed across the project area.
The opportunity exists to leave some existing snags and manage for a range of forest structures, which would allow for future snag development.

**Objective 212:** In conifer forested portions of a planning unit, provide at least once during a rotation (approximately 100 years) an average of 5 to 10 tons per acre of down, dead woody material at least 3 inches in diameter, provided there is no conflict with fire or pest management objectives. In the shelterwood silvicultural system, accomplish this through commercial and precommercial treatments. Provide this tonnage no later than the removal cut (overstory removal) or a combination of removal cut and precommercial thinning of the established stand (thinning to be accomplished within 10 years of the removal cut).

Dead and down woody material represents an important habitat component for several plant and animal species in the Black Hills. Woody material on the forest floor is also an important feature of the forest nutrient cycle. Like snags, dead and down woody material is slowly replaced once it is lost.

Visual reconnaissance indicates the majority of the project area’s stands are contributing towards this objective. The opportunity exists to provide dead and down woody material by leaving some stands untreated and through careful silvicultural techniques in treated stands. This opportunity will be limited in areas where fuel reduction or pest management is the priority (i.e. Wildland Urban Interface zones).

**Objective 213:** Maintain or enhance existing riparian area biodiversity, physical structure and size.

As described above under Objective 105, riparian areas are a critical aspect of the Black Hills ecosystem. Maintaining or enhancing existing riparian areas will provide for a diversity of plant and animal habitat and healthy water sources.

Riparian areas in the project area are associated with several drainages in the project area. Some riparian areas have become overgrown with pine. The opportunity exists to enhance riparian vegetation conditions by removing encroaching pine. Enhanced hardwood vegetation could encourage beaver occupation, which would improve riparian conditions by raising the water table.

**Objective 214:** Restore riparian shrub communities across the forest by 500 acres during the Plan period on sites capable of supporting this community.

See Objective 213 above.

**Objective 217:** Maintain habitat for game and fish populations in each planning unit at the state objectives in effect in 1996.

The project area provides habitat for game species such as deer, elk, and wild turkey. Fish-bearing streams in the project area include the forks of Boxelder Creek and several of its tributaries. Management practices that can adversely affect fish include livestock overgrazing in riparian zones, channelization, and sedimentation from roads or other ground disturbing activities. Lack of forage in forested areas currently compromises habitat values in the project area for deer and elk. Wild turkeys are affected by a lack of variety in forest structure necessary for roosting and feeding habitat.
The opportunity exists to increase habitat values by closing roads, preserving open meadows, managing some forest stands in an uneven-aged condition, encouraging growth of browse species through timber cutting and prescribed fire, and other vegetative management actions.

**Objective 218:** Conserve or enhance habitat for resident and migratory non-game wildlife.

This objective refers to a wide variety of wildlife species with a wide variety of habitat needs. Several species of resident and migratory non-game wildlife are found at different times of the year within the Steamboat project area.

The opportunity exists to conserve or enhance a variety of habitats by conducting a range of vegetative management treatments that will promote structural diversity across the project area.

**Objective 221:** Conserve or enhance habitat for R2 sensitive species and species of local concern (SOLC).

Sensitive species and species of local concern are identified based on their population status. These species typically are not common, have limited available habitat, or have populations or habitat that are very sensitive to change. Conservation of these species and their habitat is important in preserving the Black Hills ecosystem.

Several plant and animal species listed by the Rocky Mountain Region (R2) of the Forest Service as Sensitive are documented in the project area. Habitats for other sensitive species, species of local concern, and management indicator species exist in the project area. The opportunity exists to conserve or enhance habitat for these species through vegetative treatments, prescribed fire, avoidance and changes to the transportation system (limiting motorized access to critical areas).

**Objective 230:** Eradicate or limit spread (acres) of new introductions of non-native pests (insects, diseases, plants) to minimize ecosystem disruption.

Non-native pests can have a variety of negative impacts upon an ecosystem by outcompeting native species, degrading native habitat, or by directly killing native plants or animals. It is vital to ecosystem health that new infestations be controlled as soon as possible to minimize the negative impact to the ecosystem.

The opportunity exists to monitor for new infestations and eradicate them quickly when detected. Also, measures such as ensuring that only weed-free seed is used to re-seed disturbed areas and that weed-free gravel is used during road construction or improvement activities can limit the introduction and spread of non-native plants.

**Objective 231:** Prevent new infestations and manage to reduce established noxious weed infestations. Treat at least 8,000 acres per year during the next ten years to limit noxious weed infestations.

Noxious weeds are typically able to establish themselves in disturbed areas more quickly than native vegetation or are able to outcompete native plants in undisturbed sites. By outcompeting native flora, noxious weeds negatively impact habitat for species that depend on a particular native plant.
Several invasive weeds species are known to exist in the Steamboat project area. Ground-disturbing activities associated with the proposed activities may increase susceptibility to invasion and spread of noxious weeds. The opportunity exists to reduce the risk of introduction and spread of noxious weeds through application of standard resource protection, mitigation, and monitoring measures designed to prevent, detect, and eliminate noxious weed infestations.

**Objective 234:** Create or maintain a moderate-to-low crown-fire hazard adjacent to occurrences of R2 sensitive and species of local concern plants and botanical areas bordered by continuous, dense conifer stands where long-term persistence is at risk from a single high-intensity fire.

The Steamboat project area contains suitable habitat for plants identified as sensitive or species of local concern. Severe wildfires originating near these occurrences and burning across them have the potential to negatively impact these unique botanical resources. Likewise, management activities conducted directly within the habitat areas have the potential to make those areas unsuitable.

Where dense stands of pine border suitable plant habitat, the opportunity and need exists to reduce crown density and overall fuel loading to reduce the risk of a severe wildfire negatively impacting sensitive and species of local concern plants. Additionally, the opportunity exists to design and conduct treatments in a way that does not negatively impact suitable plant habitat.

**Objective 238:** The following are objectives for management indicator species (MIS). MIS will be monitored using trends in habitat; however, when available, population trends may be used as a strong indicator of management response. Monitoring will be conducted at a Forest scale and not at the project level. Population monitoring will be discretionary as provided by 36 CFR 219.14(f).

- Maintain or enhance habitat for ruffed grouse, beaver, song sparrow, grasshopper sparrow, white-tailed deer and brown creeper; as outlined in specific direction pertaining to aspen, other hardwoods, riparian areas, grasslands, spruce and ponderosa pine (e.g., Objectives 201, 205, 211, 239-LVD, 5.1-204).
- Maintain habitat opportunities for black-backed woodpeckers across the Forest, as outlined in specific direction pertaining to conifer habitat, snags and recently burned habitat (e.g., Objectives 211, 11-03, 5.1-204, Standard 2301)
- Maintain habitat for golden-crowned kinglets, as outlined in specific direction pertaining to spruce habitat (e.g., Objective 239-LVD).
- Maintain or enhance habitat quality and connectivity for mountain suckers, as outlined in specific direction pertaining to aquatic resources (e.g., Objectives 103, 104, 215, Standards 1201, 1203, 1205, Guideline 1115).

MIS serve as a yardstick to determine whether management actions are effective. If a certain species shows a decline in population, or if the amount of habitat available to them declines, then the management actions (or lack of) used to regulate their habitat are possibly ineffective.

Habitat for ruffed grouse, beaver, song sparrow, white-tailed deer, brown creeper, black-backed woodpecker, mountain sucker, and golden-crowned kinglet exists in the project area. The opportunity exists to maintain or enhance habitat for these species as described elsewhere in this section for the objectives listed above.
**Objective 239-LVD:** Manage for 20,000 acres of spruce across the Forest using active management to achieve multiple-use objectives. Treat spruce within 200 feet of buildings, where spruce has encroached into hardwoods, and for emphasis species management.

The Black Hills National Forest is dominated by ponderosa pine. Approximately 92% of the forested area of the Black Hills is ponderosa pine, with only 2% white spruce (USDA- Forest Service 2005a). Given the relative rarity of white spruce in the Black Hills, it is an important aspect of habitat diversity.

The Steamboat project area includes 138 acres of white spruce. Given the relative scarcity of spruce, it is unlikely that it would be treated, but treatment of spruce may occur in WUI areas.

**Goal 3. Provide for sustained commodity uses in an environmentally acceptable manner.**

**Objective 303:** Offer 838 million board feet (MMBF) of sawtimber and 21 million cubic feet (MMCF) of roundwood per decade [across the National Forest].

The timber industry is an important component of the economies of communities in and around the Black Hills. Local mills depend on lumber harvested from the Black Hills to maintain production levels. The presence of the timber industry also provides the Forest a tool for removing pine in an effort to reduce fire hazard and mountain pine beetle risk.

This objective applies to the entire Forest and has not been met for the current decade. The opportunity exists to provide sawtimber and roundwood through commercial timber harvest on the Steamboat project area.

**Objective 309:** Provide the following changes to the National Forest System Roads (NFSRs) and two-track roads in support of long-term sustainable production of commodities [across the National Forest]:

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Length/decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Construction</td>
<td>280 miles</td>
</tr>
<tr>
<td>Road Reconstruction</td>
<td>870 miles</td>
</tr>
<tr>
<td>Road Obliteration</td>
<td>140 miles</td>
</tr>
<tr>
<td>Two-track Obliteration</td>
<td>270 miles</td>
</tr>
</tbody>
</table>

The Steamboat project area currently includes approximately 134 miles of roads including county, NFS, non-NFS and private roads. Open road density for the project area is approximately 3.5 miles of road per square mile of land. Many of the roads in the Steamboat area are unclassified (non-National Forest System). Unclassified roads negatively impact wildlife habitat by allowing motorized users to access areas that they are not intended to enter. They are often in poor condition because they are not maintained which leads to erosion and siltation of nearby waterways. The overall poor condition of these unclassified roads can also pose a threat to individuals who use them.

The roads analysis process for the project area showed that the need exists for access to conduct management activities and allow motorized recreation, but a need also exists to reduce maintenance costs, sedimentation, disturbance of wildlife, and negative effects on non-motorized recreational opportunities. The opportunity exists to construct new roads or improve existing roads necessary to conduct proposed management activities.
Goal 10. Establish and maintain a mosaic of vegetative conditions to reduce the occurrences of stand-replacing fire and insect-and-disease events, and to facilitate insect-and-disease management and firefighting capability adjacent to at-risk communities, sensitive resources, and non-Federal land and generally across the Forest.

**Objective 10-01:** Manage for 50- to 75-percent moderate-to-low fire hazard in the wildland-urban interface and reduce fire hazard within proximity of structures to current NFPA standards except in Management Area (MA) 1.1 Black Elk Wilderness, MA 2.2 Research Natural Areas, MA 3.1 Botanical Areas, MA 4.2B Peter Norbeck Scenic Byway, and MA 5.4A Norbeck Wildlife Preserve. Manage the remainder of the Forest for 50 percent moderate-to-low except in MA 1.1 Black Elk Wilderness, MA 2.2 Research Natural Areas, MA 3.1 Botanical Areas, MA 3.7 Late-successional Forest Landscapes, MA 4.2 Peter Norbeck Scenic Byway, and MA 5.4A Norbeck Wildlife Preserve.

This objective is closely tied to the National Fire Plan (NFP), which was developed following the 2000 fire season. The NFP established guidelines for identifying and prioritizing Wildland Urban Interface (WUI) areas. The Steamboat project area contains approximately 2,713 acres of private land, all of which is designated as WUI. The project area includes the town of Nemo, South Dakota, along with several sub-developments where multiple houses are located within an area of private land. The need exists to reduce fire hazard in WUI areas.

Fire hazard is most often reduced by removing fuels that would allow fires to grow large and spread quickly. This is achieved through a variety of vegetative treatments. The opportunity exists in the Steamboat project area to reduce fire hazard, especially in the wildland urban interface.

**Objective 10-04:** Reduce or otherwise treat fuels commensurate with risks (fire occurrence), hazard (fuel flammability), and land and resource values common to the area, using the criteria in Forest-wide Guideline 4110.

Forest-wide guideline 4110 defines the level to which fuels should be reduced based on the risk, hazard, and value ratings for that area. Essentially, those areas with high risk, hazard, or value should experience the highest level of fuel reduction. Reducing fire risk and hazard would protect people, property, and forest resources.

The Steamboat project area covers portions of four different Fire Protection Assessment compartments, each of which have a high rating for risk, hazard, or value. Based on these ratings, the opportunity exists to reduce fire risk and hazard in the project area.

**Objective 10-07:** Where outbreaks of mountain pine beetle could present risks to management objectives for ponderosa pine, reduce acreage of ponderosa-pine stands that are in medium or high risk for infestation.

Mountain pine beetle infestations, at epidemic levels, can create large patches of dead timber, which negatively impact the natural resource values of the area. Active management in areas where endemic infestations are known to occur can prevent them from reaching epidemic levels.
Aerial surveys conducted in 2009 and 2010 indicated small, scattered pockets of mountain pine beetle activity in the project area, with additional larger outbreaks located immediately west of the project area. Dense stands of ponderosa pine are at the highest risk of mortality by mountain pine beetle. The opportunity exists to decrease beetle risk in the project area by reducing the density of ponderosa pine.

### 1.4.3 Management Area-specific Goals and Objectives

In addition to the Forest-wide goals and objectives outlined in Chapter 1 of the Forest Plan, each Management Area has goals and objectives specific to that area (see Chapter 3 of the Forest Plan). In the event that a Forest-wide goal or objective conflicts with a Management Area-specific goal or objective, the more restrictive goal or objective will take precedent. Below is a summary of the needs and opportunities associated with the Management Area-specific goals and objectives in the Steamboat project area.

**Management Area 5.4 – Big Game Winter Range**

**5.4-201:** Manage tree stands for wildlife habitat and vegetative diversity. (Goal)

Management Area 5.4 is managed with an emphasis on providing big game winter range. Cover and grazing areas are most important for big game during the winter because their availability is limited by weather conditions.

The opportunity exists to achieve this goal by using a variety of silvicultural treatments to maintain and enhance big game winter range in the Steamboat project area by creating open areas for grazing and retaining or promoting development of denser areas for thermal and hiding cover.

**5.4-204:** Improve forage on range areas. (Goal)

Ponderosa pine encroachment represents the most serious threat to open meadow areas in the Steamboat project area. Nearly 100 years of active fire suppression has allowed pine regeneration, which historically would have been removed from open meadows by fire, to become established on meadow edges, reducing the size of meadow areas. These meadows represent important grazing habitat for big game.

The opportunity exists to increase the amount of available forage on open meadows through removal of encroaching ponderosa pine regeneration.

**5.4-206:** Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes. (Objective)

<table>
<thead>
<tr>
<th>SS1</th>
<th>SS2</th>
<th>SS3A</th>
<th>SS3B</th>
<th>SS3C</th>
<th>SS4A</th>
<th>SS4B</th>
<th>SS4C</th>
<th>SS5</th>
</tr>
</thead>
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<tr>
<td>5%</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
<td>5%</td>
<td>25%*</td>
<td>25%*</td>
<td>5%*</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates greater than
** indicates less than
*10% of the structural stage 4 ponderosa pine acreage in the management area will have an average tree size of “very large”. Seek opportunities to increase understory shrubs in open-canopy structural stages.

**Active management is allowed, and may be necessary, to provide desired late-successional characteristics.

This objective applies to MA 5.4 across the Forest. An opportunity exists in the Steamboat project area to contribute to this objective on a Forest-wide basis by altering the structural stage distribution within the project area. This objective is not meant to be achieved at the project level.

**5.4-207: Manage for an open-road density of 1 mile of road per square mile or less for general public travel from December 15 through May 15.** (Objective)

Overall, the Steamboat project area has an open-road density of approximately 3.4 miles of road per square mile. Reducing open-road density from December 15-May 15 reduces the stress on big game animals during critical wintering and calving/fawning times.

The open-road density for MA 5.4 within Steamboat is also 3.4 miles of road per square mile since no other management areas are present. Forest Highway 26 and Forest System Road (FSR) 414.5 (Nemo Road) are the primary routes and remain open year round. Many non-system roads exist in MA 5.4 and provide potential travel routes during the closure period. The opportunity exists to achieve this objective through closure of non-system roads.

### 1.5 Purpose of and Need for Action

The primary purpose of and need for action in the Steamboat project area is to provide for structural diversity in big game winter range, reduce the risk of high intensity wildfire, and reduce the risk of mountain pine beetle infestation across the project area.

**Provide for Structural Diversity in Big Game Winter Range**

The Forest Plan provides for a diversity of forest structure, and wildlife habitat, through structural stage objectives in specific MAs. These structural stage objectives outline the desired Forest-wide distribution of ponderosa pine age classes and are designed so that a variety of structure, ranging from open grassland to late successional (i.e. old growth) forest, will exist across the forest. Structural stage objectives are in place for MA 5.4 in the Steamboat project area (Objective 5.1-204). Other MA-specific goals, objectives, standards and guidelines are in place to enhance big game habitat in MA 5.4.

The entirety of the Steamboat project area is in MA 5.4. In general, the structural stage distributions, both Forest-wide and within the project area, are skewed heavily to mature forest (structural stage 4) with a lack of early to mid-successional habitat (structural stages 1, 2 and 3) and late successional habitat (structural stage 5). Habitat for a variety of wildlife species, including Region 2 Sensitive Species, Management Indicator Species and Species of Local Concern is located within the project area. The opportunity exists to improve big game winter range conditions while also increasing structural diversity for other wildlife species.
Reduce the Risk of High Intensity Wildfire

Forest Plan Objective 10-01 directs that the Forest be managed for 50-75% moderate-to-low fire hazard in the wildland urban interface (WUI). The Steamboat project area includes 2,713 acres of interspersed private land. The project area is also immediately adjacent to the communities of Nemo and Piedmont and other populated areas along the Interstate 90 corridor. The Lawrence, Meade and Pennington County Community Wildfire Protection Plans establish a ½ mile WUI buffer around all structures.

Currently, there are approximately 490 known private structures located either within the Steamboat project area or within ½ mile of the project area boundary. Approximately 75% of the forested land in the project area is rated as high or very high fire hazard and only about 25% is rated low or moderate. In 2002, over 600 acres within the project area were burned by the Little Elk fire and in 2005 approximately 4,000 acres were burned in the Ricco fire. The opportunity exists to reduce fire hazard across the project area.

Reduce Risk of Mountain Pine Beetle Infestation

The Forest Plan provides direction for maintaining a mosaic of vegetation conditions to reduce the susceptibility of ponderosa pine stands to mountain pine beetle infestation. Forest Plan Objective 10-07 states that where outbreaks of mountain pine beetle could present risks to management objectives for ponderosa pine, the acreage of ponderosa pine stands that are at medium or high risk for infestation should be reduced.

Currently, approximately 85% of the ponderosa pine stands on NFS land in the project area are rated as being at a high or medium risk of mountain pine beetle infestation. Mountain pine beetle activity is currently at low levels in the Steamboat project area compared to other areas of the Black Hills National Forest. However, existing forest conditions within the project area are conducive to the rapid spread of pine beetles if they become established in the future. Heavier concentrations of pine beetle activity are located immediately west of Steamboat with the potential for infestations to move into the project area. The opportunity exists to reduce the impact of mountain pine beetles should they become better established in the project area by reducing stand density in ponderosa pine.

1.6 Proposed Action

1.6.1 Development of the Proposed Action

An interdisciplinary team of Forest Service resource specialists developed the proposed action to respond to the purpose and need for the project (as described in the previous section) and to ensure that the project was consistent with Forest Plan direction. A baseline proposed action was included in the public scoping letter distributed on December 10, 2010. Input on this initial proposed action was also collected at a public meeting held on January 12, 2011. Comments received during the comment period and at the public meeting were used to refine the proposed action and to develop alternatives to the proposed action.
During the comment period, feedback was received from the public both supporting and opposing the proposal. The public voiced a wide range of concerns ranging from the proposed action containing too much timber harvest and associated road construction to the proposed action not including enough timber harvest and subsequent reduction of mountain pine beetle risk and fire hazard. Concerns were also voiced regarding the type of timber harvest prescribed (e.g. even-aged versus uneven-aged) and the specific placement of treatments to best achieve the purpose and need.

Overall, respondents favored treatments that would reduce fire hazard and pine beetle risk on NFS land. Support was voiced for expanding thinning and fuel treatments and conducting vegetation treatments that would help reduce the risk of mountain pine beetle infestation and reduce the impacts of wildfire to private land. Strong local government and industry support was received for continuing to harvest timber on a sustainable basis to meet multiple use objectives while reducing the threat of mountain pine beetle epidemics.

Construction of new roads raised some concerns regarding associated negative impacts such as erosion, weed infestations and the potential for increased motorized use. Some commenters were concerned with increased motorized vehicle access in big game winter range. Addition or subtraction of routes on the Forest-wide Motorized Vehicle Use Map (MVUM) is considered at the Forest level, but the environmental impact of any new roads constructed under the Steamboat Project are analyzed in this DEIS.

A discussion of the issues identified from the scoping comments appears in Section 1.9.

### 1.6.2 Summary of Proposed Action

Below is a brief summary of Alternative B, the proposed action. All of the alternatives are presented in more detail in Chapter 2.

Proposed activities include:

- Non-commercial thinning of 1,372 acres to reduce the amount of standing fuels and to release overgrown and stagnant stands.
- Pine removal from 630 acres of aspen/birch stands to maintain aspen or birch as the cover type.
- Commercial harvest of 10,048 acres. Treatments include overstory removal, shelterwood cut, individual tree selection, group selection, patch clearcut, and commercial thinning to varying residual densities. The purpose of these treatments is to reduce pine beetle risk, reduce fire hazard, improve overall stand vigor, and enhance structural diversity.
- Reducing slash and dead fuel buildup through prescribed burning. A total of 10,608 acres could be burned under Alternative B.
- Pine removal from meadow areas would occur on 206 acres across the project area to curb pine encroachment into open grassy areas.
- Products other than logs (POL) would be harvested from 1,116 acres. These products include posts and poles. The treatment would harvest pine trees 5-9” diameter at breast height (DBH) (trees too small for inclusion in other commercial harvests, which require trees 9” or greater DBH).
• Understory thinning of 460 acres to maintain or improve habitat conditions in structural stage 5 stands and goshawk nest areas.
• Construction of 20 miles of new road and conversion of 5 miles of non-system road to system road. Maintenance of approximately 75 miles of existing system roads would also be necessary. Newly constructed or converted roads would be closed to motorized travel upon the completion of management activities unless specified for motorized use in the MVUM. Travel management opportunities on existing roads are determined by the Forest-wide travel management plan. Routes open to motorized travel are displayed on the MVUM.

1.7 Decision Framework

The responsible official will decide which actions, if any, to implement. This decision will be based on:

• Whether the proposed action addresses the issues, is responsive to national policy or guidance and direction in the Forest Plan, and meets the purpose of and need for action in the Steamboat project area.
• Whether the information in this analysis is sufficient to implement proposed activities.

The responsible official for the Steamboat Project decision is the Northern Hills District Ranger, unless Alternative C is chosen. In that case, the responsible official is the Forest Supervisor due to the necessity of a Forest Plan amendment to implement Alternative C. If the proposed action is selected, project implementation could begin as early as spring 2012. Most actions would be accomplished within a decade. Certain actions could last longer.

1.8 Public Involvement and Scoping

Scoping is the process of obtaining public comments about proposed federal actions to determine the range of issues to be addressed. Comments on the proposed action, potential concerns, and opportunities for managing the Steamboat project area were solicited from members of the public, other public agencies, tribal governments, adjacent property owners, interest groups, and Forest Service specialists. Various methods were used to request comments, including:

• The Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on December 15, 2010. The NOI asked for public comment on the proposal through January 14, 2011.
• A news release was submitted to the local news media on January 7, 2011. This release invited the public to the open house and included a brief description of the proposed action.
• A scoping letter was mailed to approximately 423 interested parties, including property owners, tribal members, state and federal agencies, and other organizations on December 10, 2010. This letter included a description of the project area, an overview of the planning process, a general explanation of the proposed actions, and an invitation to comment.
• A public open house meeting was held at the Fire Hall in Piedmont, South Dakota, on January 12, 2011. The meeting was attended by six interested parties who met with Forest Service officials to view maps of the project area and discuss the proposed actions. Attendees were encouraged to submit comments on the proposed actions or to document their concerns associated with the project area.
• Other information sharing, communication and interaction with interested parties, agencies, and individuals has occurred on a continuing basis during project planning. Information shared by such parties has been considered by the IDT in the development of this DEIS.

1.9 Issues

Comments received during the scoping process are used to help define issues, develop alternatives and mitigation measures, and analyze effects. A total of 14 parties provided feedback via letters or electronic mail during the formal scoping process. Many concerns were raised in relation to management activities in the Steamboat project area. Most of these concerns were relatively minor issues that are addressed through mitigation measures and design criteria. Issues such as these are not at large enough of a scale to warrant development of an alternative to the proposed action. Other concerns brought forth during scoping, such as greater emphasis on reducing risk of mountain pine beetle infestation or reducing the impact of new road construction, were considered more closely.

A total of 99 individual comments were identified from the 14 letters and emails received. From the comments, three significant issues were identified. Issues are points of disagreement, debate, or dispute over a proposed action based on environmental effects. Several issues were identified from the scoping comments. However, only significant issues were used to develop alternatives.

Issues were deemed non-significant if they were:

• beyond the scope of the proposed action,
• irrelevant to the decision being made,
• already decided by law, regulation, the Forest Plan or other higher authority,
• conjectural in nature and not supported by scientific evidence, or
• limited in the magnitude, extent, speed, or direction of effects relating to the issue

All other issues were determined to be significant.

A discussion of the three significant issues identified from the Steamboat scoping comments follows. These three issues were used to develop two additional alternatives for achieving the purpose and need in the Steamboat project area. These alternatives, along with the no-action (Alternative A) and modified proposed action (Alternative B) are described in detail in Chapter 2. The impacts of implementing each of the four alternatives are described in Chapter 3.

1.9.1 Risk of Mountain Pine Beetle Infestation

Multiple comments brought forward the issue that the treatments included in the Steamboat proposed action do not go far enough in reducing the risk of mountain pine beetle infestation across the project area. The proposed action (as presented in the scoping letter) included approximately 12,380 acres of vegetation treatment across the 21,833 acres of NFS land in the Steamboat project area. Approximately 6,755 acres of ponderosa pine on NFS land with a mountain pine beetle risk rating of moderate or high were not included in the proposed action. Commenters concerned with the ongoing mountain pine beetle infestation across the Black Hills suggested that the proposed action should have included more
treatments focused on reducing risk in these moderate to high risk stands. Alternative C was developed in response to this issue.

**Issue Indicators:**

- Untreated acres with moderate or high risk of mountain pine beetle infestation.
- Acres of ponderosa pine at moderate or high risk of mountain pine beetle infestation (pre and post-treatment).

### 1.9.2 New Road Construction

Comments were received that raised concerns over the inclusion of 18 miles of new road construction and 4 miles of new road conversion in the proposed action (as presented in the scoping letter). The commenters assert that the Steamboat project area is already heavily roaded and that because the entire project area is classified as MA 5.4 (Big Game Winter Range), additional roads would negatively impact wildlife. A concern was also raised that the addition of new roads to the system could have a negative impact on watersheds, which are classified as highly sensitive in the Steamboat project area. Commenters suggested that the miles of new road construction could be reduced or eliminated entirely to protect these resources. Alternative D was developed in response to this issue.

**Issue Indicators:**

- Miles of new road construction.
- Open road density (summer and winter).

### 1.9.3 Uneven-aged Management

Comments were received that supported a greater amount of uneven-aged management than what was included in the proposed action. The comments asserted that uneven-aged treatments (e.g. individual tree selection and group selection) will create greater structural diversity in big game winter range than even-aged treatments (e.g. commercial thin, overstory removal, shelterwood cut). Uneven-aged management creates stands with trees from multiple age classes, whereas even-aged management results in a stand with most of the trees in one or two age classes that are typically situated in distinct layers (e.g. overstory and understory). The original proposed action included approximately 7,014 acres of even-aged management compared to 1,441 acres of uneven-aged management. Commenters suggested that increasing the proportion of uneven-aged treatments will increase structural diversity and benefit wildlife habitat conditions while also reducing mountain pine beetle risk and fire hazard.

Based on this issue, the IDT attempted to identify additional areas where uneven-aged management could be applied. In order for uneven-aged management to be appropriate, certain stand conditions must already exist on the ground. The IDT review indicated that opportunities for identifying uneven-aged management were rigorously explored in the development of the proposed action and that few, if any, additional uneven-aged management opportunities exist in the Steamboat project area.
It was determined that the issue of uneven-aged management, while significant, is not strong enough to drive an additional action alternative because of the limited opportunities for conducting additional uneven-aged management. Any alternative resulting from this issue would not differ appreciably from the proposed action. However, the issue is partly addressed through the action alternatives. Under each action alternative developed, non-commercial thinning is proposed as a potential follow-up treatment for any unit receiving a commercial timber harvest prescription. Doing so allows for flexibility in altering the stand structure following the initial commercial entry and provides a tool for creating varied stand structure in the future.
2 ALTERNATIVES

2.1 Introduction

This chapter provides a detailed description of the no action alternative (Alternative A), the modified proposed action (Alternative B) and two additional action alternatives (Alternatives C and D). Maps of the three action alternatives (Alternatives B, C and D) are located in Appendix A.

This chapter presents and compares the alternatives both quantitatively and qualitatively. The intent is to provide the public and the decision maker a basis for a choice among management options when considering the environmental consequences of implementing each alternative, as disclosed in Chapter 3 of this DEIS. In addition, a brief overview is provided of the alternatives considered by the IDT and the decision maker but eliminated from detailed development and study. The last section of the chapter contains a tabular summary of the management actions proposed under each alternative and the response of the alternatives to the issue indicators identified in Section 1.9.

2.2 Alternatives Considered in Detail

This section describes activities that are planned to occur during implementation of the alternatives. All figures are approximate and may vary due to irregular stand structure, small inclusions of inoperable ground, or other factors not immediately evident upon initial analysis. Actual figures may increase or decrease during on-the-ground preparation of the project.

2.2.1 Alternative A – No Action

NEPA requires the study and use of the no action alternative as a basis for comparing the effects of the proposed action and other alternatives.

The no action alternative assumes that none of the elements of the proposed action and other action alternatives would take place in the Steamboat project area in the next 10 to 15 years. Under this alternative, no attempt is made to actively respond to the purpose of and need for action or the issues brought forth during scoping. Vegetation management would not take place unless authorized by other decisions. Vegetation structure would change over time through natural growth and mortality and events such as wildfires, storms, and insect and disease outbreaks. Ongoing activities authorized under previous NEPA analyses such as scheduled road maintenance, motorized recreation, treatment of noxious weeds, livestock grazing, and prescribed burning would continue.

2.2.2 Alternative B – Modified Proposed Action

The modified proposed action is intended to be responsive to the purpose of and need for action specified for the Steamboat project area. It should also move conditions within the project area toward desired future conditions as described in the Forest Plan. The original proposed action was developed and released for public review and comment in December 2010. The proposed action was modified
slightly after the scoping period ended. These modifications involved correcting errors in the data and
updating the silvicultural prescriptions for some stands. Most errors were identified based on field
reconnaissance efforts and review of spatial data. These modifications do not significantly alter the
proposed action or create the need for an entirely separate alternative. Changes made to the proposed
action between scoping and development of this DEIS are detailed below:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Original Proposed Action (Acres)</th>
<th>Alternative B—Modified Proposed Action (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Thin</td>
<td>4,655</td>
<td>4,617</td>
</tr>
<tr>
<td>Overstory Removal</td>
<td>970</td>
<td>874</td>
</tr>
<tr>
<td>Shelterwood Cut</td>
<td>1,379</td>
<td>1,392</td>
</tr>
<tr>
<td>Group Selection</td>
<td>255</td>
<td>293</td>
</tr>
<tr>
<td>Non-commercial Thin</td>
<td>1,408</td>
<td>1,372</td>
</tr>
<tr>
<td>Product-other-than-log</td>
<td>1,031</td>
<td>1,116</td>
</tr>
<tr>
<td>Commercial Aspen/Birch Enhancement</td>
<td>636</td>
<td>630</td>
</tr>
<tr>
<td>Commercial Meadow Enhancement</td>
<td>200</td>
<td>206</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation System Activities</th>
<th>Original Proposed Action (Miles)</th>
<th>Alternative B—Modified Proposed Action (Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Road Construction</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Non-system to System Road Conversion</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Existing Road Reconstruction/Pre-Use Maintenance</td>
<td>76</td>
<td>75</td>
</tr>
</tbody>
</table>

All other treatment types not listed in the above table were unchanged between scoping and
development of the DEIS.

The modified proposed action includes a variety of commercial and non-commercial vegetation
treatments on approximately 12,336 acres. Commercial treatments are proposed for approximately
10,048 acres. Stewardship opportunities through which the Forest Service exchanges goods for services
may be allowed under this alternative. Some treatments would stand alone, while others include initial
treatments as well as follow-up treatments such as non-commercial thinning or prescribed burning.

Alternative B also includes approximately 10,692 acres of fuels treatments. These treatments include
10,608 acres of prescribed burns that would be conducted following commercial or non-commercial
harvest and 84 acres of hand or mechanical fuels reduction treatments. It is not expected that the
entire 10,608 acres will be burned. Rather, it is anticipated that approximately 1,000 acres per year, a
total of 10,000 acres over the life of this project, would actually be implemented. The full acreage is
being analyzed to allow for flexibility in future management. Specific burn units will be selected after
the initial vegetation treatments have been completed and resulting site conditions are observed. For
each prescribed burn that is conducted, a site specific burn plan will be developed prior to
implementation.

Full implementation of the treatments proposed under Alternative B would require an estimated 20
miles of new NFS road (i.e., a brand new road template built) and 5 miles of non-system road conversion
(i.e., a non-system road or template already exists and will be added to the system). The proposed
action would also require the use of approximately 75 miles of existing NFS road that would some level of maintenance prior to use. Preparation activities could range from minimal maintenance activities (pre-use maintenance) to reconstruction of the road template, depending on the condition of the road at the time of implementation. All newly constructed or converted roads would be closed following the completion of management activities unless specified as open for motorized use in the MVUM. Existing NFS roads that undergo maintenance would remain a part of the NFS. Closure status and allowable uses of all NFS roads is determined by the MVUM.

Treatments proposed under Alternative B are summarized in Table 2-2 and described in detail below. Proposed post-sale treatments would take place as funding allows. Figures are approximate.

### Table 2-2. Proposed Activities - Alternative B

<table>
<thead>
<tr>
<th>Vegetation and Fuels Treatments</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial Vegetation Treatments</strong></td>
<td></td>
</tr>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>302</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>78</td>
</tr>
<tr>
<td>Overstory Removal</td>
<td>874</td>
</tr>
<tr>
<td>Commercial Thin</td>
<td>4,617</td>
</tr>
<tr>
<td>Shelterwood Cut</td>
<td>1,392</td>
</tr>
<tr>
<td>Patch Clearcut</td>
<td>190</td>
</tr>
<tr>
<td>Individual Tree Selection</td>
<td>1,186</td>
</tr>
<tr>
<td>Group Selection</td>
<td>293</td>
</tr>
<tr>
<td>Product-other-than-log</td>
<td>1,116</td>
</tr>
<tr>
<td><strong>Total Commercial Treatments</strong></td>
<td>10,048</td>
</tr>
<tr>
<td><strong>Non-commercial Vegetation Treatments</strong></td>
<td></td>
</tr>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>328</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>128</td>
</tr>
<tr>
<td>Non-commercial Thin</td>
<td>1,372</td>
</tr>
<tr>
<td>Understory Thin</td>
<td>460</td>
</tr>
<tr>
<td><strong>Total Non-commercial Treatments</strong></td>
<td>2,288</td>
</tr>
<tr>
<td><strong>Fuels Treatments</strong></td>
<td></td>
</tr>
<tr>
<td>Fuel Reduction</td>
<td>84</td>
</tr>
<tr>
<td>Prescribed Burning</td>
<td>10,608</td>
</tr>
<tr>
<td><strong>Total Fuels Treatments</strong></td>
<td>10,692</td>
</tr>
<tr>
<td><strong>Timber Volume Removed</strong></td>
<td></td>
</tr>
<tr>
<td>Sawtimber (MMBF)</td>
<td>48.3</td>
</tr>
<tr>
<td>Roundtimber (CCF)</td>
<td>40,253</td>
</tr>
<tr>
<td><strong>Transportation System</strong></td>
<td></td>
</tr>
<tr>
<td>New Road Construction</td>
<td>20</td>
</tr>
<tr>
<td>Non-system to System Road Conversion</td>
<td>5</td>
</tr>
<tr>
<td>Existing Road Reconstruction/Pre-use Maintenance</td>
<td>75</td>
</tr>
<tr>
<td><strong>Total Road Maintenance Activities</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

**Proposed Vegetation Treatments**

The harvest system (e.g. whole tree yarding or cut to length) utilized will depend on individual site characteristics. Depending on the system used, this could result in slash piles at log landings. Slash piles
would generally be burned, but may also be chipped. Timber harvest would use both ground-based and cable yarding systems.

Aspen/Birch Enhancement
Aspen/birch enhancement is intended to maintain or encourage growth in aspen or birch stands. This treatment may be applied to stands with a pine, aspen or birch cover type.

- **Stands with a pine cover type**—When applied to stands with a pine cover type, the pine portion of the stand would be treated with a commercial thin. Pine areas within stands with a 4C structural stage would be thinned to 60 BA, and pine areas within stands with a 4B structural stage would be thinned to 40 BA.
- **Stands with an aspen or birch cover type**—When applied to stands with an aspen or birch cover type, all commercial and non-commercial pine may be removed across the stand.

Regardless of cover type, areas of older, decadent or declining aspen or birch may be thinned or clearcut to regenerate the aspen or birch.

Aspen/birch enhancement can be either commercial or non-commercial in nature, depending on the size of ponderosa pine being removed from the stand. If pine with a DBH greater than nine inches is present, then the treatment would be commercial; less than nine inches DBH and the treatment would be non-commercial.

Meadow Enhancement
This treatment involves removal of pine in historical meadow areas to increase vegetative diversity and grass production in meadow communities. As with aspen/birch enhancement, the treatment can be either commercial or non-commercial in nature depending on the size of the encroaching pine.

Overstory Removal
The objective of removing overstory trees is to liberate the established understory regeneration. Residual trees would be retained at seed cut spacing where regeneration is less than 400 trees per acre at least two feet tall or where prescribed burning is proposed. Prescribed burning following treatment is generally not proposed in order to protect regeneration, but is included in selected stands to maintain road-to-road containment perimeters for prescribed burn units. Non-commercial thinning may occur following commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

Commercial Thin
This treatment involves removing commercial-sized pine (greater than nine inches DBH). Unlike overstory removal, not the entire overstory would be removed; rather, overstory trees would be thinned to a prescribed density allowing the remaining overstory greater availability of sunlight and nutrients while reducing the density of the stand. Retention densities would vary from 40 to 80 square feet of basal area. The best formed, most dominant, and vigorous trees would be retained. This treatment is prescribed for stands with a ponderosa pine cover type. Species selected for retention would discriminate against white spruce. Conifers may be removed from within and up to 30 feet from the edge of aspen pockets in excess of ¼ acre. Non-commercial thinning may occur following
commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Shelterwood Cut**
The shelterwood cut treatment involves thinning overstory trees to create optimal regeneration conditions. The best formed overstory trees are retained at approximately 30 square feet of basal area (approximately 35 foot spacing between trees). The remaining overstory trees provide a seed source for regenerating the stand in the future. Site preparation for seedling establishment may be accomplished with prescribed burning. Non-commercial thinning may occur following commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Patch Clearcut**
Patch clearcut involves the removal of all conifers from patches not to exceed 10 acres in size. The size and number of patches harvested in any given stand would vary depending on site characteristics. Patches would be irregularly shaped to blend into the landscape, creating a more natural appearance. The intent of this treatment is to create open browsing areas with adjacent thermal cover for big game. The open areas created by patch clearcuts can also provide fuel breaks that can slow down an advancing wildfire. Non-commercial thinning may occur following commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Individual Tree Selection**
Individual tree selection (also called single-tree selection) is a method of creating or maintaining an uneven-aged stand structure. Uneven-aged stands, when completely regulated, have at least three distinct age classes present. In this method, individual trees in all diameter classes are removed to create a broken or uneven canopy. The largest number of stems is in the smallest diameter class, with the number decreasing more or less regularly with increasing size. The fewest number of stems is in the largest diameter class. Non-commercial thinning may occur following commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Group Selection**
This uneven-aged treatment creates or maintains multiple age classes in even-aged groups and maintains the age classes in perpetuity through stand regulation. Groups are up to two acres in size and are scattered throughout a site. Groups occupy 20% of the site. Groups are openings designed to create the youngest age class of trees. The rest of the site will be variable density thinned. To achieve regulation, the site would have five age classes with each age class occupying approximately 20% of the site. Non-commercial thinning may occur following commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Product-other-than-log**
Products other than logs, generally posts and poles, are made from trees between five and nine inches DBH. The primary objective of these treatments is to increase growth and vigor of remaining trees. Suppressed, defective, and excess trees are removed. This treatment may be commercial or non-commercial, depending on the pulp and pole markets. Dominance is a desirable characteristic and is taken into account during tree retention selection. Non-commercial thinning may occur following
commercial treatment to maintain the stand and achieve desired conditions (see the description of non-commercial thinning below).

**Non-commercial Thin**
Non-commercial thinning would involve the reduction of standing stems less than nine inches DBH, retaining 200-400 stems per acre (approximately 12 foot spacing between trees). Cut material is lopped and scattered within the stand to maintain nutrients on the site. Stands may be burned to hasten fuel decomposition and reduce uncontrolled fire risk. Piling and burning of residual material may be conducted in place of lop and scatter in stands that are adjacent to private property to reduce the amount of ground fuels in WUI areas. The purpose of non-commercial thinning is to a) remove excess regeneration from the understory, providing the remaining trees greater access to nutrients, b) remove fuels from the understory, and/or c) retain appropriate growing stock levels.

**Understory Thin**
Understory thins are proposed to maintain or enhance habitat conditions in certain stands, such as goshawk nesting areas and late successional forest (structural stage 5). Non-commercial sized (less than nine inches DBH) trees would be removed to reduce understory density and competition for resources. Doing so also creates a diversity of vegetative structure in the understory. Understory thinning also reduces the amount of surface fuels available to a wildfire.

**Fuel Reduction**
Fuel reduction involves the removal of vegetative material from the understory through the use of hand tools (e.g. chainsaws) or machinery (e.g. chippers or masticators). The intent is to reduce the amount of fuel available to wildfires, particularly in WUI areas.

**Prescribed Fire**
A total of 10,608 acres of the project area will be analyzed for prescribed burning as a follow-up to harvest treatments. It is not expected that all of this acreage would be burned. Rather, it is anticipated that approximately 1,000 acres per year, a total of 10,000 acres over the life of this project, would actually be implemented. The full 10,608 acres is being analyzed for burning to allow for flexibility in the future. Specific burn units would be selected after the initial vegetation treatments have been completed and resulting site conditions are observed. For each prescribed burn that is conducted, a site specific burn plan will be developed prior to implementation.

**Objectives of Prescribed Fire**
The primary objectives of prescribed burning include:

- reducing natural and activity fuels consistent with Forest Plan guideline 4110;
- maintaining the effectiveness of fuel treatments over time by controlling regeneration densities;
- enhancing soil conditions by returning inorganic and organic chemicals found in logging slash to the soil (Forest Plan guideline 4105); and
- enhancing wildlife habitat by creating vegetative diversity across the landscape and stimulating forage production for big game, especially in MA 5.4.

These objectives are consistent with the purpose and need for action identified for the Steamboat project area.
Procedures for Implementing Prescribed Fire

Prior to any prescribed burn taking place on the ground, a burn plan will be developed. Burn plans are reviewed by Forest resource specialists to ensure consistency with the Forest Plan and are authorized by the Line Officer. These plans identify the area in which a prescribed burn will take place, the objectives of applying fire to the ground, the conditions under which a burn will be allowed, and the methodologies for achieving the objectives of the burn.

Considerations for Determining Prescribed Fire Unit Boundaries

As burn plans are developed for areas within the Steamboat project area, the following items will be considered when determining the boundaries of prescribed burn units:

1. Prescribed burning will be emphasized in pine stands that are proposed to be commercially thinned or in areas where hardwoods are prevalent. Commercially thinned stands where little regeneration is present allows for a larger window in which burns may be carried out to meet specified objectives. Prescribed burning in both pine and hardwoods can also create diversity in vegetative conditions across the landscape and reduce the rate at which a wildfire might spread across the landscape.

2. Stands that are within ½ mile of concentrated urban interface areas will not generally be included as part of a prescribed burn unit to alleviate concerns about the potential for escape. However, prescribed burning may be considered as a follow-up or maintenance treatment in these areas when doing so would meet stand objectives and the potential for escape is determined to be low.

3. Stands that have either been treated in the past with a silvicultural prescription that emphasized stand regeneration (e.g. overstory removal or shelterwood cut) or are proposed for such a treatment under the Steamboat Project will not generally be included as part of a prescribed burn unit if the following apply:

   a. Non-commercial thinning within the stand has already been accomplished or is prescribed, or
   b. There are nine or more tons per acre of dead and down fuels three inches in diameter or less.

However, prescribed fire may be authorized in such stands as a follow-up or maintenance treatment to achieve stand objectives when other treatment methods are not available.

The goal behind this consideration is to reduce tree mortality in areas where regeneration harvest has or will be applied. It is estimated that approximately 10 tons of dead and down fuels will produce fireline intensities or flame lengths sufficient to kill 95 percent of pine trees 20 feet in height and less. Trees that are 20 feet tall are those that have a DBH of three to five inches. Where there is a specified objective to retain trees smaller than three to five inches, surface fuel loadings will be such that the fireline intensity will achieve objectives provided by the silviculturist. Prescribed burning may be used to treat stands in which the majority of stems per acre are in the seedling stage, provided surface fuel loading does not produce fireline intensities that would result in unacceptable mortality in trees as defined by the silviculturist.
There may be instances in which such stands are included in a prescribed burn unit boundary. Reasons for inclusion may be to consolidate a burn block and reduce the need for dozer line construction, which leads to additional and longer lasting ground disturbance, or to control seedling/sapling density to maintain or enhance fuel treatment effectiveness.

Road Management Activities
Completion of the proposed vegetation management activities would require maintenance and additions to the existing road network. These activities are above and beyond routine maintenance, which would occur on an as needed basis regardless of the decision related to the Steamboat Project.

New Road Construction
Road construction refers to creating new routes where no route has previously been developed. New roads would be constructed to Forest Service specifications and would adhere to Forest Plan standards and guidelines, Best Management Practices (BMPs) and project-specific design criteria.

All new roads constructed under the Steamboat Project would be closed following the completion of management activities unless specified as open to motorized use in the MVUM. The method of closure would be determined based on site conditions.

Non-system to System Road Conversion
Conversion refers to the addition of non-system roads to the National Forest System (NFS). The routes proposed for conversion are typically unclassified routes. The road template already exists on the ground. Under the Steamboat Project, the route would be added to the NFS and improved as necessary to meet Forest Service specifications. Like newly constructed roads, converted routes would also adhere to Forest Plan standards and guidelines, BMPs and project-specific design criteria. These routes would also be closed following management activities unless they are specifically identified as being open in the MVUM.

Maintenance of Existing Roads
Reconstruction or pre-use maintenance is proposed for existing NFS roads that would require improvement prior to management activities occurring. Of these two activities, reconstruction is generally the more intense activity and could include widening the road or slight rerouting based on site specific conditions. Pre-use maintenance involves more routine activities such as grading or brushing of the roadway. These two activities are lumped together for analysis purposes to allow for flexibility in applying specific activities. Road conditions may change between the time of analysis and implementation of the project. Analyzing for both activities provides the leeway for applying the most appropriate action at the time of implementation.

Temporary Roads
Temporary roads may also be required to facilitate vegetation management activities. These are generally short spurs off of other routes that are not intended to become part of the Forest’s transportation system but are only intended to facilitate the management actions associated with this decision. These roads are closed to motor vehicle access following harvest activities, and closure includes any actions necessary (e.g. slashing in the route, seeding to promote revegetation, etc.) to stabilize the route surface and reduce erosion.
2.2.3 Alternative C

Alternative C was developed in response to the issue of mountain pine beetle infestation. Specifically, the comments received during scoping questioned why approximately 6,755 acres of pine stands at moderate or high risk of pine beetle infestation were left untreated by the proposed action. Alternative C addresses that issue by incorporating the treatments included in Alternative B and assigning a silvicultural prescription to the majority of the stands with a moderate or high beetle risk that were not treated under Alternative B.

Alternative C includes a total of 18,049 acres of commercial and non-commercial treatment. Approximately 16,588 acres would be treated through commercial timber harvest with an additional 1,461 acres receiving non-commercial treatment. The level of fuel treatment under Alternative C would be identical to Alternative B, with approximately 84 acres of fuel reduction treatments and up to 10,608 acres of prescribed burning.

Full implementation of Alternative C would require 41 miles of new road construction and 10 miles of new road conversion. In addition, 81 miles of existing NFS roads would require some level of maintenance. Temporary roads may also be required to facilitate vegetation management activities.

Implementation of Alternative C would require modification at the decision stage or a project-specific amendment to the Forest Plan. Standard 3108 defines the size of goshawk nest areas and the structural stages representing the most desirable habitat in those nest areas. Treatments proposed in Alternative C would alter the structural stage in nest areas to the degree that the alternative would not be in compliance with standard 3108. To implement Alternative C without amending the Forest Plan, the decision maker could elect to drop the treatments in question from the alternative. If modification is not done, a project-specific amendment to the Forest Plan would be required that exempts Alternative C from standard 3108. This amendment would apply only to the Steamboat Project and not to any past or future projects elsewhere on the Forest. Such an amendment would require that the Record of Decision (ROD) for the Steamboat Project be signed by the Forest Supervisor rather than the District Ranger. See the ‘Wildlife and Fisheries’ section in Chapter 3 for a summary of the goshawk analysis or the Steamboat Project Wildlife and Fisheries Biological Evaluation, available upon request, for the full analysis of the impacts to goshawks and their habitat.

<table>
<thead>
<tr>
<th>Vegetation and Fuels Treatments</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>302</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>78</td>
</tr>
<tr>
<td>Overstory Removal</td>
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<tr>
<td>Commercial Thin</td>
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<tr>
<td>Shelterwood Cut</td>
<td>2,644</td>
</tr>
<tr>
<td>Patch Clearcut</td>
<td>190</td>
</tr>
<tr>
<td>Individual Tree Selection</td>
<td>1,186</td>
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<tr>
<td>Group Selection</td>
<td>293</td>
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<tr>
<td>Product-other-than-log</td>
<td>1,599</td>
</tr>
<tr>
<td><strong>Total Commercial Treatments</strong></td>
<td><strong>16,588</strong></td>
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</table>
### Vegetation and Fuels Treatments

<table>
<thead>
<tr>
<th>Non-commercial Vegetation Treatments</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>328</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>128</td>
</tr>
<tr>
<td>Non-commercial Thin</td>
<td>638</td>
</tr>
<tr>
<td>Understory Thin</td>
<td>288</td>
</tr>
<tr>
<td>Planting</td>
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</table>

**Total Non-commercial Treatments** | 1,461 |

<table>
<thead>
<tr>
<th>Fuels Treatments</th>
<th>Acres</th>
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<tbody>
<tr>
<td>Fuel Reduction</td>
<td>84</td>
</tr>
<tr>
<td>Prescribed Burning</td>
<td>10,608</td>
</tr>
<tr>
<td><strong>Total Fuels Treatments</strong></td>
<td><strong>10,692</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timber Volume Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawtimber (MMBF)</td>
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<tr>
<td>Roundtimber (CCF)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation System</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Road Construction</td>
<td>41</td>
</tr>
<tr>
<td>Non-system to System Road Conversion</td>
<td>10</td>
</tr>
<tr>
<td>Existing Road Reconstruction/Pre-use Maintenance</td>
<td>81</td>
</tr>
</tbody>
</table>

**Total Road Maintenance Activities** | 132 |

The description of individual treatments appearing under Alternative B also applies to Alternative C, with the following exception:

**Planting**

Planting would involve the hand planting of ponderosa pine in stands where sufficient natural regeneration is not present. Planting would occur in select overstory removal stands that do not yet meet the minimum regeneration level based on monitoring data.

### 2.2.4 Alternative D

Alternative D was developed in response to the issue of new road construction. Concerns were raised during the scoping period that 18 miles of new road construction, as was included in the original proposed action, would have a negative impact on soil and water resources and could potentially affect the quality of big game winter range. Alternative D responds to this issue by eliminating all new road construction. The treatments proposed under Alternative D represent those treatments from Alternative B that are accessible from the existing road network. This network includes four miles of new road conversion; although those roads are not currently part of the NFS system, the templates already exist on the ground and use of those roads would not require creation of an entirely new route.

Alternative D includes 9,394 acres of commercial and non-commercial vegetation treatments. Approximately 7,106 acres of commercial timber harvest are proposed along with approximately 1,905 acres of non-commercial treatments. The level of fuel treatment proposed under Alternative D is identical to Alternatives B and C with 84 acres of fuel reduction and up to 10,608 acres of prescribed burning.
As discussed above, Alternative D would not require new road construction. Four miles of new road conversion are included along with 70 miles of maintenance of existing NFS roads. Temporary roads may also be required to facilitate vegetation management activities.

<table>
<thead>
<tr>
<th>Vegetation and Fuels Treatments</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Vegetation Treatments</td>
<td></td>
</tr>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>302</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>78</td>
</tr>
<tr>
<td>Overstory Removal</td>
<td>775</td>
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<tr>
<td>Commercial Thin</td>
<td>2,661</td>
</tr>
<tr>
<td>Shelterwood Cut</td>
<td>970</td>
</tr>
<tr>
<td>Patch Clearcut</td>
<td>190</td>
</tr>
<tr>
<td>Individual Tree Selection</td>
<td>905</td>
</tr>
<tr>
<td>Group Selection</td>
<td>181</td>
</tr>
<tr>
<td>Product-other-than-log</td>
<td>1,044</td>
</tr>
<tr>
<td><strong>Total Commercial Treatments</strong></td>
<td><strong>7,106</strong></td>
</tr>
<tr>
<td>Non-commercial Vegetation Treatments</td>
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</tr>
<tr>
<td>Aspen/Birch Enhancement</td>
<td>328</td>
</tr>
<tr>
<td>Meadow Enhancement</td>
<td>128</td>
</tr>
<tr>
<td>Non-commercial Thin</td>
<td>1,372</td>
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<tr>
<td>Understory Thin</td>
<td>460</td>
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<tr>
<td><strong>Total Non-commercial Treatments</strong></td>
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</tr>
<tr>
<td>Fuels Treatments</td>
<td></td>
</tr>
<tr>
<td>Fuel Reduction</td>
<td>84</td>
</tr>
<tr>
<td>Prescribed Burning</td>
<td>10,608</td>
</tr>
<tr>
<td><strong>Total Fuels Treatments</strong></td>
<td><strong>10,692</strong></td>
</tr>
<tr>
<td>Timber Volume Removed</td>
<td></td>
</tr>
<tr>
<td>Sawtimber (MMBF)</td>
<td>34.2</td>
</tr>
<tr>
<td>Roundtimber (CCF)</td>
<td>28,471</td>
</tr>
<tr>
<td>Transportation System</td>
<td>Miles</td>
</tr>
<tr>
<td>New Road Construction</td>
<td>0</td>
</tr>
<tr>
<td>Non-system to System Road Conversion</td>
<td>4</td>
</tr>
<tr>
<td>Existing Road Reconstruction/Pre-use Maintenance</td>
<td>70</td>
</tr>
<tr>
<td><strong>Total Road Maintenance Activities</strong></td>
<td><strong>74</strong></td>
</tr>
</tbody>
</table>

The description of individual treatments appearing under Alternative B also applies to Alternative D.

### 2.2.5 Activities Common to All Action Alternatives

**Watershed Improvement Projects**

Per Forest Plan direction, watershed improvement projects or other activities that will improve the health of the watershed must be a part of project planning for projects planned in Class 3 watersheds. Class 3 watersheds were identified during the Forest Plan development process as being of high concern and in which management activities must be done with great care (further explanation of Class 3 watersheds is provided in the *Hydrology and Soils* section in Chapter 3 of this document). All of the
Hydrologic Unit Code (HUC) 7th-level watersheds that comprise the Steamboat project area are identified as Class 3. Therefore, a variety of watershed improvement projects have been incorporated into the modified proposed action and alternatives, including:

- meadow and hardwood enhancement along streams across the project area, and
- reduction in the number of connected disturbed areas (CDAs) through road maintenance/improvement across the project area.

**Sanitation Harvest Provision**

Sanitation treatments are considered to be preventative and are most effective prior to the start of an epidemic. A treatment is used to remove resident beetle populations from the stand before they are able to infest the stand as a whole. In an attempt to prevent the mortality of the entire stand, the use of sanitation is best incorporated at the first indication of beetle infested trees. Sanitation is the removal of infested trees; however, it is reasonable to do any proposed treatments once sanitation is deemed appropriate. Use of all treatments, particularly preventative treatments such as thinning, are done together to have the highest level of effectiveness in protecting the stand as a whole.

The purpose and need for this project recognizes that there is a need to alter stand structure within the project area to reduce the threat of mountain pine beetle infestation. In an effort to be responsive to mountain pine beetle infestations, sanitation harvest proposals could be prepared for areas of mountain pine beetle infestation within the project area. These proposals would identify site specific treatments intended to limit the spread of beetles.

The intent of the sanitation harvest provision is to increase the efficiency and speed at which the Forest Service is able to respond to emerging mountain pine beetle infestations. Infested areas would be treated to remove beetle-hit trees. In addition to removal of infested trees, thinning treatments to increase resiliency of the stand and to decrease the likelihood of a sustained outbreak could be implemented. Proposed treatments would likely involve cutting green, beetle-infested trees and thinning stands to residual basal areas below 80. Consultation with a Forest Service entomologist indicated that sanitation harvest methods should be pursued when a population has reached incipient epidemic levels (Allen 2010). The first major sign of incipient epidemic levels occurring are groups of beetle-hit trees beginning to show up on a landscape scale. Specifically, when two or more groups of three to four beetle attacked trees on 20 to 320 acres occur in two to three consecutive years (Allen 2010).

The Northern Hills Ranger District will utilize the most recent information available (e.g. aerial pest survey data, stand exam data, field verification, other interested parties) as it designs and prioritizes sanitation harvest proposals to ensure that the most effective strategy is developed. Proposals will be reviewed by resource specialists prior to implementation to determine whether any special design criteria are required to protect forest resources and to ensure that the proposals comply with Forest Plan direction. No new system roads would be constructed to access sanitation harvest units. If the scale of management actions required to address the epidemic goes beyond the scope of this sanitation harvest provision, additional NEPA analysis would be required to treat larger areas of tree mortality from beetle infestations.
Harvest Systems
The specific harvest system to be employed for any given area to be treated would be determined at the time of layout. The harvest system selected will be based on topographical considerations, acceptable levels of residual fuels within stands, and soil nutrient requirements. In general, whole tree yarding is preferred within the WUI to reduce fuel loading.

Activity Fuels
Both commercial and non-commercial treatments generally result in wood by-products that function as a source of fuel in the forest. This section describes the Northern Hills Ranger District’s approach to addressing activity fuels resulting from commercial and non-commercial treatment activities within the Steamboat project area.

Commercial Treatments
Commercial treatments entail cutting commercial-sized trees (greater than nine inches DBH) and removing the logs from the site. There has not historically been a market for the residual material (i.e., limbs and tops of trees) resulting from commercial timber harvest. The residual material, often referred to as slash or activity fuel, functions as a fuel source that could potentially feed a forest fire. Because fuels reduction is a key objective in the Forest Plan, harvest methods that allow for the removal of activity fuels are generally preferred over those that do not. This is especially true in the wildland urban interface and adjacent to private property. In such areas, slash is generally piled and burned. Less frequently, material is chipped and distributed on site. As markets for biomass develop, it is expected that logging slash will become commercially valuable. As that happens, slash may be hauled off-site rather than piled and burned.

Sometimes, it is neither feasible nor desirable to pile and burn activity slash. This is the case in areas where the terrain makes the use of certain logging equipment a challenge or in areas where soil productivity is a concern. In such areas, slash is often lopped and scattered on site.

Non-Commercial Treatments
Non-commercial thinning treatments entail cutting trees that are not of a commercial size. Where funding and terrain allow, this is usually accomplished with a masticator/chipper. The machinery cuts the trees and grinds or chips them, dispersing the material across the forest floor. On steep sites or in rocky areas, such machinery cannot be used. Instead, trees are cut by hand, and the material is lopped and scattered on site. Mastication/chipping is a preferred method for accomplishing non-commercial thinning because the activity fuels, while left on site, pose less of a fire hazard than the larger material resulting from the lop and scatter method. If trees are hand-felled adjacent to private property and fuel loading is a concern in that area, the material is often piled and burned to eliminate high levels of surface fuels.

Post-Treatment Transportation Management
The BHNF recently issued a decision on a new travel management plan, which went into effect in December 2010. This plan changes the travel management paradigm from “open unless marked closed” to “closed unless marked open.” The plan specifies what routes are open for public motorized travel and what types of vehicles are allowed on those routes. Routes open to motorized travel are displayed in the Motorized Vehicle Use Map (MVUM), which is updated on an annual basis. Any newly constructed or converted roads authorized under the Steamboat project would be closed following
Post-sale Activities
The Knutson-Vandenburg (KV) Act authorizes the Forest Service to collect money from timber sales for resource enhancement, protection, and improvement work in the timber sale area. Actions proposed as KV activities for the Steamboat project area are listed below:

- **Non-commercial thinning, release and weed cleaning, and product-other-than-log (POL) thinning:** Thinning of stems less than nine inches DBH; intensity varies due to stand density and overstory conditions. Included slash treatment may be lop and scatter, chipping, or removal to a landing where tops may be burned. Could follow treatments on acres identified for treatment.

- **Regeneration surveys 3rd and 5th year post-harvest:** Essential KV; Monitoring will determine if mortality rate of trees less than nine inches DBH is less than 75 percent after prescribed burning. At least one survey must be conducted post-burn. Would be conducted following overstory removal and patch clear cut treatments.

- **Vegetation monitoring:** Post treatment data collection for use in monitoring and evaluation of activities. Follows standard stand exam protocols for complete condition evaluation. Could be implemented on any treatment type not covered by 3rd and 5th year post-harvest regeneration surveys.

- **Site preparation:** Mechanical scarification or prescribed burning to expose mineral soil for ponderosa pine establishment. Would be identified for implementation if regeneration surveys indicate inadequate stocking. Would apply to overstory removal and shelterwood cut treatments.

- **Removal of encroaching pine from hardwood stands:** Removal of pine from selected hardwood stands. All activity-created material would be hand-piled and burned. These treatments may occur in addition to those areas proposed for hardwood enhancement under the action alternatives.

- **Removal of encroaching pine from meadow areas:** Removal of pine from selected meadows. All activity-created material would be lopped and scattered. These treatments may occur in addition to those areas proposed for meadow enhancement under the action alternatives.

- **Noxious weed treatment and monitoring:** Spray and monitor noxious weeds following all ground disturbing activities.

- **Road closure:** All new roads constructed or converted under the Steamboat Project would be closed upon the completion of management activities. Closure methods would be determined at the time of closure depending on site conditions. Possible methods include: locked gates, boulders, dirt berms, downed trees, fences, partial obliteration and recontouring.

2.2.6 Treatment Timing (All Action Alternatives)

The NFMA generally prohibits the harvest of stands before they reach their maximum growth rate [16 U.S.C. 1604(m)]. Exceptions in this law allow the harvest of individual trees, or even parts or whole stands of trees, before this time to thin and improve timber stands and salvage damaged stands of trees [16 U.S.C. 1604(m1)]. Further exceptions are allowed in order to achieve multiple-use objectives other than timber harvest [16 U.S.C. 1604(m2)].
Alternatives B, C and D would harvest some stands before their maximum potential growth rate has been reached. These harvest treatments are consistent with the exceptions provided in 16 U.S.C. 1604(m2) and amended Forest Plan guideline 2411, and include the following:

- Non-commercial thinning
- Commercial thinning
- Pine encroachment cutting
- Fuel treatments

These treatments are proposed to meet the amended Forest Plan multiple-use objectives stated in Chapter 1. Refer to Appendix B for a more detailed description of how this project complies with law, regulation and policy relating to timber harvest.

### 2.3 Alternatives Considered but Eliminated from Detailed Study

A range of alternatives were considered by the Steamboat IDT, but not all of those alternatives were analyzed in detail. Following are brief descriptions of alternatives the IDT considered but eliminated from detailed analysis.

#### 2.3.1 Uneven-aged Management

Based on the issues discussed in Section 1.9, an alternative addressing the issue of uneven-aged management was considered by the IDT but ultimately eliminated from detailed analysis. It was determined that opportunities for uneven-aged management beyond what is included in the proposed action were limited and that an alternative based on this issue would not represent a significant departure from the proposed action. Opportunities for uneven-aged management were rigorously explored during development of the proposed action and applied to those stands where uneven-aged treatment was appropriate. Because certain stand conditions must be present to implement uneven-aged management, it cannot simply be applied to any stand.

#### 2.3.2 Wildlife Viability and Recreation

One commenter suggested an alternative that responds to the impacts of the proposed action on wildlife viability and recreation. This suggestion did not specifically state how the proposed action would fail to address these issues nor suggest how these issues relate to the purpose and need for the Steamboat Project.

The issue of wildlife viability is beyond the scope of the Steamboat Project as population viability was analyzed during the Forest Plan revision and subsequent Phase II Amendment. The current planning rule (2000) does not require analysis of wildlife viability at the project level. The impacts of the Steamboat Project on federally listed threatened or endangered species, Region 2 sensitive species, and Forest species of local concern and management indicator species are fully analyzed in this DEIS.
Likewise, the effects of the project on recreation opportunities are also in this DEIS. Existing recreation opportunities would be maintained under each of the action alternatives. The only potential change would occur if a new road constructed under the Steamboat Project were added to the MVUM. The Steamboat Project does not in itself add routes to the MVUM, but any routes added to the NFS under Steamboat could eventually be added to the MVUM in the future. Any such decision would be documented in a separate analysis.

## 2.4 Comparison of Alternatives

The public and decision maker can compare the alternatives based on their environmental effects and whether or not they achieve the purpose and need for action. Tables 2-5 and 2-6 below provide a comparison of the alternatives by level of activity and response to the purpose and need. Analysis of environmental effects is presented in Chapter 3.

### Table 2-5. Comparison of Activities by Alternative

<table>
<thead>
<tr>
<th>Vegetation Treatment (Acres)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Action</td>
<td>Modified Proposed Action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Hardwood Enhancement</td>
<td>0</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Commercial Meadow Enhancement</td>
<td>0</td>
<td>78</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Non-commercial Hardwood Enhancement</td>
<td>0</td>
<td>328</td>
<td>328</td>
<td>328</td>
</tr>
<tr>
<td>Non-commercial Meadow Enhancement</td>
<td>0</td>
<td>128</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>Overstory Removal</td>
<td>0</td>
<td>874</td>
<td>3,740</td>
<td>775</td>
</tr>
<tr>
<td>Commercial Thin</td>
<td>0</td>
<td>4,617</td>
<td>6,556</td>
<td>2,661</td>
</tr>
<tr>
<td>Shelterwood Cut</td>
<td>0</td>
<td>1,392</td>
<td>2,644</td>
<td>970</td>
</tr>
<tr>
<td>Patch Clearcut</td>
<td>0</td>
<td>190</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>Individual Tree Selection</td>
<td>0</td>
<td>1,186</td>
<td>1,186</td>
<td>905</td>
</tr>
<tr>
<td>Group Selection</td>
<td>0</td>
<td>293</td>
<td>293</td>
<td>181</td>
</tr>
<tr>
<td>Product-other-than-log</td>
<td>0</td>
<td>1,116</td>
<td>1,599</td>
<td>1,044</td>
</tr>
<tr>
<td>Non-commercial Thin</td>
<td>0</td>
<td>1,372</td>
<td>638</td>
<td>1,372</td>
</tr>
<tr>
<td>Understory Thin</td>
<td>0</td>
<td>460</td>
<td>288</td>
<td>460</td>
</tr>
<tr>
<td>Planting</td>
<td>0</td>
<td>0</td>
<td>79</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Acres</strong></td>
<td>0</td>
<td><strong>12,336</strong></td>
<td><strong>18,049</strong></td>
<td><strong>9,394</strong></td>
</tr>
<tr>
<td><strong>Total Sawtimber Volume (MMBF)</strong></td>
<td>0</td>
<td>48.3</td>
<td>72.5</td>
<td>34.2</td>
</tr>
<tr>
<td><strong>Total Roundtimber Volume (CCF)</strong></td>
<td>0</td>
<td>40,253</td>
<td>60,398</td>
<td>28,471</td>
</tr>
<tr>
<td><strong>Fuels Treatment (Acres)</strong></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Fuels Reduction</td>
<td>0</td>
<td>84</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>Prescribed Burning Following Vegetation Treatments</td>
<td>0</td>
<td>10,608</td>
<td>10,608</td>
<td>10,608</td>
</tr>
<tr>
<td><strong>Total Acres</strong></td>
<td>0</td>
<td><strong>10,692</strong></td>
<td><strong>10,692</strong></td>
<td><strong>10,692</strong></td>
</tr>
<tr>
<td><strong>Road Construction (Miles)</strong></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>New Road Construction</td>
<td>0</td>
<td>20</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Non-system to System Road Conversion</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Maintenance</td>
<td>0</td>
<td>75</td>
<td>81</td>
<td>70</td>
</tr>
</tbody>
</table>
Table 2-6. Comparison of Alternatives by Issue Indicators

<table>
<thead>
<tr>
<th>Issue: Reduce Pine Beetle Risk</th>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pine Beetle Risk Rating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>12,265</td>
<td>4,250</td>
<td>1,691</td>
<td>6,273</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>6,287</td>
<td>6,314</td>
<td>3,201</td>
<td>6,271</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2,508</td>
<td>10,496</td>
<td>16,168</td>
<td>8,516</td>
<td></td>
</tr>
<tr>
<td><strong>Moderate or High Risk Stands Left Untreated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of Untreated Pine with Moderate or High Insect Risk Rating</td>
<td>18,552</td>
<td>6,799</td>
<td>250</td>
<td>9,725</td>
<td></td>
</tr>
<tr>
<td>Issue: New Road Construction</td>
<td>Miles</td>
<td>Miles</td>
<td>Miles</td>
<td>Miles</td>
<td></td>
</tr>
<tr>
<td>Miles of New Construction</td>
<td>0</td>
<td>20</td>
<td>41</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Open Road Density (Miles/Square Mile)</td>
<td>3.4</td>
<td>4.3</td>
<td>4.9</td>
<td>3.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 2-7. Comparison of Alternatives by Purpose and Need Elements

<table>
<thead>
<tr>
<th>Purpose and Need Element*</th>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fire Hazard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very High</td>
<td>11,873</td>
<td>4,816</td>
<td>2,142</td>
<td>6,505</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4,512</td>
<td>2,150</td>
<td>1,743</td>
<td>2,117</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>3,255</td>
<td>6,473</td>
<td>7,229</td>
<td>6,682</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2,243</td>
<td>8,444</td>
<td>10,769</td>
<td>6,579</td>
<td></td>
</tr>
<tr>
<td><strong>Structural Diversity in Winter Range</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uneven-aged Harvest</td>
<td>0</td>
<td>1,479</td>
<td>1,479</td>
<td>1,086</td>
<td></td>
</tr>
<tr>
<td>Meadow Enhancement (Commercial + Non-commercial)</td>
<td>0</td>
<td>206</td>
<td>206</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Aspen/Birch Enhancement (Commercial + Non-commercial)</td>
<td>0</td>
<td>630</td>
<td>630</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Understory Thin</td>
<td>0</td>
<td>460</td>
<td>288</td>
<td>460</td>
<td></td>
</tr>
<tr>
<td>Structural Stage 5 (Late Succession)</td>
<td>82</td>
<td>567</td>
<td>235</td>
<td>567</td>
<td></td>
</tr>
</tbody>
</table>

* A comparison of the effects of each alternative on mountain pine beetle risk rating, which is a purpose and need element, appears in Table 2-6 above.

Table 2-8. Summary of Effects by Alternative and Selected Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fire/Fuels</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No fuels treatments would occur; 75% of project area would have high or very high fire hazard</td>
<td>Fuels treatments would occur on up to 10,362 acres; 32% of the project area would have high or very high fire hazard</td>
<td>Fuels treatments would occur on up to 10,362 acres; 18% of the project area would have high or very high fire hazard</td>
<td>Fuels treatments would occur on up to 10,362 acres; 39% of the project area would have high or very high fire hazard</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Forest Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No timber harvest would occur; 88% of the project area would have high or moderate bug risk</td>
<td>Vegetation treatment would occur on up to 12,366 acres; 50% of the project area would have high or moderate</td>
<td>Vegetation treatment would occur on up to 18,049 acres; 23% of the project area would have high or moderate</td>
<td>Vegetation treatment would occur on up to 9,394 acres, 60% of the project area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
<td><strong>C</strong></td>
<td><strong>D</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hydrology/Soils</strong></td>
<td>No existing Connected Disturbed Areas (CDA) would be mitigated; no new road-stream crossings would be constructed</td>
<td>28 of the existing 35 CDA would be repaired; new road-stream crossings would be designed so that they do not become CDA; 10 new road-stream crossings proposed; moderate risk of sedimentation, erosion or mass movement as a result of proposed activities</td>
<td>31 of the existing 35 CDA would be repaired; new road-stream crossings would be designed so that they do not become CDA; 20 new road-stream crossings proposed; highest risk of sedimentation, erosion or mass movement as a result of proposed activities</td>
<td>27 of the existing 35 CDA would be repaired; new road-stream crossings would be designed so that they do not become CDA; 6 new road-stream crossings proposed; lowest risk of sedimentation, erosion or mass movement as a result of proposed activities</td>
<td></td>
</tr>
<tr>
<td><strong>Wildlife</strong></td>
<td>No direct impacts to habitat from management activities; highest risk of fire and bugs impacting wildlife habitat; 82 acres would be managed for structural stage 5 into the future</td>
<td>Moderate risk of fire and bugs compared to other alternatives; for all analyzed species, finding is “may impact individuals, but no loss of viability”; treatments within goshawk nest areas would maintain or enhance habitat; 567 acres would be managed for structural stage 5 into the future</td>
<td>Low risk of fire and bugs compared to other alternatives; for all analyzed species finding is “may impact individuals, but no loss of viability”; some treatments would not improve or maintain identified goshawk nesting habitat, requiring a Forest Plan amendment; 235 acres would be managed for structural stage 5 into the future</td>
<td>Risk of fire and bugs would be highest of action alternatives, but lower than Alt. A; for all analyzed species finding is “may impact individuals, but no loss of viability”; treatments within goshawk nest areas would maintain or enhance habitat; 567 acres would be managed for structural stage 5 into the future</td>
<td></td>
</tr>
</tbody>
</table>

*For more detailed effects analysis, refer to Chapter 3 of this document and the associated resource reports in the Steamboat project file.*
3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This section describes the affected environment and discloses the potential effects of the proposed action and each alternative. It forms the scientific and analytical basis for the comparison of the potential environmental effects of the alternatives. In determining potential environmental consequences of each alternative, the IDT considered the following.

- The probable consequences of each alternative on environmental resources.
- Achievement of the stated purpose and need for the project.
- Adherence to Forest Plan standards and guidelines.
- Compliance with federal and state laws and regulations.

Chapter 3 of the Forest Plan FEIS and the Phase II FEIS discuss the short and long term effects, irreversible and irretrievable commitment of resources, and adverse environmental effects associated with implementing management practices in the Black Hills National Forest. The Steamboat Project EIS tiers to the Revised Forest Plan FEIS (USDA-Forest Service 1997), the Phase II Amendment FEIS (USDA-Forest Service 2005a), the Phase II Amendment ROD (USDA-Forest Service 2005b) and the Phase II Amendment Biological Assessment/Biological Evaluation (BABE) (USDA-Forest Service 2005f) to avoid repetition and to allow this description to focus on the site-specific effects that would result from implementation of the proposed action.

3.2 Forest Resources

3.2.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat Project Area for forest resources. It summarizes the Steamboat Project Silviculture Report (Haas 2011), which is located in the Steamboat project file.

3.2.2 Existing Conditions

Structural Stage

Structural stage (SS) is an important forest attribute, categorizing stands based on tree size and density. The Forest Plan identifies distribution objectives for management areas where structural stage could be altered through management. It is not expected, or required, that the areas meet these objectives in the first rotation. However, management is designed as a step to move the areas toward a condition that will meet the distribution objectives in the future. The Steamboat project area is comprised entirely MA 5.4 (Big Game Winter Range).

Structural stages are defined by the following characteristics in the Forest Plan:

- **Structural Stage 1** – Grass/Forb
- **Structural Stage 2** – Shrub/Seedling
• **Structural Stage 3** – Sapling/Pole
  - **3A** – Canopy closure less than 40 percent
  - **3B** – Canopy closure greater than 40 percent but less than 70 percent
  - **3C** – Canopy closure greater than 70 percent

• **Structural Stage 4** – Mature
  - **4A** – Canopy closure less than 40 percent
  - **4B** – Canopy closure greater than 40 percent but less than 70 percent
  - **4C** – Canopy closure greater than 70 percent

• **Structural Stage 5** – Late Succession

Table 3-1: Estimated Acres of Pine by Structural Stage and Alternative for Management Area 5.4 in the Steamboat Project Area

<table>
<thead>
<tr>
<th>Structural Stage</th>
<th>Forest-wide Objective</th>
<th>Alternative A No Action</th>
<th>Alternative B Modified Proposed Action</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5%</td>
<td>1,682 (8%)</td>
<td>1,724 (8.2%)</td>
<td>1,724 (8.2%)</td>
<td>1,724 (8.2%)</td>
</tr>
<tr>
<td>2</td>
<td>5%</td>
<td>153 (0.7%)</td>
<td>137 (0.7%)</td>
<td>137 (0.7%)</td>
<td>137 (0.7%)</td>
</tr>
<tr>
<td>3A</td>
<td>10%</td>
<td>626 (3%)</td>
<td>3,582 (17%)</td>
<td>6,124 (29%)</td>
<td>3,427 (16.3%)</td>
</tr>
<tr>
<td>3B</td>
<td>15%</td>
<td>1,480 (7%)</td>
<td>1,300 (6.2%)</td>
<td>1,245 (5.9%)</td>
<td>1,196 (5.7%)</td>
</tr>
<tr>
<td>3C</td>
<td>5%</td>
<td>1,840 (8.7%)</td>
<td>482 (2.3%)</td>
<td>390 (1.9%)</td>
<td>658 (3.1%)</td>
</tr>
<tr>
<td>4A</td>
<td>25%</td>
<td>4,813 (22.9%)</td>
<td>9,744 (46.4%)</td>
<td>9,663 (46.2%)</td>
<td>8,245 (39.2%)</td>
</tr>
<tr>
<td>4B</td>
<td>25%</td>
<td>5,168 (24.5%)</td>
<td>1,927 (9.9%)</td>
<td>973 (4.6%)</td>
<td>2,452 (12.4%)</td>
</tr>
<tr>
<td>4C</td>
<td>5%</td>
<td>5,216 (24.8%)</td>
<td>1,597 (9%)</td>
<td>569 (3.2%)</td>
<td>2,654 (14.2%)</td>
</tr>
<tr>
<td>5</td>
<td>5%</td>
<td>82 (0.4%)</td>
<td>567 (0.4%)</td>
<td>235 (0.2%)</td>
<td>567 (0.4%)</td>
</tr>
</tbody>
</table>

The existing condition shows a large majority of the project area in 4B and 4C structural stages. Fortunately, these structural stages provide economical opportunities for adjustment. Using the shelterwood system in 4B and 4C stands results in those stands transitioning to structural stages 1, 2, or 4A. In addition to even age management systems, the use of uneven age management systems can result in changes in structure across the landscape as well as intra stand diversity. Structural stage 5 was identified and designated through the analysis and evaluation process.

The Forest Plan calls for providing 10 percent of structural stage 4 with an average tree size of “very large” where the average size pine is greater than 16 inches DBH. Currently, nine percent of the ponderosa pine in MA 5.4 within the Steamboat project area have a tree size of ‘very large.’

**Plant Species Composition**

The vast majority of the NFS land in this project area is dominated by ponderosa pine (21,060 acres, 98%). Other cover types include 320 acres (<1%) of aspen/birch/other hardwoods, and 138 acres (<1%) of white spruce. There are numerous small inclusions (10 acres and less in size) of oak, aspen and other hardwoods well distributed throughout the area. These are usually very productive pine sites where pine will eventually take over the site if no treatment is done. In addition, there are 229 acres (<1%) of grassland and non-forested land. Some of these areas have pine encroaching on them.
**Age Class Distribution**

Approximately 11,165 acres (53%) of the pine cover type are greater than 100 years of age. 5,996 acres (29%) of the pine acres are between 60 and 100 years old, with 3,890 acres (18%) being 60 years or less.

**Figure 3-2: Age Class Distribution by Suitable and Unsuitable Sites**
The distribution of age classes ranges from 0 to 250 years with the majority of stands in the 80 to 140 year age classes. The age class curve is bell shaped with the greatest acreage in the 100-year class as illustrated in Figure 3-2. Most stands in the project area were regenerated post European settlement and are indicative of intensive harvest activities and fire suppression occurring within the last 140 years. The width of the bell curve where the majority of acres occur is between 80 and 140 years, which indicates that many of the stands were regenerated over a 40 year period from approximately 1890 until 1930. This corresponds with historical accounts of heavy logging activity in that time period. Also the low percentage of structural stages 1, 2, and 3 are apparent as SS and age are correlated. There is a period from 1930 to 1970 (40 to 80 year age classes) where the amount of new stand regeneration declines rapidly. Regeneration was less prevalent due to a shift in harvesting methods and amounts as well as a reduction in mineral soil exposure from fire. Within the past 30 years, an increase in the amount of regeneration harvesting has occurred as can be seen by the upward trend in acres in the 0, 10 and 20 year age classes. To develop an even distribution of age classes across the landscape over a 200-year period, approximately five percent of the area would have to be regenerated each decade. In theory, this could occur; however, management objectives, accessibility and natural stand replacement events make the probability of that level of regeneration very unlikely.

**Stocking Levels**

The majority of suitable ponderosa pine acres in the project area are within the timber management zone as identified in Appendix H-2 of the Forest Plan (USDA-Forest Service 2005c). Although they are within the zone, many of these stands are at a high hazard for mountain pine beetle infestation. Considering the existing ongoing epidemic within the project area and that Forest Plan Goal 10, Objective 10-07 states “where outbreaks of MPB could present risks to management objectives, reduce acreage of ponderosa pine stands that are in medium or high risk for infestation”, management activities will move many of these stands to the lower range within the management zone. Although basal areas are generally a good indication of stocking in most sawtimber and pole timber stands, it does not represent smaller diameter stands (less than six inches DBH) nor large diameter stands (greater than 16 inches DBH) well. Figure 3-3 below displays the existing condition and the estimated results of proposed treatments in the action alternatives on basal area distribution. The effects of these proposed changes are described under the alternatives; however, this chart shows them together for comparison.

![Figure 3-3. Acres per Basal Area Class](chart.png)
In the existing condition (Alternative A), 8,335 acres have a BA less than 40, 2,566 acres are between 40 and 79 BA, 6,708 acres are between 80 and 120 BA, and 6,987 acres are over 120 BA. The area shows little diversity in basal area distribution, with much of the area above desired stocking densities.

**Regeneration**

Pine regeneration is occurring in the project area where the crown canopy is open and where competition from grasses, shrubs and forbs is low. In areas where grasses have invaded the site, regeneration is at moderate to low levels. Where pine regeneration is desired, such as in regeneration harvests, activities within the project area should be designed to reduce ground cover competition and expose mineral soil, increasing natural regeneration potential. Past regeneration harvests in adjacent areas have resulted in fully stocked stands of pine when the soil was disturbed. Experience shows that even with competition from grass, pine sites in the project area generally regenerate to full stocking levels, without additional site preparation, within 5 to 10 years.

**Insects and Disease**

Current losses from insect and disease are at endemic levels within the project area. Western gall rust (*Peridermium harknessii*) has been observed in the area. Most of the galls have been observed to be occurring on the limbs and not on the boles of the ponderosa pine. The result will be reduced growth of the pine stands but should not be considered a major threat to the merchantability of the stands in the area. Armillaria root disease (*Armillaria ostoyae*) is another important disease in the Black Hills that kills trees by breaking down cambial tissue, effectively girdling the tree, and causing decay of both sapwood and heartwood. Armillaria centers can vary in size from a few trees to 1,000 acres. Within the project area there is little evidence of armillaria centers and can be considered a minor problem. Also, red rot disease (*Dichomitus squalens*) is common throughout the Black Hills and is a major cause of defect loss in ponderosa pine, especially as pine become overmature. Mortality increases and merchantable volume decreases due to red rot disease within the overmature pine. Diplodia tip blight (*Sphaeropsis sapinea*) is a fungus that attacks ponderosa pine needles and cones reducing growth and eventually killing the pine; however, the occurrence of Diplodia tip blight is uncommon in the Black Hills.

Some of the project area has undergone previous harvesting and non-commercial thinning activities. Slash buildup from these activities has the potential to favor an increase of insects, especially the pine engraver or Ips beetle (*Ips pini*). Where non-commercial thinning has been implemented, no major infestation has occurred and additional activities can be considered a minimal risk. Mountain pine beetle (*Dendroctonus ponderosae*) is currently at endemic levels within the project area. However, areas throughout the Black Hills, and adjacent to the Steamboat project area, are experiencing widespread epidemic infestations of mountain pine beetle. The table below displays the current insect risk rating scheme. This scheme is based on tree size and canopy closure percent. As observed in the existing condition, much of the project area is at a high or moderate susceptibility to mountain pine beetle infestation.
The risk of mountain pine beetle infestation (calculated from stand exam data processed through FVS) is a concern as 88% of the pine cover type is at high or moderate risk. The hazard rating refers to the chances of losses within a stand if an infestation occurs within the area, not the probability of an infestation occurring. If an infestation occurs within stands with a high hazard rating, then one can expect higher overall losses than those stands with lower hazard ratings. The Phase II FEIS indicates the tie between mountain pine beetle risk and fire hazard, and shows that any stand at medium or high beetle risk is at medium to very high fire hazard (USDA-Forest Service 2005a).

Another common insect found throughout the Black Hills that causes mortality in ponderosa pine is the red turpentine beetle (*Dendroctonus valens*). In contrast to the mountain pine beetle, the red turpentine beetle is not aggressive. These beetles are usually not the primary cause of mortality in pine. Red turpentine beetles are opportunistic and typically attack trees already weakened by drought, fire, other insects, or logging damage. If enough damaged pine exists for their numbers to multiply, they can fly to otherwise healthy pine and be the primary cause of their death. In the Steamboat area, red turpentine beetle activity is very low and is not expected to increase.

The western pine tip moth (*Rhyacionia bushnelli*) and the southwestern pine tip moth (*Rhyacionia neomexicana*) are both found in the Black Hills. Both moths attack small trees (less than 10 feet in height) and are not considered serious pests in the Steamboat project area. The activity level of both species is currently low and not expected to increase.

Other insects affecting both pine and other species of trees in the project area may be present, but are having minimal impact on the area and are expected to have a low impact in the future.
Growth and Yield

Volume estimates for the entire 21,060 acres of ponderosa pine in the Steamboat project area indicate a calculated volume of 3.9 million board feet. Volume per acre in these stands range from 1,000-35,000 board feet per acre.

The growth and yield potential for pine stands in the project area is average for ponderosa pine. Site Index (SI), which is height growth potential at a base age and an indicator of site quality, shows that 11,178 acres have a SI greater than or equal to 60 at a base age of 100. This indicates above average production on the Black Hills National Forest. Also, timber productivity, which is the potential cubic foot volume (CF) growth per year at CMAI, shows that 13,330 acres have an SI greater than 35, which is the average for the Black Hills National Forest. These stand growth indicators, combined with volume estimates, indicate that stands within the project area are capable of timber production.

3.2.3 Environmental Consequences

Summary of Effects

<table>
<thead>
<tr>
<th></th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Type/Species Composition</td>
<td>0</td>
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<td>830</td>
<td>830</td>
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<td>Mountain Pine Beetle Risk (Acres)</td>
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<tr>
<td>Acres &gt; 100 BA treated</td>
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<td>Acres 60-100 BA treated</td>
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<td>Age Class Distribution</td>
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<td>Immediate impact on age class distribution</td>
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<td>Moderate number of acres; high diversity of treatments.</td>
<td>High number of acres; moderate diversity of treatments.</td>
<td>Low number of acres; high diversity of treatments.</td>
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<td>Regeneration</td>
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<td>Planting required</td>
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Analysis of Effects

Alternative A (No Action)

Direct and Indirect Effects
Under this alternative, no timber management activities would occur other than ongoing activities such as firewood gathering, Special Forest Product (SFP) collections and other activities approved under prior environmental analyses. Alternative A is used as a baseline for comparison with the other alternatives. No commercial volume would be removed, insect and wildfire risk would not be reduced, structural stage diversity and timber productivity would not be improved.

Insects and Disease
Based on current stand conditions, the overstocked stands of pine pose a high hazard for mountain pine beetle infestation. This hazard would likely increase over time as stands grow and stocking levels increase. There are 18,576 acres (88%) of NFS conifer stands in the project area that currently have a high or moderate risk rating. Coupling with the high beetle populations in the area, the likelihood of a continuous, widespread, epidemic-level infestation of mountain pine beetle is high. Significant changes are taking place near the Steamboat project area due to mountain pine beetle mortality. If no action is taken, many currently forested areas, eventually including those within the Steamboat project area, could lose most or all of their mature pine overstory. This loss of mature pine trees would add greatly to fuel loads and wildfire hazard on a long-term basis and cause substantial changes to wildlife habitat.

If pine stands are left untreated, the mountain pine beetle hazard would remain high in the majority of the project area until stocking levels decrease due to mortality from insect activity or wildfire. It is not possible to determine the exact stands that would become infested and the precise level of beetle-caused mortality, but reasonable estimates can be made based on the current extent of the epidemic, the expanding pine beetle brood populations available to infest new trees, and the large volume and wide distribution of moderate to high hazard stands in the project area. Considerable changes could occur across the landscape of the Steamboat project area.

Initially, the highest levels of pine tree mortality would be expected in the southern and western parts of the project area; however, pockets of infested trees are currently occurring throughout the project area (USDA-Forest Service 2010). In the hardest hit areas, near complete mortality of the larger trees would occur on up to 80 percent of structural stages 4B, 4C and 5 (dense stands with larger trees). Significant but lesser amounts of mortality would be expected in structural stage 3B, 3C and 4A; 3B and 3C because of the tree density and 4A because of the larger tree size. Stands in high mortality areas would revert to younger age structural stages. Adding younger structural stage stands helps to increase vegetation diversity in the area, which is dominated by mature pines. However, the large volume of dead and down trees would significantly increase fuel loads and wildfire hazard in the WUI. This increases the probability for large, intense wildfires resistant to control that threaten natural resources, private property, and human life.

In areas that currently have lower infestation levels, it is assumed they would also have lower overall mortality rates. This may not be the actual case, as the current epidemic could easily overwhelm the entire project area. In these areas, structural stage 4B, 4C and 5 stands are expected to have substantial beetle-caused mortality, with a high percentage being changed to structural stage 4A, and lesser amounts to younger structural stages 2 and 3.
The pine engraver beetle is non-aggressive and breeds in damaged ponderosa pine trees and slash greater than two inches in diameter. Unless severe drought, weather damage or fire damage occurs within the area, the probability of a major buildup of the pine engraver beetle insects is very unlikely. Other insects and diseases are expected to remain at current levels barring natural disasters.

**Plant Species Composition**
With no action, plant species composition and diversity would decrease. Pine is encroaching into hardwood and meadow areas and filling in small openings in the forest canopy. As the canopy closes, aspen and other hardwoods would diminish in numbers until natural disturbances once again open up the canopy. On many sites, forbs and grasses in the under story would be shaded out, reducing quality of other resources such as wildlife, range, recreation and aesthetics.

**Other Effects**
Other effects of no action in the project area would include increased mortality and the resulting decrease in growth and yield due to the continuation of the pine beetle epidemic, reduction of diameter growth due to age and overstocking in stands not impacted by pine beetle activity, and an increase in the risk of high intensity wildfire. Without treatment, the 12,558 acres of pine type with a high risk for infestation would experience reduced growth due to overcrowding and competition for nutrients, water and light. Age class distribution would not change except for changes created through unpredictable natural processes such as insect infestations and wildfire. Long-term effects in stands not heavily impacted by pine beetle infestation would be an increase in mortality due to competition between pine, an increase in merchantable defect due to disease, and an increased crown fire hazard. Long term sustainability of the timber resource would be in jeopardy since much of the mature forest would be killed by the pine beetle and relatively few acres are currently young and available to grow into the next generation of mature forest.

Periodic annual increment is declining in some stands and is less than desired conditions due to overstocking and age. The effect of not taking action would be a further decline in the periodic annual increment. The National Fire Management Act (NFMA) requires that even-aged stands scheduled to be harvested during the planning period would generally have reached the culmination of mean annual increment (CMAI) of growth. During the diagnosis phase of the analysis, 175 stands were identified that had reached CMAI. Net growth would remain positive under Alternative A, but would be below its potential.

As the stands of pine become increasingly dense, they would become susceptible to snow damage. Dense stands of pine with interlocking crowns cannot shed snow as well as open stands. During times of heavy snowfall and wind, snow can build up on the crowns of dense stands and cause heavy breakage. Stands with open canopies shed their snow as wind shakes them and are less susceptible to snow buildup. Under this alternative, increased snow damage would likely occur.

The potential for a stand replacing wildfire would be higher without treatment. Crown fires would cause many of the stands to be completely consumed. The effect of such a high intensity fire to the timber resource would be a loss of timber value, a large reduction of age class distribution, a disruption of an even flow of timber to local mills, an increase in insects, and a disruption of the natural regeneration process. Solarization would reduce the success of both natural and artificial regeneration. Soil
sterilization would reduce productivity for many years, as the process of rebuilding soil horizons in this relatively dry climate is slow.

**Cumulative Effects**
The area considered for cumulative effects analysis is the Steamboat project area. The time period considered is a total of 50 years; 25 years into the past and future.

**Past Activities**
The Black Hills has a long history of natural and human disturbance on this landscape, the most significant occurring in the last 25 years, which includes large wildfires, the most recent mountain pine beetle infestation and commercial and non-commercial vegetative treatment. Many treatments were designed to lower the basal area to promote increased growth and vigor as well as lessen susceptibility to mountain pine beetle attack and large wildfires. Approximately 3,859 acres of pine forest burned in the Ricco fire of 2005. This fire consumed mature pine stands resulting in the loss of commercial volume and disturbance of wood fiber production. Other effects included and increase in SS1 and a reduction of acres at risk for future wildfire and insect infestation. Levels of pine beetle activity have increased over the past 10 years in the project area. Large scale outbreaks are occurring in close proximity of the project area. Changes in forest structure, loss of commercial volume and productivity are impacts associated with pine beetle activity. Small areas within the project area are experiencing pine beetle activity.

The effect of past commercial and non-commercial treatments has been an increase of merchantable volume growth rates and increase in the quality of timber. However, not all stands were treated in the past and growth has occurred leading to many overstocked stands. An additional effect has been an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees. There has been an increase in individual tree growth by releasing remaining trees from competition for light, water and nutrients. Due to heavy cutting, some stands were regenerated resulting in seedlings. A reduction of the risk to the pine stands due to the reduction of basal area below the level of susceptibility to pine beetle attack also occurred, but risk is now high due to growth.

Past practices of fire suppression and minimal management induced disturbance have cumulatively resulted in an area overstocked with trees that lack age and size diversity.

**Present Activities**
No major activities are presently occurring on NFS lands within the project area and none are proposed under Alternative A. Post-sale (KV) activities will continue in the Cavern, Kirk, and Windy timber sale areas. These activities were analyzed under previous decision documents and were developed to maintain the productivity of the area. Development on private land has occurred on parcels of land in the project area. Areas that were once open meadows are increasingly being converted into sub-developments. Since private land comprises 12 percent of the project area (2,713 acres) and approximately half of that is timberland, the effects of timber harvesting practices on private land could affect the project area. The amount of timber harvesting on private land during any one decade has been small and its effects on NFS timberland have been minimal.

**Proposed or Reasonably Foreseeable Activities**
Anticipated future silviculture activities, not connected to this analysis, that will occur within the area are as follows: fuel breaks adjacent to developed private land may be created for protection of these improvements. Within the planning area several closed timber sales, as noted above, will have ongoing KV activities. This
analysis incorporated and considered the KV treatments and associated effects. Firewood gathering and Christmas tree cutting by permit will continue to occur within the area. Other silvicultural treatments such as small salvage sales for the removal of storm damage, road right-of-way clearing, pine encroachment removal, hardwood regeneration and release may occur within the project area. The size of these projects would generally be small and the cumulative effects of these projects should not be of any measurable significance. Ongoing mechanical treatments and prescribed burning activities occurring on NFS land within the project area have similar effects to past treatments. This includes relatively small amounts of treatments on private land within the project area, mostly in conjunction with development. Anticipated future silviculture activities, not connected to this analysis are minor in scope. The size of these projects would generally be small and cumulative effects of these projects should be very minor. Continuing development of private land and actions taken on private land to protect property from wildfire and mountain pine beetle would result in additional scattered openings and lower basal areas, but would have no major effect on the forested landscape within the project area.

Alternative A, by not taking any action to address the purpose and need outlined for the Steamboat Project, would result in significant changes on the landscape and adverse cumulative effects to the timber resource. These effects would include further movement away from Forest Plan goals and objectives for vegetative diversity, wildfire hazard, mountain pine beetle risk, and timber production. Past and present forest improvements would be negatively affected by ongoing pine beetle infestations and could be completely eliminated where wildfires occur.

**Alternative B (Proposed Action)**

*Direct and Indirect Effects*

The intention of this alternative is to move the timber resources within the project area toward the desired future condition identified in the Forest Plan.

Under this alternative, 12,336 acres of forestland would be treated using a variety of commercial and non-commercial prescriptions. Many of the stands in the project area have inclusions of less than 10 acres in size that may have basal areas, age classes, size classes and tree species that differ from the majority of the stand. Treatments specified generally apply to 80 percent or more of the stand. As these stands are laid out and marked for treatment, these inclusions may not be prescribed and marked as specified in the stand treatment table, but rather prescribed using criteria developed for other stands with similar characteristics (i.e., an inclusion of pole size pine may be thinned if located within a stand scheduled for a seed tree cut).

Commercial treatments include overstory removal, shelterwood cut, commercial thinning, group selection, individual tree selection, hardwood enhancement, meadow enhancement, patch clearcut and POL. Non-commercial treatments include prescribed burning and non-commercial thinning of trees less than nine inches DBH. Removal of pine from meadows (meadow enhancement) and hardwood enhancement can be commercial or non-commercial depending on the size of the pine trees being removed. The following describes treatment types and their effect:

**Removal Cuts**

Overstory removal cuts would occur on 874 acres and would generally be followed with non-commercial thinning. The overmature overstory stands have reached CMAI and are no longer needed for seed and shade.
The removal of the pine overstory would liberate the established understory from competition for light, water and nutrients. Generally, all overstory pine nine inches DBH and greater would be removed, retaining only pine necessary for other resource needs. In areas where regeneration is less than 300 trees per acre at least two feet tall, or where prescribed burning is planned, residual trees may be retained for seed tree purposes. Prescribed burning following treatment is generally not proposed in order to protect regeneration, but select stands may be included to maintain road to road containment perimeters of prescribed burn blocks. The preferred logging method would be whole tree yarding within 300 feet of private property to reduce the amount of residual fuels left on the ground. The effect overstory removal would be an increase in growth of the remaining pine, the establishment and production of forage for both cattle and wildlife, an increase in the nutrients and fuel loading outside the 300 foot private land buffer, a decrease in vertical diversity (i.e., multi-storied stands), and a reduction in the amount and continuity of aerial fuels. Post-sale work included in this treatment would be prescribed burning, cull tree cutting, regeneration surveys, and possible non-commercial thinning to manage the growing stock levels.

**Shelterwood Cut**
Shelterwood cuts would begin the regeneration process on 1,392 acres of pine. Pine would be left at an approximate basal area of 30 square feet per acre. Leave trees would generally be dominant or co-dominant pine with full crowns and good form. Form and vigor are considered a higher priority than spacing in leave tree selection, so leave basal area may range from 20 to 40 square feet per acre. Opening up the canopy allows sufficient sunlight to reach the forest floor to establish seedlings, yet provides enough shade to limit the harsh microclimates of full canopy openings. The scarification provided by whole tree logging and possible prescribed burning exposes mineral soil necessary for ponderosa pine seedling establishment. These stands have reached CMAI. Proposed treatment stands may have immature inclusions or stories within them. Treatment of these inclusions would be appropriate to their condition, for example thinning a pole timber inclusion rather than implementing a shelterwood cut. Mortality due to age in the retained overstory pine within the stands should be minor over the next decade. This silvicultural method has been extensively used in this area and regeneration success is very high. Cull tree cutting (included in the non-commercial thinning treatment type) and prescribed burning would be allowed in these stands post-harvest prior to adequate seedling establishment. Post-harvest activities would include prescribed burning and pre-commercial thinning as well as regeneration surveys.

**Commercial Thinning**
Commercial thinning would occur on 4,617 acres of the area. Commercial thinning would generally consist of retaining the best formed, most dominant and vigorous trees. Residual densities would generally be 50-60 BA with some stands treated to lower or higher basal areas based on proximity to structures on private land, communities, and the need to achieve the structural stage goals for the management emphasis areas. Thinning would reduce the stocking levels of the overstory in overstocked stands. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees would develop larger diameters due to a reduction of competition which concentrates the stand growth on the fewer stems. Reduction of basal area below the level of susceptibility to pine beetle attack would reduce risk to the pine stands. The trade off is total yield would not be maximized because the trees would not fully occupy the stand. This treatment also includes non-commercial thinning of trees less than nine inches DBH, and possible prescribed burning to reduce fuels and reintroduce fire to the ecosystem. Whole tree skidding is the preferred method to remove as much slash as possible during harvest activities.

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Individual Tree Selection

Individual tree selection on 1,186 acres would create an uneven-age stand structure. Individual trees in all diameter classes would be removed to create an uneven canopy. The largest number of stems would be in the smallest diameter class, with the number in each diameter class decreasing with increasing size. Uneven-aged stands, when regulated, have at least three age classes. Residual densities would range from 50-60 BA in trees with a DBH greater than nine inches. Trees smaller than nine inches DBH would be thinned according to a variable density or uneven-age distribution based on height classes or variable spacing. Multiple age classes distributed throughout a stand creates diversity for wildlife habitat, enhances scenic values, increases forage availability and maintains regulation of timber products.

Group Selection

Group selection is an uneven-aged treatment that would occur on 293 acres of the project area. This treatment creates or maintains multiple age classes in even-age groups. The age classes are maintained in perpetuity through stand regulation. Groups are up to two acres in size and are scattered throughout a site. Groups are openings designed to create the youngest age classes (SS 1 or SS2). The area between the groups would be thinned to a residual 50-60 BA in trees greater than nine inches DBH. Group selection creates an uneven-aged stand that contains intra-stand diversity, increasing habitat diversity for plants and animals.

Product-other-than-log (POL)

Product-other-than-logs are made from trees generally between five and nine inches DBH. The primary objective of this treatment is to concentrate growth and vigor on residual trees. Suppressed, defective, and excess trees are removed. This treatment may be commercial or non-commercial and is proposed on 1,116 acres of the project area in Alternative B.

Hardwood Retention and Restoration

The enhancement of 630 acres of hardwoods (aspen/birch) from pine competition by the commercial and non-commercial removal of conifers is proposed in this alternative. Aspen/birch enhancement is intended to maintain or encourage growth. This treatment may be applied to stands with either a pine or aspen/birch cover type.

- **Stands with a pine cover type**—When applied to stands with a pine cover type, the pine portion of the stand would be treated with a commercial thin. Pine areas within stands with a 4C structural stage would be thinned to 60 BA, and pine areas within stands with a 4B structural stage would be thinned to 40 BA.
- **Stands with an aspen/birch cover type**—When applied to stands with an aspen or birch cover type, all commercial and non-commercial pine may be removed across the stand.

This treatment would move toward the Forest Plan goal of increasing the aspen component, but does not reach the goal of doubling aspen acres across the forest. The effects of this treatment would be an increase in vegetative diversity, vertical and horizontal diversity, and increased vigor of hardwood communities by release from pine competition. Indirectly, hardwood dependent wildlife species would have increased availability of habitat. An additional indirect benefit would be the value of hardwood stands as fuel breaks. If pine trees with a DBH greater than nine inches are present, the treatment would be commercial; if pine trees are less than nine inches DBH, the treatment would be non-commercial.
Patch Clearcut
Patch clearcuts are proposed on 190 acres of the project area. This commercial and non-commercial treatment would include the removal of all conifers from patches not to exceed 10 acres in size. The size and number of patches harvested in a site would vary depending on site characteristics. Patches would be at a minimum of two per site and irregularly shaped to blend into the landscape. Sites were preferably identified on south aspects where grass forming soils were present. The intent of this treatment is to open browsing areas for various resource needs. Prescribed burning would help facilitate revegetation of grasses and forbs.

Non-commercial Thinning
Non-commercial thinning would occur as the primary treatment on approximately 1,372 acres of the area. At the time of implementation an adaptive management approach would be conducted in regards to non-commercial activities. Following commercial harvests, an assessment would be conducted to determine if the appropriate follow-up treatment is non-commercial thinning, prescribed burning or both. Thus, non-commercial thinning could occur on up to 10,048 acres as a complimentary treatment following commercial treatments. Non-commercial thinning would occur in pine stands and consists of cutting pine at least one foot in height and up to nine inches in diameter, leaving the largest pine at a rate of at least 150 trees per acre. Site specific non-commercial treatments would be determined after the commercial units are completed. Thinning would reduce the stocking levels in overstocked stands and move those stands toward the Forest Plan desired condition. The improved distribution of the residual understory would increase the quality of the timber through the removal of damaged, diseased, and poorly formed trees, would lower the vertical fuel loading and would decrease the cost of future weeding and cleaning activities. There would be an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees would develop larger diameters due to a reduction of competition, which concentrates the stand growth on fewer stems. A reduction of risk to the pine stands would occur due to the reduction of basal area below the level of susceptibility to pine beetle attack. Slash buildup from non-commercial thinning, if not treated properly, could encourage Ips beetle (Ips pini) buildup and mortality in residual stands of pine. Past practices of lopping and scattering or burning of slash within a year of treatment has reduced Ips infestation to less than a few trees per acre. Scattering slash or mastication is proposed as they facilitate the rapid drying of fuels, which reduces conditions favorable for Ips buildup.

Prescribed Burning
Broadcast prescribed burning could occur on up to 10,000 acres, out of a possible 10,608 proposed for burning, reducing ground fuels and increasing vegetative diversity in the understory. In some of the stands, the understory vegetation is lacking due to needle cast and a closed canopy cover. A low to moderate intensity prescribed fire would reduce inhibiting duff and stimulate residual grasses and forbs. Burning in stands to be regenerated would favor grass establishment and reduce regeneration. The effects of prescribed burning on the timber resource would be a short-term increase in growth from the nutrients released into the soil and from decreased pine competition. Some tree mortality may occur associated with prescribed burning that would decrease the number of live stems per acre; this mortality may be beneficial (reducing competition) or detrimental (exceeding mortality rate limits and long term yield). The level of mortality allowed or desired for each prescribed burn unit would be determined by the silviculturist and fuels specialist, based on site-specific conditions, during development of the prescribed burn plan for that unit. Additional protection of the timber resource from high-intensity wildfire would be increased by the removal of ground fuels and ladder fuels. Burning would encourage grass and forb production, particularly oak, which compete with pine regeneration.
Structural Stage
Within the project area, stand structure would generally change from a closed canopy structure to an open canopy structure. More than 7,800 acres would move from the more closed 3B, 3C, 4B and 4C structures to the open structures of 3A and 4A. This is designed to reduce mountain pine beetle risk and to accomplish the goal of fire hazard reduction within the WUI. This was done also to achieve Forest Plan objective 10-01 to manage for 50 to 75 percent moderate-to-low fire hazard in the WUI and reduce fire hazard within proximity of structures (USDA-Forest Service 2005c). Implementing Alternative B would result in some immediate changes of structural stage distribution across the project.

<table>
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<tr>
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<th>Change</th>
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</tr>
<tr>
<td>SS 2</td>
<td>153</td>
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</tr>
<tr>
<td>SS 3A</td>
<td>626</td>
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</tr>
<tr>
<td>SS 3B</td>
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<tr>
<td>SS 3C</td>
<td>1,840</td>
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<td>SS 4B</td>
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<td><strong>21,060</strong></td>
<td></td>
</tr>
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</table>

Changes in structural stage are generally from the following for Alternative B:

- Small increase in SS1 due to meadow enhancement.
- Small decease in SS2 due to removal cuts having sapling (1-9” DBH) size regeneration.
- Moderate increase in SS3A due to removal cuts and pre-commercial thinning.
- Small decrease in SS3B due to non-commercial thinning in sapling/pole size stems.
- Decrease in SS3C due to commercial and non-commercial thinning in sapling/pole size stems.
- Large increase in SS4A due to shelterwood establishment cut, uneven age management and commercial thinning.
  - Large decrease in SS4B due to commercial and regeneration treatments opening the canopy.
  - Large decrease in SS4C due to commercial and regeneration treatments opening the canopy.
- Increase in SS5 due to under thinning.

Past experience indicates the forest is not lacking in trees between one and nine inches DBH; however, the data does show that there are relatively few pure stands of this structural stage. It was assumed that all overstory removal treatments resulted in SS3.

Other assumptions made to determine post-treatment structural stage:

- Only primary treatments were used for post SS conversion.
- Whole tree yarding used as the primary activity fuel method.
• Commercial thinning was evenly spaced unless specifically noted in a stand.
• All shelterwood establishment cuts were between 20-40 BA.

This alternative is intermediate in its effect on moving the area towards the desired condition for structural stage; it makes more progress than Alternatives A or D but less progress than Alternative C. Reductions in tree size are due to commercial thin treatments that remove larger sized trees and removal cuts.

Changes to Forest-wide structural stages as a result of Alternative B are displayed in the table below. Generally, structural stages change only slightly, less than one percent. Changes of a higher magnitude are difficult to effect when treating a relatively low proportion of the forest as a whole. Therefore, the goal is to move toward the Forest-wide objectives with each entry.

<table>
<thead>
<tr>
<th>MA 5.4</th>
<th>Objective</th>
<th>Existing *</th>
<th>Acres</th>
<th>%</th>
<th>Alt. B</th>
<th>Acres</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>1</td>
<td>5%</td>
<td>45,616</td>
<td>13%</td>
<td>45,658</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5%</td>
<td>10,152</td>
<td>3%</td>
<td>10,136</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3A</td>
<td>10%</td>
<td>17,454</td>
<td>5%</td>
<td>20,410</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3B</td>
<td>15%</td>
<td>22,227</td>
<td>7%</td>
<td>22,047</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3C</td>
<td>5%</td>
<td>15,763</td>
<td>5%</td>
<td>14,405</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>4A</td>
<td>25%</td>
<td>86,487</td>
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<td>91,418</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4B</td>
<td>25%</td>
<td>87,864</td>
<td>26%</td>
<td>84,623</td>
<td>25%</td>
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<tr>
<td></td>
<td>4C</td>
<td>5%</td>
<td>52,865</td>
<td>16%</td>
<td>49,246</td>
<td>15%</td>
<td></td>
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<tr>
<td></td>
<td>5</td>
<td>5%</td>
<td>1,066</td>
<td>0.3%</td>
<td>1,551</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>339,494</strong></td>
<td><strong>100</strong></td>
<td><strong>100%</strong></td>
<td><strong>339,494</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Plant Species Composition**
Plant species composition and diversity would increase under this alternative. The amount of hardwood and meadow acreage would increase a minor amount with the largest increase in plant species composition increasing in the understory of the pine stands. Pine regeneration in the understory after harvest would be abundant and may be a limiting factor in their establishment. Understory species establishment and diversity would be much greater than the existing condition (Alternative A) because mechanical treatments and prescribed burning would limit pine regeneration and encourage grass, shrub and forb establishment.

**Age Class Distribution**
Age class distribution would improve in this alternative by removing the overstory on approximately 874 acres. In addition, the shelterwood cuts on 1,392 acres should establish regeneration under the reserve trees, providing future young stands. A correlation exists between tree age and diameter; generally, cutting larger trees reduces stand age and cutting smaller trees (i.e., thinning from below) would increase stand age. In this alternative, there would be an increase in the amount of mature open forest due to shelterwood cuts and commercial thinning. This would help increase vigor for resistance to insect infestation and help promote fiber production for large tree growth objectives. There would also be a small increase in the sapling and pole age classes due to removal of larger and older pine. Uneven-age treatments such as group selection and individual tree selection would create multiple age classes mixed throughout a site, providing intra-stand diversity.
Regeneration
The natural regeneration of pine and other native species of trees within the project area should be adequate to meet regeneration stocking standards outlined in the Forest Monitoring Plan. Whole tree yarding, which is the preferred method for activity fuels created by management, would have the effect of site preparation by scarification of the forest floor, which favors regeneration establishment and has a positive effect in discouraging competition from grasses and forbs during seed germination and early regeneration establishment. The abundance of regeneration would; however, create dense, sapling size pine within the next 20 to 40 years, which would lead to an increased fire hazard as the saplings represent ladder fuels. Non-commercial thinning would be necessary to reduce the vertical fuel loading, as well as release the residual trees from competing vegetation. Where prescribed burning occurs, regeneration would be reduced due to the rapid establishment of competitive grasses and forbs. Long term effects would be increasing acreage of healthy pine regeneration and the establishment of a new age class. Short term effects could include the need for tree planting and the associated labor and cost.

Insects and Disease
According to Schmid et al (2007) the most important aspect of managing mature ponderosa pine stands in the Black Hills is minimizing pine beetle-caused mortality through tree thinning. The best effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and sanitation for areas of beetle buildup (Schmidt et al 2007). These are forest management actions that increase tree vigor and reduce stand susceptibility to beetle attack through reducing stocking levels. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Sanitation harvest (removal of infested trees) can also provide protection to surrounding uninfested trees and stands by removing sources of attacking beetles. Creating diverse stand conditions across the landscape results in an overall forest that is less susceptible to beetles in the future. Treatments proposed in Alternative B would reduce the mountain pine beetle risk across the project area, as displayed in Table 3-5.

<table>
<thead>
<tr>
<th>Risk Rating</th>
<th>Alternative A (Existing Condition)</th>
<th>Alternative B</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>12,265</td>
<td>4,250</td>
</tr>
<tr>
<td>Moderate</td>
<td>6,287</td>
<td>6,314</td>
</tr>
<tr>
<td>Low</td>
<td>2,508</td>
<td>10,496</td>
</tr>
</tbody>
</table>

Long term effects to the landscape would be a smaller proportion of the pine forest transitioning to a high risk rating and a less chance that a large scale insect infestation will affect the landscape. Alternative B significantly reduces the risk of mountain pine beetle infestation in the project area; the overall effect is less than Alternative C but greater than Alternative D.
Slash buildup from treatments could encourage Ips beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices such as lop and scatter logging systems have helped to reduce the amount of infestations by scattering the fuels for rapid drying, effectively reducing favorable conditions for Ips. Whole tree skidding in association with burning of slash piles within a year of treatment reduces the amount of slash and reduces conditions favorable for Ips infestation. Other insects and diseases affecting both pine and other species of trees in the project area are having minimal impact on the area and would probably continue to have a low impact under this alternative.

**Growth and Yield**

Growth and yield for stands within the project area would improve as a result of Alternative B. Approximately 48.3 million board feet (MMBF) of commercial timber would be removed in this alternative. Treatments implemented under this alternative would capture a portion of the current commercial potential and provide sustained commercial timber opportunities for the future. Improved and sustainable growth volume yield over time would be addressed by increasing growth rates in overstocked stands through the reallocation of resources, diversifying stand structure, and reducing stand susceptibility to insects and wildfire. Alternative B improves current and future growth rates while providing volume at this entry and in the future.

**Cumulative Effects**

The area considered for cumulative effects analysis is the Steamboat project area. The time period considered is a total of 50 years; 25 years into the past and future.

**Past Activities**

Past activities are listed under Alternative A above. Cumulative effects of past treatments and treatments proposed in this alternative would generally be positive. Thinning of stands created with regeneration harvests would bring those stands into desired condition. Fire hazard reduction and pine beetle risk that was lowered with past treatments would be maintained where treatment occurs in these alternatives. Plant species diversity was increased with past treatments and would be minimally increased in these alternatives where treatment occurs.
Present and Future Activities
In addition to the present and future activities identified in Alternative A, implementation of any of the action alternatives would result in a decreased mountain pine beetle risk, reduced risk to high intensity wildfire, increased growth rates, improved overall quality of retained trees in treated areas, increased forage and shrub presence and growth, and improvement in the structural stage and age class balances.

The difference in cumulative effects between the action alternatives is directly related to the quantity and type of treatments. Alternative C would have the highest associated cumulative effect due to having the highest level of treatment. Alternative D would have the least effect and Alternative B would be intermediate in its impact. The effects of any of the three action alternatives would generally be positive and move this area toward Forest Plan goals and objectives.

Volume removed under any of the action alternatives would not be available at future entries. Volume removed under the action alternatives would be offset by short term increases in merchantable productivity and long term increases in productivity due to regenerated stands. Thinning would result in reallocation of resources to residual trees; thus, in the long term, increasing volume production. Regeneration treatments initiate or release vigorous growing stands that can fully utilize available resources and provide future commercial opportunities. Alternative C would contribute the most volume removed and Alternative D the least with Alternative B intermediate.

Non-commercial activities are also identified in each action alternative. These activities would generally be a secondary treatment and enhance or maintain the conditions created by the primary vegetation treatment.

Alternative C

Direct and Indirect Effects
This alternative was developed to address comments requesting a more aggressive approach with regards to reducing mountain pine beetle risk.

Under this alternative, 18,049 acres of forestland would be treated, including commercial and non-commercial treatments. The range of silvicultural activities proposed under this alternative is aggressive in comparison of the other action alternatives. The treatments in the proposed action (Alternative B) were expanded upon to effect a greater reduction to mountain pine beetle risk across the project area.

The direct and indirect effects of individual treatment types (e.g. removal cuts, shelterwood cuts, etc.) would be the same as described above under Alternative B, albeit the effects would be more widespread due to the increased acreage treated under Alternative C. The description of those effects is not repeated here.

Structural Stage
Within the project area, stand structure would generally change from a closed canopy structure to an open canopy structure. More than 7,800 acres would move from the more closed 3B, 3C, 4B and 4C structures to the open structures of 3A and 4A. This is intended to reduce mountain pine beetle risk and to accomplish fire hazard reduction within the WUI. This was also done to achieve Forest Plan objective.
10-01 to manage for 50 to 75 percent moderate-to-low fire hazard in the WUI and reduce fire hazard within proximity of structures (USDA-Forest Service 2005c).

<table>
<thead>
<tr>
<th>SS</th>
<th>Existing (Alt. A)</th>
<th>Alt. C</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,682</td>
<td>1,724</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>153</td>
<td>137</td>
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</tr>
<tr>
<td>3A</td>
<td>626</td>
<td>6,124</td>
<td>5,498</td>
</tr>
<tr>
<td>3B</td>
<td>1,480</td>
<td>1,245</td>
<td>-235</td>
</tr>
<tr>
<td>3C</td>
<td>1,840</td>
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</tr>
<tr>
<td>4B</td>
<td>5,168</td>
<td>973</td>
<td>-4,195</td>
</tr>
<tr>
<td>4C</td>
<td>5,216</td>
<td>569</td>
<td>-4,647</td>
</tr>
<tr>
<td>5</td>
<td>82</td>
<td>235</td>
<td>153</td>
</tr>
<tr>
<td>Total</td>
<td>21,060</td>
<td>21,060</td>
<td></td>
</tr>
</tbody>
</table>

Changes in structural stage are generally from the following for Alternative C:

- Small increase in SS1 due to meadow enhancement.
- Small decrease in SS2 due to removal cuts having sapling (1-9” DBH) size regeneration.
- Large increase in SS3A due to extensive removal cuts and pre-commercial thinning.
- Small decrease in SS3B due to non-commercial thinning in sapling/pole size stems.
- Decrease in SS3C due to commercial and non-commercial thinning in sapling/pole size stems.
- Large increase in SS4A due to shelterwood establishment cut, uneven-age management and commercial thinning.
  - Large decrease in SS4B due to commercial and regeneration treatments opening the canopy.
  - Large decrease in SS4C due to commercial and regeneration treatments opening the canopy.
- Increase in SS5 due to under thinning.

Table 3-6 displays the effect of Alternative C on the Forest-wide structural stage distribution. Generally, structural stages change only slightly, less than one percent. Changes of a higher magnitude are difficult to effect when treating a relatively low proportion of the forest as a whole. Therefore, the goal is to move toward the Forest-wide objectives with each entry.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Existing *</th>
<th>Alt. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>Acres</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>5%</td>
<td>45,616</td>
</tr>
<tr>
<td>2</td>
<td>5%</td>
<td>10,152</td>
</tr>
<tr>
<td>3A</td>
<td>10%</td>
<td>17,454</td>
</tr>
<tr>
<td>3B</td>
<td>15%</td>
<td>22,227</td>
</tr>
<tr>
<td>3C</td>
<td>5%</td>
<td>15,763</td>
</tr>
<tr>
<td>4A</td>
<td>25%</td>
<td>86,487</td>
</tr>
</tbody>
</table>
### Objective

<table>
<thead>
<tr>
<th>SS</th>
<th>Objective</th>
<th>Existing *</th>
<th>Alt. C</th>
</tr>
</thead>
<tbody>
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<td>4B</td>
<td>%</td>
<td>Acres</td>
<td>%</td>
</tr>
<tr>
<td>25%</td>
<td>87,864</td>
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<td>83,669</td>
</tr>
<tr>
<td>4C</td>
<td>%</td>
<td>Acres</td>
<td>%</td>
</tr>
<tr>
<td>5%</td>
<td>52,865</td>
<td>16%</td>
<td>48,218</td>
</tr>
<tr>
<td>5</td>
<td>%</td>
<td>Acres</td>
<td>%</td>
</tr>
<tr>
<td>5%</td>
<td>1,066</td>
<td>0.3%</td>
<td>1,219</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>339,494</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Plant Species Composition

Plant species composition and diversity would increase in this alternative. The amount of hardwood and meadow acreage would increase a minor amount with the largest increase in plant species composition occurring in the understory of the pine stands. The increased amount of removal cuts proposed in this alternative would increase the amount of understory vegetation, but would also result in a lack of vegetative diversity due to the abundance of ponderosa pine regeneration. Actively addressing meadow encroachment by removing pine trees and the enhancement of hardwood stands would help maintain and improve species and cover type diversity.

### Age Class Distribution

Age class distribution would improve in this alternative by removing the overstory on approximately 874 acres. In addition, shelterwood cuts on 1,392 acres should establish regeneration under the reserve trees, providing future young stands. In this alternative, there would be an increase in the amount of mature open forest, helping to increase vigor for resistance to insect infestation and promoting fiber production for large tree growth objectives. There would also be a small increase in the sapling and pole age classes due to removal of larger and older pine. Uneven-age treatments such as group selection and individual tree selection would create multiple age classes mixed throughout a site, providing intra-stand diversity. Age class distribution would be significantly affected in the short term by this alternative. Large concentrations of new pine regeneration under shelterwood cuts would increase the age class distribution. In addition, treatments such as group selection and individual tree selection would create multiple age classes mixed throughout the site, providing intra-stand diversity.

### Regeneration

The natural regeneration of pine and other native species of trees within the project area should be adequate to meet regeneration stocking standards outlined in the Forest Monitoring Plan when a shelterwood cut is the proposed treatment. However, under this alternative, removal cuts were proposed regardless of adequate regeneration stocking, but the site was required to have reached CMAI. To fulfill the standard set forth by the Forest Plan in regards to adequate stocking, planting is proposed on 1,131 acres under Alternative C. Whole tree yarding, which is the preferred method for removing activity fuels created by harvest activities, would have the side effect of scarification of the forest floor, which favors regeneration establishment and has a positive effect in discouraging competition from grasses and forbs during seed germination and early regeneration establishment. The abundance of regeneration would; however, create dense, sapling size pine within the next 20 to 40 years, which would lead to an increased fire hazard as the saplings represent ladder fuels. Non-commercial thinning would be necessary to lower the vertical fuel loading as well as to release the residual trees from competing vegetation. Where prescribed burning occurs, regeneration would be reduced due to the rapid establishment of competitive grasses and forbs. Long term effects would be increasing acreage of healthy pine regeneration and the establishment of a new age class.
Insects and Disease

The most effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and conducting sanitation harvest in areas of beetle buildup (Schmidt et al 2007). These are forest management actions that increase tree vigor and reduce stand susceptibility to beetle attack through reducing stocking levels. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Sanitation harvest (i.e., removal of infested trees) can also provide protection to surrounding uninfested trees and stands by removing sources of attacking beetles. Creating diverse stand conditions across the landscape would result in an overall forest that is less susceptible to beetles in the future. Treatments proposed in Alternative C would reduce the mountain pine beetle risk across the project area, as displayed in Table 3-7.

<table>
<thead>
<tr>
<th>Risk Rating</th>
<th>Alternative A (Existing Condition)</th>
<th>Alternative C</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>12,265</td>
<td>1,691</td>
</tr>
<tr>
<td>Moderate</td>
<td>6,287</td>
<td>3,201</td>
</tr>
<tr>
<td>Low</td>
<td>2,508</td>
<td>16,168</td>
</tr>
</tbody>
</table>

The chart indicates a substantial decrease in the risk of mountain pine beetle infestation. The long term effect on the landscape would be a decreased percentage of pine forest transitioning to a high risk rating and a lower chance that a large-scale pine beetle infestation would affect the landscape. This alternative would provide the largest reduction in risk of pine beetle infestation of any action alternative.

Growth and Yield

Growth and yield for ponderosa pine stands within the project area would generally be improved as a result of implementing Alternative C. Approximately 72.5 MMBF of commercial timber would be removed in this alternative. Extensive thinning of the project area would open up many of the stands where full crown closure has occurred and stand growth is stagnating due to competition for resources. All stands scheduled for a removal cut have met CMAI; however, in this alternative the site was not required to be adequately regenerated at the time of the removal. To meet the Forest Plan requirement, post overstory removal planting has been proposed to bring the site to full stocking level, defined as 150-300 trees per acre. Thus growth and yield would be compromised for a period of time until the regeneration can be established. In addition, the risk of low seedling survival coupled with risk of insect and disease, would inhibit potential growth in the future.

Cumulative Effects

See the discussion of cumulative effects under Alternative B above.

Alternative D

Direct and Indirect Effects

The intention of this alternative is to move the timber resources towards the desired conditions outlined in the Forest Plan. In this alternative, all new road construction was eliminated to address the concern that new road construction would have a negative impact on other resources.
Under this alternative, 9,394 acres of forestland would be treated, including commercial non-commercial treatments. The range of silvicultural activities proposed under this alternative is minimal in comparison of the other proposed alternatives. Alternative D includes all of the non-commercial treatments proposed under Alternative B along with the commercial treatments from Alternative B that would not require construction of a new road to accomplish.

The direct and indirect effects of individual treatment types (e.g. removal cuts, shelterwood cuts, etc.) would be the same as described above under Alternative B, albeit the effects would be less widespread due to the decreased acreage treated under Alternative D. The description of those effects is not repeated here.

**Structural Stage**

The effects to structural stage distribution resulting from implementation of Alternative D are similar to those of Alternative B. SS4 would continue to dominate the landscape. Stand structure within the project area would generally be even-aged with the majority of the trees having an age range of 20 years from other trees. Most of the pine would be either dominant or co-dominant. Much of the intermediate and suppressed pine would be removed in treatment areas to raise crown heights and reduce ladder fuels for crown fire hazard reduction.

Within the project area, stand structure generally would change from a closed canopy structure to an open canopy structure. More than 6,700 acres would move from the more closed 3B, 3C, 4B and 4C structures to the open structures of 3A and 4A. This is intended to reduce mountain pine beetle risk and to reduce fire hazard within the WUI. This also achieves Forest Plan objective 10-01 to manage for 50 to 75 percent moderate-to-low fire hazard in the WUI and to reduce fire hazard within proximity of structures.

**Table 3-9. Steamboat Structural Stages: Existing vs. Alt. D**

<table>
<thead>
<tr>
<th>SS</th>
<th>Alt. A (Existing)</th>
<th>Alt. D</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,682</td>
<td>1,724</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>153</td>
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<td>3A</td>
<td>626</td>
<td>3,427</td>
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<tr>
<td>4C</td>
<td>5,216</td>
<td>2,654</td>
<td>-2,562</td>
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<tr>
<td>5</td>
<td>82</td>
<td>567</td>
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</tr>
<tr>
<td>Total</td>
<td>21,060</td>
<td>21,060</td>
<td></td>
</tr>
</tbody>
</table>

Changes in structural stage (SS) are generally from the following for Alternative D:

- Small increase in SS1 due to meadow enhancement.
- Small decrease in SS2 due to removal cuts having sapling (1-9" DBH) size regeneration.
- Moderate increase in SS3A due to removal cuts and non-commercial thinning.
- Small decrease in SS3B due to non-commercial thinning in sapling/pole size stems.
• Decrease in SS3C due to commercial and non-commercial thinning in sapling/pole size stems.
• Moderate increase in SS4A due to shelterwood cuts, uneven age management and commercial thinning.
• Moderate decrease in SS4B due to all commercial treatments opening the canopy.
• Moderate decrease in SS4C due to all commercial treatments opening the canopy.
• Increase in SS5 due to under thinning or ground observation.

Past experience indicates the forest is not lacking in trees between one and nine inches DBH; however, the data does show that there are relatively few pure stands of this structural stage. It was assumed that all overstory removal treatments resulted in SS3.

Other assumptions made to determine post structure stage:

• Only primary treatments were used for post structural stage conversion.
• Use of whole tree yarding as the primary activity fuel method.
• Commercial thinning was even spaced unless specifically noted in a stand.
• All shelterwood cuts retained a residual 20-40 BA.

This alternative is intermediate in its effect on moving the area towards the desired condition for structural stage; it moves more closely than Alternative A (No Action), but less closely than Alternatives B or C.

The effect of Alternative D on Forest-wide structural stages is displayed in Table 3-10. Generally, structural stages change only slightly, less than one percent.

### Table 3-10. Forest-wide Structural Stages: Existing vs. Alt. D

<table>
<thead>
<tr>
<th>MA 5.4</th>
<th>Objective</th>
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<th>Alt. D</th>
</tr>
</thead>
<tbody>
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<td>%</td>
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<td>%</td>
</tr>
<tr>
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<td>5%</td>
<td>45,616</td>
<td>13%</td>
</tr>
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<td>2</td>
<td>5%</td>
<td>10,152</td>
<td>3%</td>
</tr>
<tr>
<td>3A</td>
<td>10%</td>
<td>17,454</td>
<td>5%</td>
</tr>
<tr>
<td>3B</td>
<td>15%</td>
<td>22,227</td>
<td>7%</td>
</tr>
<tr>
<td>3C</td>
<td>5%</td>
<td>15,763</td>
<td>5%</td>
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<tr>
<td>4A</td>
<td>25%</td>
<td>86,487</td>
<td>25%</td>
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<tr>
<td>4B</td>
<td>25%</td>
<td>87,864</td>
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<tr>
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<td>5%</td>
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<td>0.3%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>339,494</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Plant Species Composition**

Plant species composition and diversity would increase in this alternative. The amount of hardwood and meadow acreage would increase a minor amount with the largest increase in plant species composition increasing in the understory of the pine stands. Pine regeneration in the understory after harvest would become abundant and may be a limiting factor in their establishment. Understory species establishment and diversity would be much greater than the existing condition because mechanical treatments and prescribed burning would limit pine regeneration in the short term and encourage grass, shrub and forb establishment.
Ponderosa pine would still continue to dominate the landscape but would not increase its extent in the short term.

**Age Class Distribution**
Age class distribution would improve in this alternative by removing the overstory on approximately 775 acres. In addition, the shelterwood cuts on 970 acres should establish regeneration under the reserve trees, providing future young stands. In this alternative, there would be an increase in the amount of mature open forest, which would help increase vigor for resistance to insect infestation and help promote fiber production for large tree growth objectives. There would also be a small increase in the sapling and pole age classes due to removal of larger and older pine to move toward Forest Plan structural stage objectives. Uneven age treatments, such as group selection and individual tree selection, would create multiple age classes mixed throughout a site providing intra-stand diversity.

**Regeneration**
The natural regeneration of pine and other native species of trees within the project should be adequate to meet stocking standards outlined in the Forest Monitoring Plan with the treatments in this alternative. Whole tree skidding, which is the preferred method for activity fuels created by management, would have the effect of site preparation by scarification of the forest floor, which favors regeneration establishment and has a positive effect in discouraging competition from grasses and forbs during seed germination and early regeneration establishment. The abundance of regeneration would; however, create dense, sapling size pine within the next 20 to 40 years, which would lead to an increased fire hazard as the saplings represent ladder fuels. Non-commercial thinning would be necessary to reduce the vertical fuel loading as well as release the residual trees from competing vegetation. Where prescribed burning occurs, regeneration would be reduced in the short term due to the rapid establishment of competitive grasses and forbs.

**Insects and Disease**
The most effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and conducting sanitation harvest in areas of beetle buildup (Schmidt et al 2007). These are forest management actions that increase tree vigor and reduce stand susceptibility to beetle attack by reducing stocking levels. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Sanitation harvest (i.e., removal of infested trees) can also provide protection to surrounding uninfested trees and stands by removing sources of attacking beetles. Creating diverse stand conditions across the landscape would result in a forest that is less susceptible to beetles in the future.

<table>
<thead>
<tr>
<th>Table 3-11. Pine Beetle Risk: Alternative A vs. Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk Rating</strong></td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Low</td>
</tr>
</tbody>
</table>

Slash buildup from treatments could encourage Ips beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices such as lop and scatter logging systems help to reduce the amount of infestations by scattering the fuels for rapid drying, effectively reducing favorable conditions for Ips.
Whole tree skidding, in association with burning of slash piles within a year of treatment, reduces the amount of slash and reduces conditions favorable for Ips infestation. Other insects and diseases affecting both pine and other species of trees in the project area are having a minimal impact at this time and would probably continue to have a low impact under Alternative D.

**Growth and Yield**
Growth and yield for stands within the project area would improve as a result of Alternative D. Approximately 34.2 MMBF of commercial timber would be removed in this alternative. Treatments implemented under this alternative would capture a portion of the current commercial potential and provide sustained commercial timber opportunities for the future. Improved and sustainable growth volume yield over time would be addressed by increasing growth rates in overstocked stands through the reallocation of resources, diversifying stand structure, and reducing stand susceptibility to insects and wildfire. Alternative D improves current and future growth rates while providing volume at this entry and for future commercial opportunities.

**Cumulative Effects**
See the discussion of cumulative effects under Alternative B above.

### 3.3 Fire and Fuels

#### 3.3.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for fire and fuels. It summarizes the Steamboat Project Fuels Specialist Report (Rafferty and Gies 2011), which is located in the Steamboat project file.

#### 3.3.2 Existing Conditions

**Past and Present Vegetation Management**

Over the past 14 years 6,246 acres of timber harvest has been completed under seven different timber sales in the Steamboat project area. Many of the treatments within these sale areas have reduced the canopy fuels and ladder fuels that contribute to high intensity fires and crown fires. Fuels treatment activities have also followed in many of the sale areas, with treatments to remove surface fuel loading, removal of ladder fuels, burning of slash piles, and construction of fuel breaks in areas adjacent to homes. The Picnic Cavern Kine prescribed fire, four miles southeast of Nemo, was completed in September 2011, totaling 1,046 acres.

**Fire Hazard on NFS Lands**

The intensity and severity of fire is a function of three environmental parameters – weather, topography and fuels. Weather affects fire behavior by adding or removing moisture from the fuels, preheating fuels, and creating wind that increases combustion and can produce erratic fire movement. Topography also affects fire behavior. Steep slopes allow a fire to travel faster than on flat ground because the flaming front preheats the fuels above the fire making them available for combustion quicker. Steep slopes also allow for burning material to roll downhill and ignite fuels below the main
As weather, topography and fuels align, fire behavior increases and the likelihood that a crown fire will initiate increases. Crown fires pose the greatest threat to human values and generate higher fire severity effects, which can negatively impact ecological values. Accordingly, crown fires are of greatest concern to fire managers because of the risk to the public and fire suppression personnel. Crown fires are difficult to control because of the limited number of suppression tactics and strategies that can be utilized.

Weather
Fuel managers use 90th percentile weather conditions for fire behavior predictions to simulate how a fire will behave under severe weather conditions when wildfires pose greater control problems and have greater impact on land resources. Ninetieth percentile weather conditions represent the hottest, driest weather conditions that occur 10 percent of the time in the project area based on historic weather data.

Ninetieth percentile weather conditions for the Steamboat project area were compiled from weather data taken between 1995 and 2005 at the Nemo Remote Automated Weather Station (RAWS) located in the southeastern portion of the project area. Table 3-12 summarizes the 90th percentile weather and fuel conditions from the Nemo RAWS:

<table>
<thead>
<tr>
<th>Temperature ($^\circ$F)</th>
<th>90th Percentile</th>
<th>1000 hour fuel moisture (%)</th>
<th>1 hour fuel moisture (%)</th>
<th>10 hour fuel moisture (%)</th>
<th>Live woody moisture (%)</th>
<th>Live herbaceous moisture (%)</th>
<th>100 hour fuel moisture (%)</th>
<th>20 foot wind (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>89</td>
<td>3</td>
<td>14</td>
<td>21</td>
<td>5</td>
<td>108</td>
<td>118</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

Topography
The Steamboat project area includes landmarks such as Little Elk Creek, Boxelder Creek, North Boxelder Creek, Stagebarn Canyon, South Stagebarn Canyon, Steamboat Rock, and Dalton Lake. The majority of the project area drains east into the prairie when seasonal flows are high, but major creeks and drainages generally disappear underground into the aquifer recharge areas before they exit the Black Hills.

Elevations vary from 3,600 feet along the eastern foothills near Piedmont to approximately 5,300 feet on the ridge top east of Nemo. The slopes in the project area range from generally flat terrain up to 70 percent with an average slope of 17 percent. The eastern side of the project area accounts for the highest percentage of slopes over 35%. South, southwest, and westerly aspects, which are generally hotter and drier and, subsequently, more fire-prone, are represented on approximately 7,871 acres or about 36% of the project area.

Fuels
Fuel conditions that lead to higher probability of crown fire initiation (i.e., torching) and crown fire spread are higher surface fuel loading, sufficient ladder fuels to carry a surface fire to the crowns of
trees, and dense canopy closure to propagate the spread of fires through the crowns. Within the Steamboat project area, wildland fuels can be categorized into three vertical strata:

**Surface Fuels**

In 2005 and 2006, photo series data collected during common stand exams for the Steamboat project area indicated that the surface fuel loadings of less than three inch material ranges from less than one ton per acre to over 15 tons per acre. Surface fuel loadings are higher in stands that have had previous commercial and non-commercial treatments without whole tree yarding, mechanical mastication or prescribed burning.

Surface fuel loading is a critical component in determining the intensity and severity of fire. Stands that have higher surface loadings generate more intensity that pre-heats the canopies of surrounding vegetation. This preheating of canopy fuel drives the moisture from and raises the temperature of the needles. This allows the canopy of the tree to more readily ignite when an ember or fire transitioning from the surface fuels into the ladder fuels occur.

Surface fuel loading can also be used to determine the fireline intensity of a fire if one were to occur in a particular area. Fireline intensity is a specific measurement of the amount of heat released per second by a one foot wide portion of the flaming front of a fire and is a function of fuel type, fuel load, fuel moisture, slope, temperature, and wind. Fireline intensity is indicative of the amount of heat that would be experienced by a person working near the fire and can be used to determine the appropriate suppression response.

**Ladder Fuels**

Typically, the smaller sapling and post-pole sized conifer trees make up the majority of ladder fuels in conifer stands. Seedlings/saplings between zero and five inches DBH and small trees between five inches and nine inches DBH typically serve as ladder fuels allowing a ground fire to reach the overstory. The number of trees per acre for these size classes are a good indicator of a surface fire’s potential of torching and reaching the crowns of the surrounding overstory. High densities (over 1,000 trees per acre) of trees less than five inches DBH are located in the project area between Forest Highway 26 and the Lawrence/Meade county line.

**Aerial/Canopy Fuels**

Ponderosa pine covers approximately 96 percent of the project area. This cover type is considered the most at risk for high intensity and severity wildfire because of its distribution on southeasterly to westerly aspects. These aspects are drier, have lower fuel and foliar moisture contents and, therefore, have more surface area available to burn. The remaining cover types in the project area could be expected to reduce potential fire behavior, especially on northerly and easterly aspects. A wildfire burning in an adjacent conifer stand would likely decrease in rate of spread and fire line intensity upon entering deciduous vegetation and in some instances spruce, mainly due to higher fuel moisture contents and shading of available fuels. However, this is unlikely to occur in the Steamboat project area due to the lack of forest cover types other than pine.

Structural stages are used throughout the Forest Plan to correlate crown fire hazard with the structural stage of conifer forests. A structural stage is any one of several developmental stages of tree stands described in terms of tree size and the extent of canopy closure they create. For example, a structural
stage 4C stand consists of older and larger trees and a crown closure of 70% to 100%. As a result, the crown closure in a 4C stand enables a fire to spread more readily through the crown of trees in that stand. Outlined in Table 3-13 is the link between forest structural stage and crown fire hazard.

### Table 3-13. Structural Stage as it Relates to Fire Hazard

<table>
<thead>
<tr>
<th>SS</th>
<th>FIRE_HAZ</th>
<th>TOTAL ACRES</th>
<th>WUI ACRES</th>
<th>NON-WUI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>1,739</td>
<td>1,027</td>
<td>712</td>
</tr>
<tr>
<td>2</td>
<td>Medium</td>
<td>381</td>
<td>181</td>
<td>200</td>
</tr>
<tr>
<td>3A</td>
<td>Medium</td>
<td>626</td>
<td>252</td>
<td>374</td>
</tr>
<tr>
<td>3B</td>
<td>High</td>
<td>1,660</td>
<td>843</td>
<td>817</td>
</tr>
<tr>
<td>3C</td>
<td>Very High</td>
<td>1,840</td>
<td>821</td>
<td>1,019</td>
</tr>
<tr>
<td>4A</td>
<td>High</td>
<td>4,850</td>
<td>2,951</td>
<td>1,899</td>
</tr>
<tr>
<td>4B</td>
<td>Very High</td>
<td>5,222</td>
<td>3,409</td>
<td>1,813</td>
</tr>
<tr>
<td>4C</td>
<td>Very High</td>
<td>5,292</td>
<td>3,486</td>
<td>1,806</td>
</tr>
<tr>
<td>5</td>
<td>Very High</td>
<td>82</td>
<td>23</td>
<td>59</td>
</tr>
<tr>
<td>Non SS (Rock, Meadow)</td>
<td>Low</td>
<td>191</td>
<td>124</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21,883</td>
<td>13,117</td>
<td>8,766</td>
</tr>
</tbody>
</table>

The Phase II Amendment of the Forest Plan focuses on fire hazard and insect risk reduction of forested stands. The primary emphasis for fire hazard in the Forest Plan is to manage for 50-75% moderate-to-low fire hazard rating.

Analysis in the Phase II FEIS correlated crown fire hazard with structure stage of pine forests (as displayed in Table 3-13) (USDA-Forest Service 2005c). Structural stage was defined for all stands within the Steamboat project area. Correlating this information to the fire hazard rating revealed the following assessment of stands in the project area:
Fire History

Numerous wildfires less than five acres in size were reported in the project area from 1970 through the present. Lightning was the predominant cause for fires. Documented large fire history includes the Johnson Fire (1936 – 700 acres), the Big Elk Fire (1949 – 5,000 acres), the Little Elk Fire (2002 – 700 acres), the Ricco Fire (2005 – 4,000 acres), and the Box Elder Fire (2007 – 225 acres). Other fires in the vicinity, but outside of the project boundary on the hogback ridge that lies east of Interstate 90 were the Blair Ranch Fire (1988 – 200 acres) and the East Ridge Fire (2006 – 3,200 acres).

Need for Action

The majority of the Steamboat project area is uninhabited except for select portions of developed private land. Within the project area, approximately 572 inhabited structures exist, creating wildland urban interface (WUI) conditions. There are several clusters of homes within the project area, many along the Interstate 90 corridor. The remaining homes are scattered amongst the private land holdings. The at-risk communities (ARC) of Nemo and Piedmont, as identified by the National Fire Plan and local Community Wildfire Protection Plans (CWPP), are either located within the Steamboat project area or within three miles of the boundary.

Nearly 75 percent of the Steamboat project area is rated high or very high for crown fire hazard. The Forest Plan emphasis is to manage for 50%-75% moderate-to-low fire hazard rating. The emphasis in reducing the crown fire hazard is to protect values-at-risk in the WUI. Forest resources would also realize benefits from the treatments by reducing the threat of stand replacing crown fire.
3.3.3 Environmental Consequences

The primary gauge for measuring the improvement in effects is based on objective 10-01 of the Forest Plan, which calls for reduction of the fire hazard within the WUI. The standard is to manage for 50%-75% moderate-to-low fire hazard in the WUI and to reduce fire hazard within proximity of structures to current National Fire Protection Association (NFPA) standards. NFS lands outside of the WUI will be managed for an improvement towards 50 percent moderate-to-low fire hazard.

Change in structural stage is the guiding measure for management of stands in the project area. Structural stage was used in the Forest Plan as the indicator of the stages of maturity in forested stands, and was assigned measures of crown fire hazard by linking the Forest Vegetation Simulator – Fire and Fuels Extension Model (FVS-FFE), and torching and crowning indices to each of the five structural stages and their sub-stages (USDA-Forest Service 2005c).

**Alternative A (No Action)**

**Direct and Indirect Effects**

Under the no action alternative, no vegetation management treatments would be implemented. Ecosystem trends and processes would continue as they have. Changes toward the desired future conditions as outlined in the Forest Plan would not occur. Management direction outlined in the National Fire Plan, Healthy Forests Restoration Act, and the Lawrence County Wildfire Protection Plan would not be met.

Under the Alternative A, the issue of altering wildland fuels in the WUI would not be addressed; no lands near or adjacent to WUI or ARC would be treated. There would be no attempt to move the Steamboat project area toward Forest Plan objective 10-01 by improving the current fire hazard ratings within the project area. Fire hazard ratings within the WUI and outside of the WUI would most likely continue to move towards high and very high as vegetative biomass increases and stand structures become more complex through forest growth. As the forest stands continue to grow and become structurally more complex or are converted to fire intolerant species, fire behavior could be more erratic, potentially causing losses to private improvements within the project area. Regardless of the management actions chosen for the Steamboat project area, fire suppression activities will continue, but could be more difficult and dangerous as the complexity of the forest structure increases under the No Action Alternative.

Using structural stage as an indicator of crown fire hazard in the Steamboat project area, 17 percent of the NFS lands within the WUI have a low to moderate hazard rating and 18 percent of the NFS lands outside of the WUI have a low to moderate rating. Currently 83 percent of the stands within the WUI and 82 percent of the stands outside of the WUI are rated at high and very high (see Table 3-14).
Indirect effects on forest stand structures, and subsequently on wildfire behavior, may occur if no treatments are planned or implemented in the project area. With no treatment, the stands would continue to create vegetative material that would add volume and structure to the fuel matrix. Continued needle and timber litter deposition would add to the surface fuel loading. Understory vegetation would continue to grow vertically, which would essentially lower the canopy base height and overstory crowns would continue to grow together increasing the canopy bulk density of the stands, thereby making them susceptible to active crown fire. Fire behavior, especially how it relates to surface to crown fire transition in ponderosa pine stands, would have increased potential to occur. Crown fire may be sustained once initiated.

Unchecked growth of conifers in hardwood stands could eventually convert these natural firebreaks into stands that are unable to alter the direction and rate of fire spread. In some ponderosa pine stands, lack of management and lack of natural disturbance could allow shade-tolerant species such as white spruce to become established. Over time, this encroachment would eventually convert the stand from a fire-tolerant species to a fire-intolerant species with low growing crowns that are easily accessed by surface fires making these stands more susceptible to stand replacing fire.

**Cumulative Effects**

The area to be analyzed for determining cumulative effects of proposed fuel treatments is all lands located within and adjacent to the Steamboat project area. The time period for analysis is a total of 30 years, from 15 years in the past through 15 years in to the future.

Overall, the effects of no management action can combine with effects from other activities in the project area to make larger impacts in the future. As the fire hazard potential in the project area continues to move toward high and very high, and development of private property within the project area continues to increase, the risk of property damage and public and firefighter exposure to wildfire would most likely increase. Firefighters would be required to take more aggressive actions such as utilizing mechanized equipment and using more personnel to keep fires small, resulting in increased suppression costs and more negative ecological effects from suppression actions. The likelihood of a fire escaping initial containment actions would also increase, allowing fires to become larger and making it necessary for firefighters to use more mechanized equipment, more personnel, and larger burnout operations to control wildfires. Use of these tactics would also increase suppression costs, increase negative ecological effects, and increase exposure of firefighters to erratic fire behavior.
In conclusion, the Alternative A would not address National, Agency, Forest, or local direction for reducing wildland fuel accumulations. This alternative would minimize disturbance from forest management activities in the short-term, but could realize more substantial effects to people and the environment from wildfire and suppression activities in the long-term.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

Alternative B would address the need to alter wildland fuels in the WUI and non-WUI areas. Additionally, the treatments proposed under this alternative would address reducing wildfire risk for some lands near or adjacent to ARC. Vegetative treatments would affect changes in crown fire hazard ratings on approximately 7,167 acres in the WUI and 5,169 acres outside the WUI. Sixty-three percent of the NFS lands within the WUI would have a low to moderate hazard rating and 75 percent of the NFS lands outside of the WUI would have a low to moderate rating moving the project area toward Forest Plan objective 10-01. Thirty-seven percent of the stands within the WUI would remain at high and very high ratings and 25 percent of the stands outside of the WUI would remain rated at high and very high (See Table 3-16). Alternative B would improve the current fire hazard ratings over the existing condition both within and outside of the WUI. The improvement in fire hazard rating could enhance fire suppression efforts by reducing the number of acres susceptible to crown fire.

### Table 3-15. Alternative B Fire Hazard Rating Changes in WUI and Non-WUI Treatment Areas.

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>WUI Existing (acres)</th>
<th>WUI Post Treatment (acres)</th>
<th>WUI Change (acres)</th>
<th>Non-WUI Existing (acres)</th>
<th>Non-WUI Post Treatment (acres)</th>
<th>Non-WUI Change (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1,239</td>
<td>4,579</td>
<td>+2336</td>
<td>1,004</td>
<td>3,865</td>
<td>+2,861</td>
</tr>
<tr>
<td>Moderate</td>
<td>1,770</td>
<td>3,730</td>
<td>+1,960</td>
<td>1,485</td>
<td>2,743</td>
<td>+1,258</td>
</tr>
<tr>
<td>High</td>
<td>2,664</td>
<td>1,528</td>
<td>-1,136</td>
<td>1,848</td>
<td>622</td>
<td>-1,226</td>
</tr>
<tr>
<td>Very High</td>
<td>7,444</td>
<td>3,280</td>
<td>-4,164</td>
<td>4,429</td>
<td>1,536</td>
<td>-2,893</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,117</td>
<td>13,117</td>
<td>8,766</td>
<td></td>
<td>8,766</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3-16. Alternative B Changes in Crown Fire Hazard Categories in WUI and Non-WUI Treatment Areas.

<table>
<thead>
<tr>
<th>Hazard Rating Category</th>
<th>WUI Existing (acres)</th>
<th>Percent</th>
<th>WUI Post Treatment (acres)</th>
<th>Percent</th>
<th>Non-WUI Existing (acres)</th>
<th>Percent</th>
<th>Non-WUI Post Treatment (acres)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to Moderate</td>
<td>3,009</td>
<td>22%</td>
<td>8,309</td>
<td>63%</td>
<td>2,489</td>
<td>28%</td>
<td>6,608</td>
<td>75%</td>
</tr>
<tr>
<td>High to Very High</td>
<td>10,108</td>
<td>78%</td>
<td>4,808</td>
<td>37%</td>
<td>6,277</td>
<td>72%</td>
<td>2,158</td>
<td>25%</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,117</td>
<td>100%</td>
<td>13,117</td>
<td>100%</td>
<td>8,766</td>
<td>100%</td>
<td>8,766</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

The effects of the treatment actions taken under Alternative B could combine with the effects of approximately 27,850 acres of other management activities that have occurred in the project area over the last 15 years. Other activities in the project area that contribute to cumulative effects include firewood cutting, timber harvest on private lands, and continued brush disposal and sale area improvement (KV) activities associated with several recently closed timber sales within and adjacent to...
the project area. Fuels reduction work and timber harvest on private lands within the project area and on other agency and private lands adjacent to the project area can have an additive effect on reducing fire hazard.

All of the previous, ongoing, and proposed treatments would change the structural stage of the forested stands in the project area. Because these treatments alter the overstory canopy, the understory ladder fuels, and the surface fuels they would contribute to lower fire hazard ratings both within and outside of the WUI. The reduced fire hazard could contribute to less erratic fire behavior, making fire suppression more effective, less time consuming, and safer for firefighters.

Overall, Alternative B would meet Forest Plan objective 10-01 and would address direction set forth by the National Fire Plan, Healthy Forest Restoration Act, and the Community Wildfire Protection Plans. This alternative may increase the disturbances from forest management activities in the short-term, but could realize fewer effects to people and the environment from wildfire and suppression activities in the long-term.

**Alternative C**

**Direct and Indirect Effects**

From a hazardous fuels reduction standpoint, this alternative is very similar to Alternative B, but is more aggressive—treating a total of 5,713 more acres than Alternative B.

The treatments proposed under this alternative would also address reducing wildfire risk for lands near or adjacent to ARC. Vegetative treatments would affect changes in crown fire hazard ratings on approximately 10,856 acres in the WUI, and 7,193 acres outside the WUI. Eighty-six percent of the NFS lands within the WUI would have a low to moderate hazard rating and 75 percent of the NFS lands outside of the WUI would have a low to moderate rating moving the project area toward Forest Plan objective 10-01. Fourteen percent of the stands within the WUI would remain at high and very high ratings and 25 percent of the stands outside of the WUI would remain rated at high and very high (see Table 3-18).

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>WUI Existing (acres)</th>
<th>WUI Post Treatment (acres)</th>
<th>WUI Change (acres)</th>
<th>Non-WUI Existing (acres)</th>
<th>Non-WUI Post Treatment (acres)</th>
<th>Non-WUI Change (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1,239</td>
<td>6,904</td>
<td>+5,665</td>
<td>1,004</td>
<td>3,865</td>
<td>+2,861</td>
</tr>
<tr>
<td>Moderate</td>
<td>1,770</td>
<td>4,486</td>
<td>+2,716</td>
<td>1,485</td>
<td>2,743</td>
<td>+1,258</td>
</tr>
<tr>
<td>High</td>
<td>2,664</td>
<td>1,121</td>
<td>-1,543</td>
<td>1,848</td>
<td>622</td>
<td>-1,226</td>
</tr>
<tr>
<td>Very High</td>
<td>7,444</td>
<td>606</td>
<td>-6,838</td>
<td>4,429</td>
<td>1,536</td>
<td>-2,893</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,117</td>
<td>13,117</td>
<td></td>
<td>8,766</td>
<td>8,766</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazard Rating Category</th>
<th>WUI Existing (acres)</th>
<th>Percent</th>
<th>WUI Post Treatment (acres)</th>
<th>Percent</th>
<th>Non-WUI Existing (acres)</th>
<th>Percent</th>
<th>Non-WUI Post Treatment (acres)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to Moderate</td>
<td>3,009</td>
<td>22%</td>
<td>11,390</td>
<td>86%</td>
<td>2,489</td>
<td>28%</td>
<td>6,608</td>
<td>75%</td>
</tr>
<tr>
<td>High to Very High</td>
<td>10,108</td>
<td>78%</td>
<td>1,727</td>
<td>14%</td>
<td>6,277</td>
<td>72%</td>
<td>2,158</td>
<td>25%</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,177</td>
<td>100%</td>
<td>27,325</td>
<td>100%</td>
<td>8,766</td>
<td>100%</td>
<td>8,766</td>
<td>100%</td>
</tr>
</tbody>
</table>

Because the vegetative treatments proposed under Alternative C are so similar to those described under Alternative B, the direct and indirect effects, cumulative effects, treatment methodologies, and results would also be similar to those described under Alternative B. Alternative C moves 23 percent more stands to low or moderate fire hazard ratings than Alternative B. Alternative C would also meet Forest Plan objective 10-01 and would address direction set forth by the National Fire Plan, Healthy Forest Restoration Act, and the Community Wildfire Protection Plans.

Alternative D

Direct and Indirect Effects
Alternative D is very similar to the treatments prescribed under both Alternatives B and C, with the total treated acreages being reduced by approximately 3,000 acres from Alternative B and over 8,500 acres from Alternative C.

The treatments proposed under Alternative D would address reducing wildfire risk for lands near or adjacent to ARC. Vegetative treatments would affect changes in crown fire hazard ratings on approximately 5,440 acres in the WUI, and 3,954 acres outside the WUI. Fifty-seven percent of the NFS lands within the WUI would have a low to moderate hazard rating and 60 percent of the NFS lands outside of the WUI would have a low to moderate rating moving the project area toward Forest Plan objective 10-01. Forty-three percent of the stands within the WUI would remain at high and very high ratings and 40 percent of the stands outside of the WUI would remain rated at high and very high (see Table 3-20).

Table 3-19. Alternative D Fire Hazard Rating Changes in WUI and Non-WUI Treatment Areas

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>WUI Existing (acres)</th>
<th>WUI Post Treatment (acres)</th>
<th>WUI Change (acres)</th>
<th>Non-WUI Existing (acres)</th>
<th>Non-WUI Post Treatment (acres)</th>
<th>Non-WUI Change (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1,239</td>
<td>3,521</td>
<td>+2,282</td>
<td>1,004</td>
<td>3,058</td>
<td>+2,054</td>
</tr>
<tr>
<td>Moderate</td>
<td>1,770</td>
<td>3,997</td>
<td>+2,227</td>
<td>1,485</td>
<td>2,685</td>
<td>+1,200</td>
</tr>
<tr>
<td>High</td>
<td>2,664</td>
<td>1,227</td>
<td>-1,437</td>
<td>1,848</td>
<td>890</td>
<td>-958</td>
</tr>
<tr>
<td>Very High</td>
<td>7,444</td>
<td>4,372</td>
<td>-3,072</td>
<td>4,429</td>
<td>2,133</td>
<td>-2,296</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,117</td>
<td>13,117</td>
<td></td>
<td>8,766</td>
<td>8,766</td>
<td></td>
</tr>
</tbody>
</table>
Table 2-20. Alternative D Changes in Crown Fire Hazard Categories in WUI and Non-WUI Treatment Areas.

<table>
<thead>
<tr>
<th>Hazard Rating Category</th>
<th>WUI Existing (acres)</th>
<th>WUI Post Treatment (acres)</th>
<th>Non-WUI Existing (acres)</th>
<th>Non-WUI Post Treatment (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to Moderate</td>
<td>3,009</td>
<td>7,518</td>
<td>2,489</td>
<td>5,743</td>
</tr>
<tr>
<td>High to Very High</td>
<td>10,108</td>
<td>5,599</td>
<td>6,277</td>
<td>3,023</td>
</tr>
<tr>
<td>Total Acres</td>
<td>13,117</td>
<td>13,117</td>
<td>8,766</td>
<td>8,766</td>
</tr>
</tbody>
</table>

The improvement in fire hazard rating under Alternative D is similar to those described previously for Alternatives B and C, although the reduction in fire hazard would be less widespread under Alternative D. The direct and indirect effects, cumulative effects, treatment methodologies, and results are very similar to those described under Alternatives B and C, although Alternative D treats a comparatively lower amount of the project area and would, therefore, reduce fire hazard across a smaller area. Alternative D would also meet Forest Plan objective 10-01 and would address direction set forth by the National Fire Plan, Healthy Forest Restoration Act, and the Community Wildfire Protection Plans.

Effects to Air Quality

Air quality in the Black Hills area is generally excellent (USDA-Forest Service 2005a). The nearest area listed by the Environmental Protection Agency for non-attainment of particulate matter less than 10 microns in size (PM10) is Sheridan, Wyoming, approximately 200 miles west (i.e., upwind) of the project area (EPA 2011). South Dakota does not have any identified PM10 non-attainment areas nor are any PM2.5 non-attainment areas identified in Wyoming or South Dakota (EPA 2011).

Alternative A (No Action)

**Direct, Indirect and Cumulative Effects**

Alternative A would have no immediate effects on air quality. Fire hazard would remain high across much of the project area. These conditions increase the potential for a large, stand-replacing fire, which would be expected to generate more smoke, possibly when smoke dispersal conditions are poor, and greater negative effects on air quality than a prescribed burn.

Alternatives B, C and D

**Direct and Indirect Effects**

Each of the three action alternatives include identical amounts of prescribed burning. Smoke from these burns could affect air quality and human health. Effects would not be expected to extend more than about 20 miles from the burn site based on experience with previous prescribed burns in the area. Although prescribed fires would increase emissions for a few days at a time, they would be expected to decrease the potential for large, uncontrolled fires for up to 20 years. Proposed burns would be conducted when smoke dispersal conditions are favorable to minimize negative effects on the immediate area. Design measures intended to minimize the impacts of prescribed burning on air quality are included in Appendix C of this document.
Prescribed burning would release carbon dioxide and other compounds into the atmosphere. Emissions of greenhouse gases, including carbon dioxide, are the main anthropogenic cause of current climate change (Seppälä et al. 2009). Forest management can enhance the capacity of forests to act as a carbon sink but can also contribute carbon to the atmosphere (Hurteau et al. 2008). The scale of individual project contributions and effects may be negligible and impossible to measure. Changing climate could affect resources in the project area over time, especially at lower-elevation sites along the edge of the prairie. Current Forest Plan direction generally would provide increased resilience to such changes.

**Cumulative Effects**

The spatial boundary for analysis of cumulative effects on air quality is all lands in the project area plus possible downwind populated areas such as the cities of Black Hawk, Rapid City, and Piedmont in South Dakota. This area is selected because these population centers are within five miles of the proposed burn blocks, where experience shows direct and indirect effects of smoke are generally discernible. In addition, these areas are likely to be in the path of smoke due to topography and prevailing winds. The temporal boundary extends from the initiation of each prescribed burn to the end of active burning, usually from a day to a week.

Other actions and events relevant to air quality include burning of slash at log landings (including large piles resulting from whole-tree yarding) in timber sales near the project area and on non-NFS lands, and prescribed broadcast burning elsewhere on the national forest or other ownerships. Burning of slash piles usually occurs in winter; in dry winters with little snow burning may occur in many areas at once during the limited time when snow cover is available. Under these conditions, the action alternatives could add to smoke effects of burning in adjacent areas. If burning conditions remain favorable for an extended period of time, it would be possible for proposed burns to occur around the same time as burns elsewhere on the Forest, which could result in the presence of smoke for a longer than usual period. Favorable conditions, however, generally last only a few weeks each season.

**Comparison of Alternatives and Summary**

Alternatives B, C and D are very similar in their post treatment effects, and are in stark contrast to no action being taken under Alternative A. Alternative A would not bring improvement towards the degradation of forest and fire hazard conditions, and conditions would continue to deteriorate over time without treatment. Vegetative biomass would continue to increase and stand structures would become more complex. This would create more erratic fire behavior, which also increases the complexity and hazard for fire suppression forces. These factors, in turn, increase the potential for loss of human life, loss of improved property, and reduction in property values due to timber loss and aesthetics. Seventeen percent of the NFS lands would continue to be in the low to moderate hazard rating in the WUI areas and 18 percent of the NFS lands outside of the WUI would continue have a low to moderate rating. This is in conflict with management directives in the Forest Plan that call for moving the project area toward Forest Plan objective 10-01 (USDA-Forest Service 2005c).
### Table 3-21. Percentage of Area in Fire Hazard Ratings by Alternative

<table>
<thead>
<tr>
<th>Fire Hazard Rating</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WUI</td>
<td>Non WUI</td>
<td>WUI</td>
<td>Non WUI</td>
</tr>
<tr>
<td>Low and Moderate</td>
<td>23%</td>
<td>28%</td>
<td>63%</td>
<td>75%</td>
</tr>
<tr>
<td>High and Very High</td>
<td>77%</td>
<td>72%</td>
<td>37%</td>
<td>25%</td>
</tr>
</tbody>
</table>

All three action alternatives would move the project area into compliance with Forest Plan objective 10-01. Alternative C moves more stands (23 percent) to low and moderate ratings than Alternatives B or D. Alternative D would have the least overall effect on lowering fire hazard with Alternative B having a moderate effect when compared to the other two action alternatives. One consideration to factor when examining Alternative C is the importance of completing secondary treatments following regeneration cuts. If left incomplete, regeneration would proliferate, which can in time lead to stand conditions that would be difficult to control. Fire may readily carry in crowns of densely populated saplings and trees between five inches and nine inches DBH.

The action alternatives would create a greater diversity of stand conditions and cover types that would help to alter fire behavior. Greater abundance of hardwood vegetation along with lower crown bulk density, higher canopy base heights of conifer stands, and reduced surface fuel loading would inhibit the spread of fire to the crowns of trees. This effect allows fire managers greater opportunities to contain future unwanted wildfires and provides for a safer environment in which to conduct suppression activities.

Private land within and near the project area will likely continue to be developed over time, making forest management increasingly complex. Landowners may be new to issues relating to forest management and may not understand the need for management on their own land or on adjacent public forest land. With the increase in the area of the WUI come more values at risk and more fire management and fire suppression issues. The use of prescribed fire and prescribed natural fire to meet management objectives would meet increasing challenges due to the patchwork of private land amongst the NFS lands.

### 3.4 Wildlife and Fisheries

#### 3.4.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for wildlife and fisheries. It summarizes the Steamboat Project Wildlife and Fisheries Specialist Report and Biological Evaluation (Goldberg 2011), which are located in the Steamboat project file.
3.4.2 Existing Conditions

Habitat Conditions

The project area is within the Black Hills coniferous forest province ecoregion (Bailey 1995). The climate is temperate steppe. Winters are cold, with temperatures below freezing. The average annual temperature ranges from 48°F (9°C) at lower elevations to 37°F (3°C) at higher ones. The frost-free season varies from 80 to 140 days, depending on altitude. Annual precipitation, which ranges from 15 to 26 inches (380 to 660 millimeters), falls mostly as winter snow. Most soils are alfisols (Bailey 1995). Topography in the project area varies and includes steep, mountainous terrain and gently sloping hills, valleys and meadows. Analysis of effects to habitats can be found in the Wildlife, Botany, Hydrology and Silviculture specialist reports prepared in conjunction with this project.

Ponderosa pine forest is the dominant habitat, covering about 96 percent of NFS land within the Steamboat project area. Other habitat types include white spruce, hardwoods (primarily aspen), grasslands and meadows, and riparian habitats (Table 3-22). All of these habitats are discussed below.

Table 3-22. Acres by Cover Type on National Forest System Lands in the Steamboat Project Area

<table>
<thead>
<tr>
<th>NFS Land Characteristics</th>
<th>21,883 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conifer</td>
<td>21,198 ac</td>
</tr>
<tr>
<td>Hardwood</td>
<td>456 ac</td>
</tr>
<tr>
<td>Non-Forested</td>
<td>229 ac</td>
</tr>
</tbody>
</table>

Ponderosa Pine Habitat

Ponderosa pine forest covers 21,060 acres of NFS land in the Steamboat project area. The structural stage of ponderosa pine is an important component for forest health; therefore, the Forest Plan established objectives for vegetative diversity within ponderosa pine stands. Structural stages are defined in the Forest Resources section of this chapter. Tables 3-1 and 3-4 in the Forest Resources section display the objective and current condition of the Forest-wide and project area structural stages in ponderosa pine cover type in MA 5.4. According to the Black Hills FY 2009 Monitoring and Evaluation
Report (USDA-Forest Service 2010), early to mid-succession structural stages (2, 3A, 3B) and late succession structural stage (5) are below the structural stage objective for MA 5.4 across the Forest. Structural stages 1 and 4C are above objectives for MA 5.4. While the structural stages are tracked on a Forest-wide basis, the Steamboat project area can be summarized in a similar fashion.

**White Spruce Habitat**

The white spruce cover type is found on 25,749 acres Forest-wide, approximately 2 percent of the Forest (USDA-Forest Service 2010). This is an increase of 25 acres from the amount reported in 2008. In 1995, there were 21,737 acres of spruce, and in 1899, it was estimated at 15,000 acres (USDA-Forest Service 1996). These data indicate a long-term upward trend in the area of white spruce. Spruce, however, remains an ecologically limited component of the Forest. Spruce has replaced pine on cool moist sites as a result of fire suppression, outbreaks of insects that affect pine, and silvicultural treatment (Alexander and Edminster 1981). On drier sites, it appears that spruce may increase, but pine will remain dominant (USDA-Forest Service 1996). Some of the change in spruce acreage may also be attributable to more accurate mapping techniques and recent inventories. Turner (1974) noted that the highest densities of spruce in the Forest are found in white spruce forests in moist canyons of the northern Black Hills.

The Steamboat project area contains a very limited amount of spruce compared to the Forest as a whole. Within the project area, white spruce currently occurs on only 138 acres, which is less than one percent of NFS land. Spruce is an ecologically important habitat for a variety of species with sensitive (SS), species of local concern (SOLC), or management indicator species (MIS) status.

**Hardwood Communities**

The Steamboat project area includes 320 acres cover typed as aspen, and 136 identified acres of other hardwoods, primarily birch and bur oak. Additional acres of hardwoods exist in the Steamboat project area in small inclusions within ponderosa pine stands. Ponderosa pine is encroaching into many hardwood community types as a result of fire suppression. Aspen, birch and oak stands provide important cover, browse, or nesting habitat for a variety of wildlife species. Loss of these stands has a negative impact on the overall diversity of wildlife habitat. Opportunities exist within the project area to enhance and increase the aspen and birch within the project area.

**Grasslands and Meadow Habitat**

NFS land within the Steamboat project area includes 229 acres of grassy meadows, some of which are wet meadows. Grasslands and meadows tend to be interspersed among forested areas in the project area and some are being overtaken by encroaching ponderosa pine. Grasslands and meadows are an important aspect of the Black Hills ecosystem as they provide critical habitat for a variety of plant and animal species. Conservation and restoration of grassland and meadow areas is desirable in maintaining a diversity of habitat types and providing natural fuel breaks that could help to slow or stop wildfires. Opportunities exist within the project area to enhance and increase the amount of meadow habitat within the project area.

**Riparian/Aquatic Habitat**

The long-term trend in aquatic habitat is variable and is influenced by a variety of factors. Increased rainfall and higher flows greatly improved stream conditions in 2009 and 2010 compared to the previous 7-8 years of drought. There are approximately 17 miles of perennial stream and 33 miles of intermittent
stream within the Steamboat project area. Suitable fish habitat, as defined by perennial streams and past fisheries surveys, includes parts of Boxelder and Little Elk Creeks. Much of the perennial stream within the project area occurs on private in-holdings. There is currently one road crossing of perennial stream and three road crossings of intermittent stream that are contributing sediment into the stream system. Barriers to fish passage, such as impassable culverts at road-stream crossings, exist in the project area. There are no barriers to fish on perennial streams and ten barriers on intermittent streams within the project area. These fish passage barriers reduce the ability of fish to colonize or reoccupy suitable habitat without human intervention, which may limit a species’ distribution and abundance. No natural lakes exist in the Black Hills (Stewart and Thilenius 1964). One small man-made lake and several small impoundments exist within the project area that provides recreational fishing opportunities. Dalton Lake is a two-acre Forest Service impoundment on Little Elk Creek. Fish habitat has been reduced over time due to sedimentation. The dam is also a barrier to upstream fish passage.

All streams in South Dakota are assigned the beneficial uses of irrigation and fish and wildlife propagation, recreation, and stock watering (South Dakota Administrative Rule 74:51:03:01). Refer to the Hydrology/Soils Specialist Report for additional information on assigned beneficial uses.

The structure and composition of the riparian areas throughout the Black Hills and in the Steamboat project area has changed over the past century due to a number of influences. Stream flow in the Black Hills has been strongly influenced by periodic drought. Private in-holdings typically result in fragmented landownership pattern along Black Hills streams. Much of the perennial creek mileage within the project area is within or adjacent to private land. Fire suppression may have had impacts (USDA-Forest Service 2005) as fire stimulates regeneration in species such as aspen and opens up habitat for other earlier seral types (Mariot and Faber-Langendon 2000). Removal of beaver, for fur or to reduce human/wildlife related conflicts, has led to a reduction in the water table. Other human related influences in the project area include mining, trampling of the stream bank from livestock grazing and road construction for timber harvest activities. Today, riparian habitat in the project area receives protection as specified in the Forest Plan. Additional information on watershed, riparian and aquatic resources can be found in the Wildlife, Botany, and Hydrology/Soils Specialist Reports.

**Threatened and Endangered Species**

The U.S. Fish and Wildlife Service (USFWS) provides a list of Federally Threatened (T), Endangered (E), Proposed (P), Candidate (C) species and Nonessential/Experimental Population (XN) via their South Dakota Field Office Internet site (USFWS 2008, most recent update 21 December 2010). The only listed species that occurs in Lawrence County is the whooping crane (Grus americana) (E). Some portions of the Steamboat project area occur in Pennington and Meade Counties. Three listed species occur in Pennington County: the whooping crane; least tern (Sterna antillarum athallasos) (E); and black-footed ferret (Mustela nigripes) (XN). Two listed species occur in Meade County: the whooping crane and least tern. No known occurrences or suitable habitat for the whooping crane, least tern, or black-footed ferret occurs within the Steamboat project area or the Northern Hills Ranger District. The Forest Service has also conducted additional consultation with the USFWS (Twiss 2003). Based on past consultation and the species list, it is determined that no currently listed species with T, E, P, C, or XN status have the potential to occur within the Northern Hills Ranger District on the Black Hills National Forest, nor has “critical habitat” been designated for any T or E species on the Forest. Therefore, no federally listed species are addressed further in this document and there will be “no effect” to threatened and endangered species and no impact to critical habitat as a result of implementing any of the alternatives considered.
**Region 2 Sensitive Species**

Sensitive species (SS) are those plant 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.
- Significant current or predicted downward trends in habitat capability that would reduce a species’ existing distribution (FSM 2670.5).

**Species Considered and Evaluated**

The IDT Wildlife Biologist reviewed the most recent Region 2 SS wildlife list (FSM R-2 Supplement 2600-2009-1, effective June 9, 2009) and identified species that may occur in or near the Black Hills. Although each of these species are known to or could potentially occur in or near the Black Hills, not all of them have potential to occur in the Steamboat project area. The IDT Wildlife Biologist conducted a pre-field wildlife and fish review of the project area for all Region 2 SS using Heritage database records, district data, literature reviews, communication with district personnel and the Forest Plan. This review was used to determine which SS would be included in the Steamboat analysis. Table 3-23 lists the sensitive species that are known to occur or have potential habitat in the Steamboat project area and are therefore included in this analysis. For all R2 SS not included in this table, it is assumed that the Steamboat Project would have “no impact” due to the lack of a known population or suitable habitat. No further analysis is provided for these species. Some of these species are also designated as MIS in the Forest Plan. Evaluations for the remaining non-Sensitive MIS and SOLC can be found in the Wildlife Specialist’s Report.

For further information about these species and generalized analysis of landscape scale project affects, reference the Forest Plan and associated BA/BE (USDA Forest Service 2005a).

<table>
<thead>
<tr>
<th>R2 Sensitive Species</th>
<th>Status</th>
<th>Known Species Presence? (X = yes)</th>
<th>Habitat Present? (X = yes)</th>
<th>Habitat and/or Occurrence Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Three-toed Woodpecker (Picoides tridactylus)</td>
<td>SS</td>
<td>X</td>
<td></td>
<td>Restricted to high elevation conifer (primarily spruce) forests in the Black Hills (Wiggins 2004).</td>
</tr>
<tr>
<td>Bald Eagle (Haliaeetus leucocephalus)</td>
<td>SS</td>
<td>X</td>
<td></td>
<td>Usually found near open water or carrion (Tallman et al. 2002); only one nest and one winter roost has ever been documented on the Forest. Neither is within a ½ mile of the project area. However, migrating and wintering bald eagles may use the project area.</td>
</tr>
<tr>
<td>Black-backed Woodpecker (Picoides arcticus)</td>
<td>SS, MIS</td>
<td>X</td>
<td></td>
<td>Burned areas with a high density of pre-burn snags; dense and/or mature forests with a high snag density (Anderson 2003). Species rare outside of burned areas (Beason et al. 2006).</td>
</tr>
<tr>
<td>Flammulated Owl (Otus flammeolus)</td>
<td>SS</td>
<td>X</td>
<td></td>
<td>Open ponderosa pine forests (Hayward and Verner 1994).</td>
</tr>
<tr>
<td>R2 Sensitive Species</td>
<td>Status</td>
<td>Known Species Presence? (X = yes)</td>
<td>Habitat Present? (X = yes)</td>
<td>Habitat and/or Occurrence Information</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>--------</td>
<td>----------------------------------</td>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Lewis’s Woodpecker (Melanerpes lewis)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Open burned areas with large snags; oak and cottonwood forests, and open, park-like ponderosa pine forests (Anderson 2003, Panjabi 2003).</td>
</tr>
<tr>
<td>Northern Goshawk (Accipiter gentilis)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Forages in a variety of forested areas and small openings; nests primarily in dense mature conifer forests (Kennedy 2003). Three goshawk territories are known to exist in the project area.</td>
</tr>
<tr>
<td>Mammals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Marten (Martes americana)</td>
<td>SS</td>
<td></td>
<td>X</td>
<td>Spruce forests with complex near-ground structure, extending into adjacent ponderosa pine stands (Buskirk 2002).</td>
</tr>
<tr>
<td>Fringed Myotis (Myotis thysanodes pahasapensis)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Found at high elevations in spruce habitat and mixed ponderosa pine, spruce and aspen habitat; roosts in a variety of structures including caves, mines, tunnels, snags and buildings (Schmidt 2003a). Known occurrences in the project area.</td>
</tr>
<tr>
<td>Townsend’s Big-eared Bat (Plecotus townsendii)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Forages on insects in a variety of habitats including forested and wet areas; requires suitable roosts in a variety of structures including caves, mines, and rocky ledges and overhangs (Schmidt 2003b). Known occurrences in the project area.</td>
</tr>
<tr>
<td>Reptiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Hills Redbelly Snake (Storeria occipitomaculata pahasapae)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Moist habitats with well-developed ground litter (Smith and Stephens 2003).</td>
</tr>
<tr>
<td>Amphibians</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Leopard Frog (Rana pipiens)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Riparian and wetland areas for tadpoles, subadults, and breeding adults; adults forage in upland habitats (Smith 2003).</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finescale Dace (Phoxinus neogaeus)</td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>Streams, small lakes and cool, boggy environments often associated with springs or beaver dams; limited primarily to the Redwater Creek drainage, with the exception of Geis Reservoir on Middle Fork Hay Creek (Isaak et al. 2003). New occurrence in Dalton Lake and Little Elk Creek in 2010 (Hirtzel 2010).</td>
</tr>
<tr>
<td>Mountain Sucker (Catostomus platyrhynchus)</td>
<td>SS, MIS</td>
<td>X</td>
<td>X</td>
<td>Occurs most often in cool, clear mountain streams, but have been observed elsewhere in large rivers, lakes and reservoirs (Isaak et al. 2003). Known occurrences within the project area (Hirtzel 2009).</td>
</tr>
<tr>
<td>Invertebrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooper’s Mountain Snail (Orechelix strigosa cooperi)</td>
<td>SS</td>
<td>X</td>
<td></td>
<td>Found on calcareous soils, lowland wooded areas and talus slopes, generally but not always with northern or eastern exposures. In contrast to other land snails, Cooper’s snail can thrive with little cover and thin litter (Anderson 2005).</td>
</tr>
</tbody>
</table>
R2 Sensitive Species | Status | Known Species Presence? (X = yes) | Habitat Present? (X = yes) | Habitat and/or Occurrence Information
--- | --- | --- | --- | ---
Regal Fritillary *(Speyeria idalia)* | SS | X | X | Tall-grass prairies; continuous prairie near marshes (Marrone 2005); greater than 1,000 acres may be required for stable populations (Royer and Marrone 1992). Best habitat in Black Hills occurs at lower elevations along Forest boundary and in interior prairies (at least 250 acres in size) (USDA-Forest Service 1996).

**Management Indicator Species**

The Forest Service Manual defines MIS as “...plant and animal species, ... selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent” (FSM 2620.5).

Forest-wide wildlife and fish MIS are:

- Black-backed woodpecker *(Picoides arcticus)*
- Brown creeper *(Certhia americana)*
- Golden-crowned kinglet *(Regulus satrapa)*
- Grasshopper sparrow *(Ammodramus savannarum)*
- Ruffed grouse *(Bonasa umbellus)*
- Song sparrow *(Melospiza melodia)*
- Beaver *(Castor canadensis)*
- White-tailed deer *(Odocoileus virginianus)*
- Mountain Sucker *(Catostomus platyrhynchus)*

Although each of these species are known to or could potentially occur in or near the Black Hills National Forest, not all of them have potential to occur in the Steamboat project area. Table 3-24 lists each species that does occur, or has potential habitat within, the Steamboat project area and is therefore included in this analysis. If an MIS or its habitat were not found in the project area, it was not identified for further analysis.

<table>
<thead>
<tr>
<th>Management Indicator Species</th>
<th>Status</th>
<th>Species Present? X=yes</th>
<th>Habitat Present? X=yes</th>
<th>Habitat and/or Occurrence Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-backed woodpecker <em>(Picoides arcticus)</em></td>
<td>MIS, SS</td>
<td>X</td>
<td>X</td>
<td>Burned areas with a high density of pre-burn snags; dense and/or mature forests with a high snag density (Anderson 2003). Species rare outside of burned areas (Beason et al. 2006).</td>
</tr>
<tr>
<td>Management Indicator Species</td>
<td>Status</td>
<td>Species Present? X=yes</td>
<td>Habitat Present? X=yes</td>
<td>Habitat and/or Occurrence Information</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------</td>
<td>------------------------</td>
<td>-----------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Brown Creeper (Certhia americana)</td>
<td>MIS</td>
<td></td>
<td>X</td>
<td>Late successional ponderosa pine and white spruce (Beason et al. 2006).</td>
</tr>
<tr>
<td>Golden-crowned Kinglet (Regulus satrapa)</td>
<td>MIS</td>
<td>X</td>
<td>X</td>
<td>Breeds almost exclusively in white spruce habitat (Beason et al. 2006).</td>
</tr>
<tr>
<td>Ruffed Grouse (Bonasa umbellus)</td>
<td>MIS</td>
<td></td>
<td>X</td>
<td>Occur widely throughout Black Hills in hardwood communities; may require variety of aspen structural stages (Wiggins 2006).</td>
</tr>
<tr>
<td>Song Sparrow (Melospiza melodia)</td>
<td>MIS</td>
<td>X</td>
<td>X</td>
<td>Found mostly in dense, riparian vegetation in the Black Hills (Beason et al. 2006).</td>
</tr>
</tbody>
</table>

**Mammals**

- **Beaver** (Castor canadensis)
  - MIS
  - X
  - X
  - Riparian habitat dominated by stands of willow, aspen and cottonwood; do not use areas lacking permanent water and suitable woody vegetation (Higgins et al. 2000). The project area contains little surface water and the project is not likely to increase measurable amounts of water.

- **White-tailed Deer** (Odocoileus virginianus)
  - MIS
  - X
  - X
  - Various habitats from forests to fields with adjacent cover; wooded draws and pine stands with closed canopies provide thermal cover, while agricultural areas and recently logged and open stands with abundant shrubs are important for foraging.

**Fish**

- **Mountain Sucker** (Catostomus platyrhynchos)
  - SS, MIS
  - X
  - X
  - Occurs most often in cool, clear mountain streams, but have been observed elsewhere in large rivers, lakes and reservoirs (Isaak et al. 2003). Known occurrences within the Project Area (Hirtzel 2009).

### 3.4.3 Environmental Consequences

**Habitat Conditions**

**Alternative A (No Action)**

**Direct and Indirect Effects**

The direct effects of Alternative A (No Action) would be minimal, as no new actions would occur. Long-term, indirect effects would vary depending on habitat type. Indirect effects would occur as a response to current conditions in the absence of active management, other than fire suppression efforts. In general, Alternative A would maintain existing habitat and protect biodiversity in the short-term. Long
term, the proportion of ponderosa pine cover type in the Steamboat project area would be expected to rise as this species continued to encroach into existing meadows and hardwood stands. Early successional habitats would continue to decline as pine stands continue to progress toward later seral stages. Currently, late successional habitat (structural stage 5) is below management objectives within the project area and Forest-wide. Over the next 10 to 20 years, some of the mature stands could further develop towards late successional habitats. However, this alternative would not result in a variety of successional stages in ponderosa pine, which would reduce habitat and structural diversity and not comply with Forest objectives. Natural disturbances such as wildfire and beetle outbreak would continue to return portions of the forest in which they occur to early successional stages. However, the no action alternative would greatly increase the chances of high intensity wildfire, insect, and disease events.

Effects by habitat types in the project area that may be affected are described in Table 3-25.

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Direct effects for no action Alternative A</th>
<th>Indirect effects for no action Alternative A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>None</td>
<td>In the absence of active management, additional dense, late successional stands with closed canopy would develop. The amount of snags is likely to increase with forest succession. These stands would have an increased risk of mountain pine beetle infestation and high intensity wildfire.</td>
</tr>
<tr>
<td>White Spruce</td>
<td>None</td>
<td>In the absence of active management, white spruce as a component of the ecosystem would likely continue to increase within its ecological limits.</td>
</tr>
<tr>
<td>Hardwood Communities</td>
<td>None</td>
<td>In the absence of active management, conifer encroachment would continue to reduce areas dominated by aspen, birch and oak.</td>
</tr>
<tr>
<td>Grassland/Meadows</td>
<td>None</td>
<td>In the absence of active management, conifer encroachment would continue to reduce meadow habitat.</td>
</tr>
<tr>
<td>Riparian/Aquatic</td>
<td>None</td>
<td>Stream fragmentation by existing dams and roads and other fish passage barriers would continue to persist. Water quality would continue to be influenced by ongoing federal/non federal activities. Drought may continue to reduce stream flows and connectivity.</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

A century of fire suppression has caused widespread alteration and degradation of wildlife habitat in the Black Hills (USDA-Forest Service 2005a). Frequent recurring disturbances like fire and insects maintained a generally open, mature pine canopy with a productive and diverse understory by thinning pine stands and creating open stands with abundant grasses, forbs, and shrubs in the understory (Sieg and Severson 1996). In the absence of frequent low-intensity fires, the increase in the density and canopy cover of pine stands has resulted in large, contiguous expanses of higher density trees with abundant pine regeneration and sparse understories (Parrish et al. 1996). Fire suppression has also resulted in the conversion of hardwood stands such as aspen and bur oak to pine, which has reduced diversity (Uresk and Severson 1998).
No new activities are proposed under Alternative A. As a result, the conditions described above would be expected to continue, or worsen in the absence of active management, into the foreseeable future. The cumulative effects of Alternative A on wildlife habitat would be similar to the indirect effects described above.

Alternative B (Proposed Action)

Direct and Indirect Effects
Alternative B is designed to create structural diversity in big game winter range and to reduce the fire hazard and risk of mountain pine beetle infestation by moving towards the Forest objectives for structural stage management. In general, there would be short-term impacts to wildlife habitat availability during treatments; however, over the long-term there would be improved diversity of habitats, and improved quality of most habitats. As a result of the hardwood enhancement treatments, there would be an increase in the amount and quality of hardwood habitat (primarily aspen). Commercial and non-commercial hardwood enhancement treatments would occur on 630 acres. The meadow enhancement treatments would enhance 206 acres of grassland/meadows.

There would be an increase in the diversity of understory plants within many pine stands due to reduced forest canopy cover and disturbance caused by prescribed fire and logging. Fifty-two percent (11,420 acres) of the treatments on NFS land within the project area would have a pre-commercial thinning component under this alternative. Prescribed fire is proposed on forty-eight percent (10,608 acres) of NFS land within the project area. There are 1,479 acres of individual tree selection and group selection treatments, which would create a more uneven aged structure across the landscape. In addition, emergency sanitation harvest treatments, including cutting of beetle infested trees and thinning of stands, may occur in sites with high pine beetle risk. Sanitation harvest provisions would be implemented only where deemed necessary to control the spread of mountain pine beetles. Proposed treatments would likely involve cutting green beetle-infested trees and thinning stands to residual basal areas below 80. These treatments would help to limit the spread of beetles and would open up these stands and result in more sunlight, moisture and nutrients being available for understory plants including grasses, forbs and shrubs. Inclusions of aspen, birch and oak within these pine stands may also benefit from these treatments. Disturbance created by prescribed fire would also help stimulate the regeneration of the less shade tolerant plant species within these stands. No new system roads would be constructed to access sanitation harvest units.

Most of the proposed treatments within the ponderosa pine stands of the project area would have an effect on the stand structural stage. Implementation of Alternative B would not immediately result in the desired distribution of structural stages for MA5.4. The treatments proposed under Alternative B would, however, help to achieve the desired distribution of structural stages in the long term. This alternative would generally reduce the amount of area in the dense mature structural stages and increase the amount of area within a more open mature stage and the sapling-pole stages.

The area in structural stages 4C and 4B would drop, bringing MA5.4 closer to Forest-wide structural stage objectives. There would be a corresponding increase in the amount of area of structural stage 4A and 3A also bringing MA5.4 closer to Forest-wide structural stage objectives.
Alternative B would also result in an increase in late successional pine forest, moving MA5.4 closer to Forest-wide structural stage objectives. Current and future structural stage 5 stands totaling 567 acres were identified and would be managed for structural stage 5 characteristics into the future.

Alternative B would include an estimated 20 miles of new NFS road construction and 5 miles of non-system road would be converted). Alternative B would also require the use of approximately 75 miles of existing NFS road that would need to be prepared for use; preparation could range from minimal maintenance activities (pre-use maintenance) to reconstruction of the road template, depending on the current condition of the road. The loss of habitat to road or trail construction is unknown, but is often estimated at five acres per linear mile (Rowland et al. 2004). There would likely be some effects from disturbance during project implementation. System roads that undergo pre-use maintenance or reconstruction would remain on the system and allowable uses would be determined by the Forest-wide travel management plan. No indirect disturbance impacts from public use of newly constructed roads are expected after the project is finished because all newly constructed or temp roads would be closed following completion of management activities. The method of closure would depend on site conditions and be determined at the time of closure.

Effects to riparian/aquatic habitat are summarized in the table below. These effects are mitigated through the use of the Forest Plan standards and guidelines, Region 2 Watershed Conservation Practices Handbook (WCPH; Forest Service Handbook 2509.25) and South Dakota Forestry Best Management Practices (BMPs). The Handbook contains proven watershed conservation practices to protect soil, aquatic, and riparian systems. If used properly, the watershed conservation practices will meet applicable Federal and State laws and regulations, including State BMPs. A summary of the relevant WCPH direction is in the Hydrology Specialist Report.

Effects to habitats due to the treatments proposed in Alternative B are provided in Table 3-26 below. Relevant Forest Plan standards and objectives are met by the use of specific design criteria applied to mitigate the impacts in the project area.

### Table 3-26. Alternative B (Proposed Action) - Direct and Indirect Effects to Habitat

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Direct Effects for Alternative B</th>
<th>Indirect Effects for Alternative B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>Commercial and non-commercial treatments to approximately 12,336 acres which includes 4,617 acres of commercial thin treatments as well as 1,479 acres of uneven management treatments. Extensive non-commercial thinning and prescribed burning. Treatments include the removal of 3,619 acres of mature, dense forest (4C).</td>
<td>Reduction of pine in structural stage 4C, 4B and 3C and increase in structural stages 4A and 3A moving towards forest wide structural stage objectives. Long term movement towards all structural stage objectives, including structural stage 5.</td>
</tr>
</tbody>
</table>
### Direct Effects for Alternative B

**White Spruce**
- A small reduction of spruce in pine habitat as a result of pine and hardwood treatment activities.
- Very little active management in spruce dominated habitat. Some treatments will occur in pine/spruce ecotones.

**Hardwood Communities**
- 630 acres of primary treatments in aspen stands with commercial and non-commercial treatments (conifer removal) and prescribed burn. Additional acres of secondary and inclusion treatments.

**Grassland/Meadows**
- 206 acres treated with commercial and non-commercial meadow enhancement treatments including prescribed burning to maintain meadows.

**Riparian/Aquatic**
- Direct effects would be limited to those incurred by new road stream crossings. Effects would include habitat loss at the crossing and short term habitat loss in the vicinity of the road crossing during construction.

### Indirect Effects for Alternative B

**White Spruce**
- Overall change in acreage of spruce would be minimal.
- White spruce as a component of the ecosystem would likely continue to increase within its ecological limits.

**Hardwood Communities**
- Increase in quantity and quality of hardwood habitat due to reduced conifer competition.
- Birch stands have been identified and will be protected.

**Grassland/Meadows**
- Enhancement of meadow habitat due to reduction in conifer encroachment.

**Riparian/Aquatic**
- Bank stabilization may decrease and sedimentation may increase due to new stream crossings (refer to Hydrology Report).
- There is also the potential for short-term impacts from sedimentation during treatment activities.

### Cumulative Effects

Cumulative effects are the additive incremental impacts from the action alternatives in relation to past, present and reasonably foreseeable future actions. Past and present actions are reflected in the existing condition. This analysis is bounded by the Northern Hills Ranger District boundary and the 15 year period required for project implementation. Relevant actions on federal and non-federal land assessed in the analysis are discussed below. A century of fire suppression has caused widespread alteration and degradation of wildlife habitat in the Black Hills (USDA-Forest Service 2005). Frequent recurring disturbances like fire and insects maintained a generally open, mature pine canopy with a productive and diverse understory by thinning pine stands and creating open stands with abundant grasses, forbs, and shrubs in the understory (Sieg and Severson 1996). In the absence of frequent low-intensity fires, the increase in the density and canopy cover of pine stands has resulted in large, contiguous expanses of higher density trees with abundant pine regeneration and sparse understories (Parrish et al. 1996). The action alternatives are expected to offset some effects of fire suppression. The net cumulative effect is expected to offset the loss of open, mature pine habitat with a productive understory.

Fire suppression has also resulted in the conversion of hardwood stands such as aspen and bur oak to pine, which has reduced diversity (Uresk and Severson 1998). The action alternatives are expected to have a positive cumulative effect on hardwood habitat which would offset some conversion to pine that has occurred as a result of fire suppression. Encroachment of pine into meadows and riparian areas has reduced grass, forb, and shrub availability. The increased biomass of pine has changed hydrologic conditions and decreased available water within the watersheds.
The project area has been logged intermittently for the last 130 years. Part of the very first timber sale authorized by the Forest Service, Case #1, occurred within the project area. Timber sales competed in the recent past are described in Appendix D. The only foreseeable future sales would be a result of the Steamboat Project.

Logging has had multiple effects on the project area. Logging has created single story stands of mature trees and multi-level pine stands with both immature and mature pine. The Steamboat Project would continue this condition, however, with an increase of individual tree selection and group selection treatments aimed at increasing multi-level pine stands on the District. Mixed pine-hardwood stands have also developed due to a proliferation of aspen in the understory as the mature pine canopy is removed. The Steamboat Project is expected to expand the area of hardwoods through implementation of aspen and birch enhancement treatments.

Several timber sales are planned or ongoing on the Northern Hills District. They include sales associated with the Nautilus, Cold Springs, Telegraph, Citadel, West Rim, Mineral and Geranium planning areas, none of which overlap with the Steamboat project area, although the Nautilus project area borders Steamboat to the west. Treatments in these areas will primarily affect the ponderosa pine cover type, and will result in the decrease of pine cover and density throughout these project areas. Pine habitat, both mature and immature, will be decreased, forested habitat will be fragmented, and hardwood stand development, as well as grass, forbs and shrub habitat will be encouraged and increased. These effects should be long-term (greater than 30 years). The Steamboat Project is expected to have similar impacts within the Steamboat project area, which is expected to incrementally add to these affects across the District.

Grazing has been a continuous activity in the project area for over 100 years and is expected to continue into the foreseeable future. Historically, however, there were larger numbers of both cattle and sheep grazing in the project area. Pasture fences did not exist, so livestock were not rotated between pastures and use was season long. In some instances, livestock grazing converted native riparian plant species to bluegrass, spread noxious weeds, altered stream banks in site-specific locations, consumed water, reduced fine fuels, and reduced the diversity of plant species. As grazing practices have improved, fences have controlled livestock distribution and altered the use of specific areas. Water developments at several springs have also changed grazing patterns. These improvements in practices have generally lessened the impacts across the project area. There would be no additional incremental impacts from the Steamboat project. The Steamboat project area has ongoing grazing in two allotments on NFS lands.

Historic and ongoing mining, grazing, logging, recreational and road-related activities have influenced stream habitat conditions within the project area. In-stream structures that block fish passage have fragmented the stream network. Barriers to fish passage, such as impassable culverts at road-stream crossings and dams exist in the project area. These fish passage barriers reduce the ability of fish to colonize or reoccupy suitable habitat especially in an upstream direction, which may limit a species’ distribution over time without human intervention. The Steamboat Project would not cause additional incremental increase in these barriers and most existing barriers and road-stream crossings would be repaired.
Direct mortality from wildlife/vehicle collisions could occur in the action alternatives. Direct mortality is expected to affect individuals and is not expected to put populations at risk. In general, the more motorized routes and motorized use in wildlife habitat, the more potential there is for wildlife/vehicle collisions. The most effects on wildlife from motorized recreation are likely to come in the form of disturbance as a result of route or area use. The miles of motorized routes and the amount of area open to motorized travel is used to evaluate the level of effects to wildlife in general and was analyzed for during the recent Forest-wide travel management plan.

Motorized vehicles have damaged roads and riparian areas when conditions are wet or in cases where streams were crossed. The use of some open roads, particularly during wet periods, has also contributed to the establishment of noxious weeds, and the erosion and degradation of riparian areas due to increasing sedimentation and changes in stream morphology. Increased use by all-terrain vehicles (ATVs) can be expected but will be focused on roads and trails designated by the MVUM and are likely to continue to degrade wildlife habitat both directly and due to habitat fragmentation.

Snags have been reduced within harvest units due to safety concerns for loggers and development of roads, skid trails, and other activities. The Steamboat Project would have additive impacts if some snags are removed for safety reasons. Fuelwood gathering has decreased the number of snags, particularly adjacent to roads where the wood can more easily be hauled out. Some incremental additive impacts are to be expected from fuelwood gathering due to greater public access, however, this project does not authorize fuelwood gathering and most new roads would be closed after project completion. Wildfires, drought, and beetle activity have all increased the overall number of snags in and around the project area.

Private lands within and adjacent to the Steamboat project area contain habitat for wildlife and; therefore, their management can have impacts on wildlife. Resource management and conservation by private citizens and companies depends on a number of factors (e.g., desired goals, market prices, development potential), making it difficult to predict future trends in private forest structure and diversity. Landowners could treat forests for lumber, which could reduce habitat for some species. Fire hazard reduction activities are likely to increase on some of these lands over the next 15 years in an effort to prevent loss of homes from wildfire, which could result in additional loss of habitat. It is assumed that urban development and other activities would continue on private lands. This would likely increase the importance of habitat located on NFS land.

**Alternative C**

**Direct and Indirect Effects**
Alternative C was developed in response to the issue of mountain pine beetle infestation. Specifically, the comments received during scoping questioned why approximately 6,755 acres of pine stands at moderate or high risk of pine beetle infestation were left untreated by the proposed action. Alternative C addresses that issue by incorporating the treatments included in Alternative B and assigning a silvicultural prescription to the majority of the stands with a moderate or high beetle risk that were not treated under Alternative B.

In general, there would be short-term impacts to wildlife habitat availability during treatments; however, over the long-term there would be improved diversity of some habitats, and improved quality
of most habitats. Structural diversity would be less compared to Alternative B due to the increased amount of treatments within mature dense stands, mostly in the form of overstory removal treatment. As a result of the hardwood enhancement treatments, there would be an increase in the amount and quality of hardwood habitat (primarily aspen). Commercial and non-commercial hardwood enhancement treatments would occur on 630 acres. The meadow enhancement treatments would enhance 206 acres of grassland/meadows.

There would be an increase in the diversity of understory plants within many pine stands due to reduced forest canopy cover and disturbance caused by prescribed fire and logging. Seventy-eight percent (17,226 acres) of the treatments on NFS land within the project area would have a pre-commercial thinning component under this alternative. Prescribed fire is proposed on forty-eight percent (10,608 acres) of NFS land within the project area. There are 1,479 acres of individual tree selection and group selection treatments which will create a more uneven aged structure across the landscape. In addition, emergency sanitation harvest treatments, including cutting of beetle infested trees and thinning of stands, may occur in sites with high pine beetle risk. Sanitation harvest provisions would be implemented only where deemed necessary to control the spread of mountain pine beetles. Proposed treatments would likely involve cutting green beetle-infested trees and thinning stands to residual basal areas below 80. These treatments would help to limit the spread of beetles and would open up these stands and result in more sunlight, moisture and nutrients being available for understory plants including grasses, forbs and shrubs. Inclusions of aspen, birch and oak within these pine stands may also benefit from these treatments. Disturbance created by prescribed fire would also help stimulate the regeneration of the less shade tolerant plant species within these stands. No new system roads would be constructed to access sanitation harvest units.

Most of the proposed treatments within the ponderosa pine stands of the project area would have an effect on the stand structural stage. Implementation of Alternative C would not immediately result in the desired distribution of structural stages for MA5.4. The treatments proposed under Alternative C would, however, help to achieve the desired distribution of structural stages in the long term. This alternative would greatly reduce the amount of area in the dense mature structural stages and increase the amount of area within a more open mature stage and the sapling-pole stages.

The area in structural stages 4C and 4B would drop greatly, bringing MA5.4 closer to Forest-wide structural stage objectives. There would be a corresponding increase in the amount of area of structural stage 4A and 3A also bringing MA5.4 closer to Forest-wide structural stage objectives. However, within the project area, structural diversity would be greatly reduced.

Alternative B would also result in a slight increase in late successional pine forest moving MA5.4 closer to Forest-wide structural stage objectives. Current and future structural stage 5 stands totaling 235 acres were identified and would be managed for structural stage 5 characteristics into the future.

Full implementation of Alternative C would require 41 miles of new NFS road construction and 10 miles of non-system road would be converted. Alternative C would also require the use of approximately 81 miles of existing NFS road that would need to be prepared for use; preparation could range from minimal maintenance activities (pre-use maintenance) to reconstruction of the road template, depending on the current condition of the road. The loss of habitat to road or trail construction is unknown but is often estimated at five acres per linear mile (Rowland et al. 2004).
approximately 205 acres of habitat lost to new road construction under Alternative C. There would likely be some effects from disturbance during project implementation. System roads that undergo pre-use maintenance or reconstruction would remain on the system and allowable uses would be determined by the Forest-wide travel management plan. No indirect disturbance impacts from public use of newly constructed roads are expected after the project is finished because all newly constructed or temp roads would be closed following completion of management activities. The method of closure would depend on site conditions and be determined at the time of closure.

Effects to riparian/aquatic habitat are summarized in the table below. These effects are mitigated through the use of the Forest Plan standards and guidelines, Region 2 Watershed Conservation Practices Handbook (WCPH; Forest Service Handbook 2509.25) and South Dakota Forestry Best Management Practices (BMPs). The Handbook contains proven watershed conservation practices to protect soil, aquatic, and riparian systems. If used properly, the watershed conservation practices will meet applicable Federal and State laws and regulations, including State BMPs. A summary of the relevant WCPH direction is in the Hydrology Specialist Report.

Effects to habitats due to the treatments proposed in Alternative C are provided in Table 3-27 below. Relevant Forest Plan standards and objectives are met by the use of specific design criteria applied to mitigate the impacts in the project area.

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Direct Effects for Alternative C</th>
<th>Indirect Effects for Alternative C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>Commercial and non-commercial treatments to approximately 18,049 acres which includes 6,489 acres of commercial thin treatments as well as 3,740 acres of overstory removal treatment. It would also include 1,479 acres of uneven management treatments. Extensive non-commercial thinning and prescribed burning. Treatments include the removal of 4,647 acres of mature, dense forest (4C).</td>
<td>Reduction of pine in structural stage 4C, 4B and 3C and increase in structural stages 4A and 3A moving towards forest wide structural stage objectives. Long term movement towards all structural stage objectives Forest-wide, however, reduced structural diversity within the project area.</td>
</tr>
<tr>
<td>White Spruce</td>
<td>A small reduction of spruce in pine habitat as a result of pine and hardwood treatment activities. Very little active management in spruce dominated habitat. Some treatments will occur in pine/spruce ecotones.</td>
<td>Overall change in acreage of spruce would be minimal. White spruce as a component of the ecosystem would likely continue to increase within its ecological limits.</td>
</tr>
<tr>
<td>Hardwood Communities</td>
<td>630 acres of primary treatments in aspen stands with commercial and non-commercial treatments (conifer removal) and prescribed burn. Additional acres of secondary and inclusion treatments.</td>
<td>Increase in quantity and quality of hardwood habitat due to reduced conifer competition. Birch stands have been identified and will be protected (see botany specialist report).</td>
</tr>
</tbody>
</table>
### Cumulative Effects
Cumulative effects associated with Alternative C would generally be similar to those described under Alternative B. Because the level of treatment proposed under Alternative C is higher than Alternative B, the magnitude of the associated cumulative effects would be higher, particularly for those cumulative effects associated with road construction and timber harvest.

### Alternative D

**Direct and Indirect Effects**

Alternative D was developed in response to the issue of new road construction. Concerns were raised during the scoping period that new road construction would have a negative impact on soil and water resources and could potentially affect the quality of big game winter range. Alternative D responds to this issue by eliminating all new road construction. The treatments proposed under Alternative D represent those treatments from Alternative B that are accessible using the existing road network.

To a lesser extent than Alternative B, Alternative D is designed to create structural diversity in big game winter range and to reduce the fire hazard and risk of mountain pine beetle infestation by moving towards the Forest Plan objectives for structural stage management. In general, there would be short-term impacts to wildlife habitat availability during treatments; however, over the long-term there would be improved diversity of habitats, and improved quality of most habitats. As a result of the hardwood enhancement treatments, there would be an increase in the amount and quality of hardwood habitat (primarily aspen). Commercial and non-commercial hardwood enhancement treatments would occur on 630 acres. The meadow enhancement treatments would enhance 206 acres of grassland/meadows.

There would be an increase in the diversity of understory plants within many pine stands due to reduced forest canopy cover and disturbance caused by prescribed fire and logging. Thirty-nine percent (8,478 acres) of the treatments on NFS land within the project area would have a pre-commercial thinning component under this alternative. Prescribed fire is proposed on forty-eight percent (10,608 acres) of NFS land within the project area. There are 1,086 acres of individual tree selection and group selection treatments, which would create a more uneven aged structure across the landscape. In addition, emergency sanitation harvest treatments, including cutting of beetle infested trees and thinning of stands, may occur in sites with high pine beetle risk. Sanitation harvest provisions would be...
implemented only where deemed necessary to control the spread of mountain pine beetles. Proposed treatments would likely involve cutting green beetle-infested trees and thinning stands to residual basal areas below 80. These treatments would help to limit the spread of beetles and would open up these stands and result in more sunlight, moisture and nutrients being available for understory plants including grasses, forbs and shrubs. Inclusions of aspen, birch and oak within these pine stands may also benefit from these treatments. Disturbance created by prescribed fire would also help stimulate the regeneration of the less shade tolerant plant species within these stands. No new system roads would be constructed to access sanitation harvest units.

Most of the proposed treatments within the ponderosa pine stands of the project area would have an effect on the stand structural stage. Implementation of Alternative D would not immediately result in the desired distribution of structural stages for MA5.4. The treatments proposed under Alternative D would, however, help to achieve the desired distribution of structural stages in the long term. This alternative would generally reduce the amount of area in the dense mature structural stages and increase the amount of area within a more open mature stage and the sapling-pole stages to a lesser extent than Alternative B.

The area in structural stages 4C and 4B would drop, bringing MA5.4 closer to Forest-wide structural stage objectives. There would be a corresponding increase in the amount of area of structural stage 4A and 3A also bringing MA5.4 closer to Forest-wide structural stage objectives.

Alternative D would also result in an increase in late successional pine forest moving MA5.4 closer to Forest-wide structural stage objectives. Current and future structural stage 5 stands totaling 567 acres were identified and will be managed for structural stage 5 characteristics into the future.

Under Alternative D, there would be no new NFS road construction. There would be four miles of new road conversion; although those roads are not currently part of the NFS system, the templates already exist on the ground and use of those roads would not require creation of an entirely new route. Alternative D would also require the use of approximately 70 miles of existing NFS road that would need to be prepared for use; preparation could range from minimal maintenance activities (pre-use maintenance) to reconstruction of the road template, depending on the current condition of the road. The loss of habitat to road or trail construction is unknown, but is often estimated at five acres per linear mile (Rowland et al. 2004). There would likely be some effects from disturbance during project implementation. System roads that undergo pre-use maintenance or reconstruction would remain on the system and allowable uses would be determined by the Forest-wide travel management plan. Effects to riparian/aquatic habitat are summarized in the table below. These effects are mitigated through the use of the Forest Plan standards and guidelines, Region 2 Watershed Conservation Practices Handbook (WCPH; Forest Service Handbook 2509.25) and South Dakota Forestry Best Management Practices (BMPs). The Handbook contains proven watershed conservation practices to protect soil, aquatic, and riparian systems. If used properly, the watershed conservation practices will meet applicable Federal and State laws and regulations, including State BMPs. A summary of the relevant WCPH direction is in the Hydrology Specialist Report.

Effects to habitats due to the treatments proposed in Alternative D are provided in Table 3-28 below. Relevant Forest Plan standards and objectives are met by the use of specific design criteria applied to mitigate the impacts in the project area.
Table 3-28. Alternative D - Direct and Indirect Effects to Habitat

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Direct Effects for Alternative D</th>
<th>Indirect Effects for Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>Commercial and non-commercial treatments to approximately 9,394 acres which includes 2,661 acres of commercial thin treatments as well as 1,086 acres of uneven management treatments. Extensive non-commercial thinning and prescribed burning. Treatments include the removal of 2,562 acres of mature, dense forest (4C).</td>
<td>Reduction of pine in structural stage 4C, 4B and 3C and increase in structural stages 4A and 3A moving towards forest wide structural stage objectives. Long term movement towards all structural stage objectives, including structural stage 5.</td>
</tr>
<tr>
<td>White Spruce</td>
<td>A small reduction of spruce in pine habitat as a result of pine and hardwood treatment activities. Very little active management in spruce dominated habitat. Some treatments will occur in pine/spruce ecotones.</td>
<td>Overall change in acreage of spruce would be minimal. White spruce as a component of the ecosystem would likely continue to increase within its ecological limits.</td>
</tr>
<tr>
<td>Hardwood Communities</td>
<td>630 acres of primary treatments in aspen stands with commercial and non-commercial treatments (conifer removal) and prescribed burn. Additional acres of secondary and inclusion treatments.</td>
<td>Increase in quantity and quality of hardwood habitat due to reduced conifer competition. Birch stands have been identified and will be protected (see botany specialist report).</td>
</tr>
<tr>
<td>Grassland/ Meadows</td>
<td>206 acres treated with commercial and non-commercial meadow enhancement treatments including prescribed burning to maintain meadows.</td>
<td>Enhancement of meadow habitat due to reduction in conifer encroachment.</td>
</tr>
<tr>
<td>Riparian/Aquatic</td>
<td>Direct effects would be limited to those incurred by new road stream crossings. Effects would include habitat loss at the crossing and short term habitat loss in the vicinity of the road crossing during construction.</td>
<td>Bank stabilization may decrease and sedimentation may increase due to new stream crossings (refer to Hydrology Report). There is also the potential for short-term impacts from sedimentation during treatment activities.</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

Cumulative effects associated with Alternative D would generally be similar to those described under Alternative B. Because the level of treatment proposed under Alternative D is lower than Alternative B, the magnitude of the associated cumulative effects would be lower. Alternative D does not include any new road construction, so cumulative effects of road construction would not occur under this alternative.

**Threatened and Endangered Species**

No known occurrences or suitable habitat for the whooping crane, least tern, or black-footed ferret occur within the Steamboat project area or the Northern Hills Ranger District (NHRD). The Forest Service has also conducted
additional consultation with the USFWS (Twiss 2003). Based on past consultation and the species list, it is
determined that no currently listed species with T, E, P, C, or XN status have the potential to occur within the
NHRD on the BHNF, nor has “critical habitat” been designated for any T or E species on the Forest. Therefore, no
federally listed species are addressed further in this document and there would be “no effect” to threatened
and endangered species and no impact to critical habitat.

**Region 2 Sensitive Species**

Sensitive species (SS) are those plant 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).

The most recent Region 2 SS wildlife list (FSM R-2 Supplement 2600-2009-1, effective June 9, 2009) was
reviewed and species that may occur in or near the Black Hills were identified. Table 7 in the Steamboat
Project Wildlife and Fisheries Biological Evaluation (Goldberg 2011) describes the Region 2 SS likely to
occur on the Black Hills National Forest. Although each of these species are known to or could
potentially occur in or near the Black Hills, not all of them have potential to occur in the Steamboat
project area. A pre-field wildlife and fish review of the project area for all Region 2 SS was completed
using Heritage database records, district data, literature reviews, communication with district personnel
and the Forest Plan to identify which SS to include in this analysis. Table 3-29 below summarizes effects
on these species; full analyses for each species are found in the Steamboat Project Wildlife and Fisheries
BE (Goldberg 2011), which is available upon request.

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
<th>Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>American three-toed woodpecker</td>
<td>A: None.</td>
<td>A: Existing habitat would remain and potential for development of additional habitat would remain high.</td>
<td>A: Would add to high potential for development of preferred habitat (white spruce forest).</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td>(Picoides tridactylus)</td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Existing habitat would remain; potential for development of additional habitat would decrease. Prescribed burns expected to positively affect habitat. Incidental loss of snags.</td>
<td>B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities (decreased fire hazard and beetle risk). Continued availability of white spruce forest in the project area and across the Forest.</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Direct</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>Determination</td>
</tr>
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<td>---------------------------------</td>
<td>----------------------------------------------------------------------</td>
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<td>----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Black-backed woodpecker (Picoides arcticus)</td>
<td>A: None.</td>
<td>A: Existing habitat would remain and potential for development of additional habitat would remain high.</td>
<td>A: Would add to high potential for development of preferred habitat (burned/infested forest).</td>
<td>A: No impact. B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Potential for development of additional habitat would decrease and current habitat would be reduced. Prescribed burns expected to positively affect habitat. Incidental loss of snags.</td>
<td>B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities (decreased fire hazard and beetle risk). Continued availability of burned and infested forest in the project area and across Forest.</td>
<td></td>
</tr>
<tr>
<td>Flammulated owl (Otus flammeolus)</td>
<td>A: None.</td>
<td>A: Potential habitat may decrease over time as stands become denser.</td>
<td>A: Would add to increased potential for loss of preferred habitat as a result of fire.</td>
<td>A: No impact. B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td>Lewis’s woodpecker (Melanerpes lewis)</td>
<td>A: None.</td>
<td>A: Existing habitat would remain and potential for development of additional habitat would remain high.</td>
<td>A: Would add to increased potential for development of preferred habitat (burned forest, insect outbreaks).</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td>Northern goshawk (Accipiter gentilis)</td>
<td>A: None.</td>
<td>A: Potential loss of foraging and nesting habitat as both become too dense. Potential loss of nest areas to mountain pine beetle or wildfire.</td>
<td>A: Would add to increased potential for loss of nesting habitat through understory growth, fire, or beetle infestation.</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td>Species</td>
<td>Direct</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>Determination</td>
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</tr>
<tr>
<td><strong>American marten (Martes americana)</strong></td>
<td>A: None. B, C, D: Low potential for individual mortality, loss of resting or den sites, and habitat disturbance.</td>
<td>A: Potential habitat may increase over time with stand density and development of additional near-ground structure. B, C, D: No effect on preferred habitat. Reduction of canopy cover and woody debris could alter prey habitat and decrease protection from predators.</td>
<td>A: Would add to increased potential for loss of preferred and dispersal habitats as a result of fire. B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities reducing risk of loss of preferred habitat.</td>
<td>A: No impact. B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td><strong>Fringed myotis (Myotis thysanodes) and Townsend's big-eared bat (Corynorhinus townsendii)</strong></td>
<td>A: None. B, C, D: No effects on potential hibernacula (mines or caves). Low potential for mortality of individual bats.</td>
<td>A: Possible decreases of foraging habitat due to increasing pine stand density and encroachment of pine into meadows and riparian areas. Increase in snag habitat. B, C, D: Foraging habitat enhancement through removal of small pine from overgrown edges of riparian meadows. Incidental loss of snags.</td>
<td>A: Would add to increased potential for loss of foraging habitat as a result of pine encroachment and fire. B, C, D: Would not add to any effects on hibernacula; would not reduce pine encroachment effects.</td>
<td>A: No impact. B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td><strong>Black Hills redbelly snake (Storeria occipitomaculata pahasapae)</strong></td>
<td>A: None. B, C, D: Possibility of individual mortality due to management activities and</td>
<td>A: Potential loss of habitat due to continuing encroachment of pine in riparian, hardwood and meadow habitats. B, C, D: Would maintain or enhance habitat through</td>
<td>A: Would add to increased potential for loss of habitat as a result of pine encroachment and fire. B, C, D: No addition to effects on riparian and other mesic habitats. Would add</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td>Species</td>
<td>Direct</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>Determination</td>
</tr>
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<td>---------------------------------</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Northern leopard frog <em>(Rana pipiens)</em></td>
<td>A: None.</td>
<td>A: Potential loss of habitat due to continuing encroachment of pine in riparian and meadow habitats. Continued negative effects on habitat from damaged roads.</td>
<td>A: Would add to increased potential for loss of habitat as a result of pine encroachment and fire and continued negative effects on habitat from damaged roads.</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Possibility of individual mortality due to management activities and motorized traffic.</td>
<td>B, C, D: Would maintain or enhance habitat through watershed improvement projects, conservation of mesic habitats, and reduction of pine encroachment in riparian and meadow areas.</td>
<td>B, C, D: No addition to effects on riparian and other mesic habitats. Would add to negative effects of motorized travel during project implementation.</td>
<td></td>
</tr>
<tr>
<td>Mountain sucker <em>(Catostomus platyrhynchos)</em></td>
<td>A: None.</td>
<td>A: Existing sources of pollution, sedimentation and fish barriers would continue to contribute to habitat degradation.</td>
<td>A: Water quality would continue to be incrementally negatively impacted by existing sources of pollution and sedimentation.</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Would maintain or enhance habitat through watershed improvement projects and conservation of mesic habitats.</td>
<td>B, C, D: Watershed improvement projects and road repair would be expected to decrease negative effects of damaged and unauthorized roads.</td>
<td></td>
</tr>
<tr>
<td>Finescale Dace <em>(Phoxinus neogaeus)</em></td>
<td>A: None.</td>
<td>A: Existing sources of pollution, sedimentation and fish barriers would continue to contribute to habitat degradation.</td>
<td>A: Water quality would continue to be incrementally negatively impacted by existing sources of pollution and sedimentation.</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward Federal listing.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Would maintain or enhance habitat through watershed improvement projects and conservation of mesic habitats.</td>
<td>B, C, D: Watershed improvement projects and road repair would be expected to decrease negative effects of damaged and unauthorized roads.</td>
<td></td>
</tr>
<tr>
<td>Cooper’s Rocky Mountain snail <em>(Oreohelix strigosa cooperi)</em></td>
<td>A: None.</td>
<td>A: Potential for loss of habitat due to fire would remain high.</td>
<td>A: Would not add to negative effects of habitat disturbance but would add to increased potential for loss of preferred habitat as a</td>
<td>A, B, C, D: May adversely impact individuals but not likely to result in a loss of viability in the</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Known colonies excluded from</td>
<td>B, C, D: Potential for damage</td>
<td></td>
<td>planning area nor cause a trend toward Federal listing.</td>
</tr>
</tbody>
</table>
Species | Direct | Indirect | Cumulative | Determination
--- | --- | --- | --- | ---
Black-backed woodpecker (Picoides arcticus) | A: None. B, C, D: Low potential for individual mortality. | A: Existing habitat would remain and potential for development of additional habitat would remain high. B, C, D: Potential for development of additional habitat would decrease and current habitat would be reduced. Prescribed burns expected to positively | A: Would add to high potential for development of preferred habitat (burned/infested forest). B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities (decreased fire hazard and beetle risk). Continued availability of |
<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown creeper (Certhia americana)</td>
<td>A: None.</td>
<td>A: Existing habitat would remain. Potential for loss of habitat due to fire or insect infestation would remain high.</td>
<td>A: Would add to increased potential for loss of preferred habitat as a result of fire or insect infestation.</td>
</tr>
<tr>
<td>Golden-crowned kinglet (Regulus satrapa)</td>
<td>A: None.</td>
<td>A: Existing preferred habitat would remain. Potential for loss of habitat due to fire or insects would remain high.</td>
<td>A: Would add to increased potential for loss of preferred habitat as a result of fire or insects.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Very low potential for individual mortality.</td>
<td>B, C, D: No effect on existing preferred habitat. Decreased potential for loss of preferred habitat due to fire or insects.</td>
<td>B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities (decreased fire hazard and beetle risk).</td>
</tr>
<tr>
<td>Ruffed grouse (Bonasa umbellus)</td>
<td>A: None.</td>
<td>A: Preferred habitat expected to continue to decline with pine encroachment.</td>
<td>A: Would add to decline in preferred habitat.</td>
</tr>
<tr>
<td>Song sparrow (Melospiza melodia)</td>
<td>A: None.</td>
<td>A: Preferred riparian habitat expected to continue to decline.</td>
<td>A: Would add to decline in preferred riparian habitat.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Expected to maintain or enhance preferred habitat and reduce risk of loss to fire.</td>
<td>B, C, D: Would not add to decline in preferred habitat.</td>
</tr>
<tr>
<td>Beaver (Castor canadensis)</td>
<td>A: None.</td>
<td>A: Areas of disturbed soil would continue to negatively affect potential aquatic habitat. Preferred aspen habitat expected to continue to decline with conifer encroachment and fire hazard.</td>
<td>A: Would add to decreases in preferred aquatic, riparian and aspen habitat.</td>
</tr>
<tr>
<td>White-tailed deer (Odocoileus virginianus)</td>
<td>A: None.</td>
<td>A: Preferred habitats would continue to decline in the absence of disturbance.</td>
<td>A: Would add to decreases in preferred early-seral habitat.</td>
</tr>
<tr>
<td>Mountain sucker</td>
<td>A: None.</td>
<td>A: Existing sources of pollution, sedimentation and fish barriers would</td>
<td>A: Water quality would continue to be incrementally negatively impacted by</td>
</tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>
Species of Local Concern (SOLC) are plant, fish and wildlife species (including subspecies or varieties) that do not meet the criteria for sensitive status. These could include species with declining trends in only a portion of Forest Service Region 2, or those that are important components of diversity in a local area. The local area is defined as NFS lands within the Black Hills National Forest (FSM 2620.5 Black Hills Supplement 2600-2005-1).

For the Steamboat project area, risk analyses were completed only for those species that occur in the project area or whose habitat occurs in the project area. Table 3-31 below summarizes effects on these species. Full analyses are found in the Steamboat Project Wildlife and Fisheries Resource Report (Goldberg 2011), which is available upon request.

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Catostomus platyrhynchus)</td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Would maintain or enhance habitat through watershed improvement projects and conservation of mesic habitats.</td>
<td>existing sources of pollution and sedimentation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B, C, D: Watershed improvement projects and road repair would be expected to decrease negative effects of damaged and unauthorized roads.</td>
</tr>
</tbody>
</table>

Table 3-31. Summary of Effects by Alternative on Wildlife Species of Local Concern

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>American dipper (Cinclus mexicanus)</td>
<td>A: None.</td>
<td>A: Existing sources of pollution, sedimentation would continue to contribute to habitat degradation.</td>
<td>A: Water quality would continue to be incrementally negatively impacted by existing sources of pollution and sedimentation.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Would maintain or enhance habitat through watershed improvement projects and conservation of mesic habitats.</td>
<td>B, C, D: Watershed improvement projects and road repair would be expected to decrease negative effects of damaged and unauthorized roads.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black-and-white warbler (Mniotilta varia)</td>
<td>A: None.</td>
<td>A: Potential habitat may decrease over time as pine encroachment continues.</td>
<td>A: Would add to decreases of potential habitat with continued pine encroachment.</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Proposed removal of conifer from aspen stands would be expected to enhance potential habitat, as would prescribed burning.</td>
<td>B, C, D: Would not be expected to add to negative effects on hardwood habitats.</td>
</tr>
<tr>
<td>Broad-winged hawk (Buteo platypterus) and Cooper's hawk (Accipiter cooperi)</td>
<td>A: None.</td>
<td>A: Potential nesting habitat would likely increase and foraging habitat would decrease in the absence of disturbance.</td>
<td>A: Would add to increased potential for loss of preferred habitat as a result of fire or insect infestation.</td>
</tr>
<tr>
<td>Species</td>
<td>Direct</td>
<td>Indirect</td>
<td>Cumulative</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Sharp-shinned hawk</strong></td>
<td>Individual mortality and loss of unknown nests.</td>
<td><strong>A</strong>: None.</td>
<td><strong>A</strong>: Would add to increased potential for loss of preferred habitat as a result of fire or insect infestation.</td>
</tr>
<tr>
<td><strong>Northern saw-whet owl</strong></td>
<td>A: None.</td>
<td><strong>B, C, D</strong>: Low potential for individual mortality and loss of unknown nests.</td>
<td><strong>B, C, D</strong>: Would add to effects of recent, ongoing, and foreseeable management activities (overall decrease in preferred habitat).</td>
</tr>
<tr>
<td><strong>Pygmy nuthatch</strong></td>
<td>A: None.</td>
<td><strong>B</strong>: Potential habitat would remain stable or increase in the absence of disturbance.</td>
<td><strong>A</strong>: Would add to increased potential for loss of preferred habitat as a result of fire or insect infestation.</td>
</tr>
<tr>
<td><strong>Long-eared myotis</strong></td>
<td>A: None.</td>
<td><strong>B, C, D</strong>: No effects on potential hibernacula (mines or caves). Low potential for individual mortality.</td>
<td><strong>B</strong>: Would add to effects of recent, ongoing, and foreseeable management activities (decreases in preferred meadow habitat).</td>
</tr>
<tr>
<td><strong>Meadow jumping mouse</strong></td>
<td>A: None.</td>
<td><strong>B</strong>: Potential habitat may decrease over time in the absence of disturbance.</td>
<td><strong>A</strong>: Would add to increases of potential habitat.</td>
</tr>
<tr>
<td><strong>Northern flying squirrel</strong></td>
<td>A: None.</td>
<td><strong>B, C, D</strong>: Proposed removal of small pine from meadows would be expected to enhance potential habitat.</td>
<td><strong>B, C, D</strong>: Would not add to effects of recent, ongoing, and foreseeable management activities (decreases in preferred meadow habitat).</td>
</tr>
</tbody>
</table>

**Species**

- Sharp-shinned hawk (*Accipiter striatus*)
- Northern saw-whet owl (*Aegolius acadicus*)
- Pygmy nuthatch (*Sitta pygmaea*)
- Long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), northern myotis (*Myotis septentrionalis*), small-footed myotis (*Myotis ciliolabrum*)
- Meadow jumping mouse (*Zapus hudsonius campestris*)
- Northern flying squirrel (*Glaucomys*)
Species that are important local game animals but are not MIS, SOLC or sensitive species are classified as demand species. These are species that are of particular interest to the public because they are hunted or fished. In addition, the Steamboat project area is entirely within MA 5.4 - Big Game Winter Range. This analysis includes one demand species, Rocky Mountain elk, and is summarized below. Full analysis can be found in the Steamboat Project Wildlife and Fisheries Resource Report (Goldberg 2011), which is available upon request.

### Demand Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
</table>

### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callused vertigo (Vertigo arthuri), frigid ambersnail (Catinella gelida), mystery vertigo (Vertigo paradoxa), striate disc (Discus shimekii)</td>
<td>A: None.  B, C, D: Known colonies excluded from proposed activities. Potential for mortality if unknown colonies exist.</td>
<td>A: Potential for loss of habitat due to fire would remain high.  B, C, D: Potential for damage to habitat at any unknown colonies. Reduction of fire hazard may protect habitat.</td>
<td>A: Would not add to negative effects of habitat disturbance but would add to increased potential for loss of preferred habitat as a result of fire.  B, C, D: Would not add to effects on known colonies. May reduce chance of habitat loss due to fire. May add to effects on unknown colonies.</td>
</tr>
</tbody>
</table>

### Table 3-32. Summary of Effects by Alternative on Demand Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
</table>
Migratory Birds and Birds of Conservation Concern

Many species of migratory birds are of international concern because of naturally small ranges, loss of habitat, population declines, and other factors. Species of concern applicable to project level conservation are identified by many sources including the Endangered Species Act, the Region 2 sensitive species list, the Forest MIS list, the USFWS’ Birds of Conservation Concern (BCC) 2008 publication (USFWS 2008), and the Wyoming Partners in Flight (PIF) Plan (Nicholoff 2003)(note: South Dakota does not yet have a PIF plan). All of these sources and their respective species of concern, except the BCC and Wyoming PIF, have been examined in the Steamboat Project Wildlife and Fisheries Resource Report (Goldberg 2011) or the Steamboat Project Wildlife and Fisheries Biological Evaluation (Goldberg 2011), both of which are available upon request. Effects on species not addressed elsewhere are summarized below in Table 3-33 and addressed in detail in the Steamboat Project Wildlife and Fisheries Resource Report (Goldberg 2011).

Table 3-33. Summary of Effects by Alternative on Migratory Birds and Birds of Conservation Concern

<table>
<thead>
<tr>
<th>Species</th>
<th>Direct</th>
<th>Indirect</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red-headed woodpecker (Melanerpes erythrocephalus)</td>
<td>A: None.</td>
<td>A: Existing habitat would remain and potential for development of additional habitat would remain high.</td>
<td>A: Would add to increased potential for development of preferred habitat (burned forest, insect outbreaks).</td>
</tr>
<tr>
<td></td>
<td>B, C, D: Low potential for individual mortality.</td>
<td>B, C, D: Existing habitat would remain; potential for development of additional habitat would increase. Prescribed burns expected to positively affect habitat. Incidental loss of snags.</td>
<td>B, C, D: Would add to effects of recent, ongoing, and foreseeable management activities (decreased fire hazard and beetle risk). Continued availability of burned forest in the project area and across the national forest.</td>
</tr>
<tr>
<td>Black-billed cuckoo (Coccyzus erythropthalmus)</td>
<td>A: None.</td>
<td>A: Habitat may decrease over time with conversion of hardwood areas to pine.</td>
<td>A: None.</td>
</tr>
</tbody>
</table>
3.5 Botany

3.5.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for botanical resources. It summarizes the Steamboat Project Botany Specialist Report and the Steamboat Project Botany Biological Evaluation (Larson 2011a, 2011b), which are located in the Steamboat project file.

3.5.2 Existing Conditions

Affected Environment

The Steamboat project area is dominated by ponderosa pine forest. Conifer-deciduous communities of ponderosa pine and aspen or birch are scattered throughout the project area, particularly along north-facing slopes and other relatively mesic microhabitats. The project area does not encompass extensive areas of sensitive plant habitat compared to areas that contain more white spruce-dominated forest habitat or more developed mixed hardwood communities. However, several major drainages within the project area harbor distinctive native plant communities and sensitive plant habitat, including the South and Middle forks of Boxelder Creek, Jim Creek and its tributaries, Estes Creek, and the upper reaches of Little Elk Creek.

Dry ponderosa pine stands are common throughout. White spruce communities are concentrated in the Dalton Lake area and along the upper portions of some of the major drainages. Mixed stands of paper birch and aspen with ironwood are found along drainages and lower north-facing slopes throughout the project area. Open meadows are relatively rare within the project area and are found mainly along perennial streams. Burned ponderosa pine forest (from wildfires in 2002 and 2005) is found along the eastern slopes of the project area.

Field Surveys

The Steamboat project area was surveyed specifically for target plant species (including sensitive plant species, plant species of local concern, state heritage program tracked species, and other plants of interest) and plant habitats associated with target plant species during the 2007 field season. Data is also available on sensitive plant habitat and occurrences for the project area from other surveys conducted within the project boundary for numerous small projects from 1994-2007. Although some of these surveys are obsolete, (i.e., some surveys conducted for a different suite of sensitive plant species) they still provide useful information. Information from all surveys conducted within the project area boundary along with aerial photographs, hillshade results (GIS spatial analysis tool), topographic maps, field investigation of areas of interest, and local professional knowledge of the area were used in the analysis of the project area.

Habitat Encountered During Survey/Identification of Sensitive Plant Habitat

Sensitive plant habitats in the Steamboat project area are paper birch and birch/aspen stands, spruce stands, riparian areas, and other sites where additional water is present (e.g. springs, seeps). In general,
high quality sites have little to no disturbance from logging (e.g. skid trails, landings), livestock use (e.g. trailing, trampling, areas of concentrated use), or recreation impacts, resulting in minimal weed infestations, soil compaction, and other alterations of microhabitat characteristics. Additional potential habitat in the project area includes meadows underlain with a limestone-derived soil which are thought to be potential habitat for *Botrychium campestre* and *Botrychium lineare*.

The Steamboat project area contains a relatively moderate proportion of the Forest’s habitat considered capable of supporting sensitive plant species. It is estimated that sensitive plant habitat is approximately four percent of the project area. See Figure 3-7 for identified potential plant habitat in the project area.

**Figure 3-7. Sensitive and SOLC Plant Habitat in the Steamboat Project Area**

The process used for identifying potential plant habitat in the Steamboat project area was as follows:

1. Contractors surveyed the project area and collected data on target plants and mapped plant habitats by community type.
2. The areas that the contractors identified as high potential plant habitat were further refined by a Forest Service botanist using topographic maps, aerial photos, known sensitive plant sites, and additional field reconnaissance.

3. Potential habitat was digitized, creating a GIS shapefile.

4. The botanist and District silviculturalist worked together to identify areas likely to be affected by proposed treatments in the vicinity of identified potential plant habitat. These areas were revisited by the botanist during the summer of 2010 and habitat delineations were further refined in the GIS shapefile.

Target Plant Occurrences Documented During Survey

Two R2 sensitive plant species are known to occur in the project area: *Cypripedium parviflorum* (lesser yellow lady’s slipper) and *Viburnum opulus* var. *americanaum* (highbush cranberry). *Cypripedium parviflorum* has approximately 19 populations in the project area and is found in numerous shady drainages in the northern half of the project area and along lower South Stagebarn and Stagebarn Canyons. *Viburnum opulus* var. *americanaum* is known from one occurrence located at a spring. Habitat exists for six other R2 sensitive plant species that were not found during surveys. All R2 sensitive species with potential habitat within the project boundary will be addressed in the effects analysis.

No plant species of local concern (SOLC) were found during the 2007 survey, and no populations of these species are known to exist in the project area.

A total of 43 target plant occurrences were found during the 2007 survey. *Cypripedium parviflorum* was the most frequently found target plant with 19 occurrences (some occurrences were recorded separately but are close enough together to consider them as part of the same population). Populations of *Polygonatum biflorum* and *Carex granularis* were also found relatively frequently for the survey area, with ten and four populations located, respectively. *Botrychium* species were relatively infrequent compared to other survey areas on the District, with one *B. minganense* site found in the western part of the project area (three *B. virginianum* occurrences were also found, but this taxon should soon be transferred to a separate genus.) In general, the number of target plants documented was relatively low for the northern Black Hills, an area usually rich in rare plant occurrences and habitat. Occurrences of other target plants were documented in prior surveys.

3.5.3 Environmental Consequences

Rare Plants Considered During Analysis

Based on the most updated available information and professional judgment, species not known to occur within the project area and with habitat preferences differing from habitat types present are not analyzed in the effects analysis portion of this document, since no impacts would occur. Table 3-34 summarizes SOLC and sensitive species known to occur in the project area and those having potential habitat in the project area. All of these species were considered during analysis of the Steamboat Project alternatives.
Table 3-34. Black Hills National Forest Plant Species of Local Concern (SOLC) and Region 2 Sensitive Species Included in Steamboat Analysis

<table>
<thead>
<tr>
<th>Scientific Name/Common Name</th>
<th>Status</th>
<th>Known to Occur in Project Area?</th>
<th>Suitable Habitat in Project Area?</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Botrychium multifidum</em></td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>leathery grapefern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gentiana affinis</em></td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>pleated gentian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Listera convallarioides</em></td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>broadlipped twayblade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lycopodium annotinum</em></td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>stiff clubmoss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Petasites frigidus</em> var.</td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><em>sagittatus</em> arrowleaf</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sweet coltsfoot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Polystichum lonchitis</em></td>
<td>SOLC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>northern hollyfern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Salix lasiandra</em> var.</td>
<td>Sensitive</td>
<td>No</td>
<td>Unknown because potential habitat is not yet defined.</td>
</tr>
<tr>
<td><em>caudata</em> greenleaf willow,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tail-leaf willow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Botrychium campestre</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Unknown because potential habitat is not yet defined.</td>
</tr>
<tr>
<td>prairie moonwort, Iowa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>moonwort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Botrychium lineare</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Unknown because potential habitat is not yet defined.</td>
</tr>
<tr>
<td>narrowleaf grapefern,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>slender moonwort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Carex alopecoidea</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>foxtail sedge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cypripedium parviflorum</em></td>
<td>Sensitive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>yellow lady's slipper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lycopodium complanatum</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>trailing clubmoss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Platanthera orbiculata</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>large round-leaf orchid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sanguinaria canadensis</em></td>
<td>Sensitive</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>bloodroot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Viburnum opulus</em> var.</td>
<td>Sensitive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><em>americanum</em> highbush</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cranberry</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There are no known SOLC plant occurrences in the project area. Habitat may be present in the project area for seven SOLC plants. The primary habitat for SOLC plants with possible habitat in the project area can be categorized as moist forested communities or riparian communities (Table 3-35). Any potentially suitable habitat that may exist overlaps with suitable habitat for R2 sensitive plant species (moist forested and riparian areas). Two R2 sensitive species are known to occur in the project area with another six having suitable habitat present. The primary habitat for these sensitive species is generally similar to that described for SOLC and is also displayed in Table 3-35.
The table below places the plant SOLC and sensitive species known to occur or have suitable habitat in the project area into general habitat categories. These habitat categories form the basis of the effects analysis below.

### Table 3-35. SOLC and R2 Sensitive Species Habitat Categories

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status</th>
<th>Habitat Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium multifidum</td>
<td>leathery grapefern</td>
<td>SOLC</td>
<td>moist forest/riparian meadow</td>
</tr>
<tr>
<td>Gentiana affinis</td>
<td>pleated gentian</td>
<td>SOLC</td>
<td>riparian meadow</td>
</tr>
<tr>
<td>Listera convallarioides</td>
<td>broadlipped twayblade</td>
<td>SOLC</td>
<td>moist forest</td>
</tr>
<tr>
<td>Lycopodium annotinum</td>
<td>stiff clubmoss</td>
<td>SOLC</td>
<td>moist forest</td>
</tr>
<tr>
<td>Petasites frigidus var. sagittatus</td>
<td>arrowleaf sweet coltsfoot</td>
<td>SOLC</td>
<td>riparian meadow</td>
</tr>
<tr>
<td>Polystichum lonchitis</td>
<td>northern hollyfern</td>
<td>SOLC</td>
<td>moist forest</td>
</tr>
<tr>
<td>Salix lasiandra var. caudata</td>
<td>shining willow</td>
<td>SOLC</td>
<td>riparian meadow</td>
</tr>
<tr>
<td>Botrychium campestre</td>
<td>prairie moonwort, Iowa moonwort</td>
<td>Sensitive</td>
<td>Unknown</td>
</tr>
<tr>
<td>Botrychium lineare</td>
<td>narrowleaf grapefern, slender moonwort</td>
<td>Sensitive</td>
<td>Unknown</td>
</tr>
<tr>
<td>Carex alopecoidea</td>
<td>foxtail sedge</td>
<td>Sensitive</td>
<td>riparian meadow</td>
</tr>
<tr>
<td>Cypripedium parviflorum</td>
<td>yellow lady's slipper</td>
<td>Sensitive</td>
<td>moist forest/riparian meadow</td>
</tr>
<tr>
<td>Lycopodium complanatum</td>
<td>trailing clubmoss</td>
<td>Sensitive</td>
<td>moist forest</td>
</tr>
<tr>
<td>Platanthera orbiculata</td>
<td>large round-leaved orchid</td>
<td>Sensitive</td>
<td>moist forest</td>
</tr>
<tr>
<td>Sanguinaria canadensis</td>
<td>bloodroot</td>
<td>Sensitive</td>
<td>moist forest</td>
</tr>
<tr>
<td>Viburnum opulus var. americanum</td>
<td>highbush cranberry</td>
<td>Sensitive</td>
<td>moist forest/riparian meadow</td>
</tr>
</tbody>
</table>

### Other plant species of conservation value

There are several uncommon plants in the Steamboat project area that do not appear on the R2 sensitive plant species list or the SOLC list, but still merit consideration. Plants tracked by the South Dakota Natural Heritage Database are of particular conservation concern. These plants and their conservation status are listed in Table 3-36.

### Table 3-36. Other plant species of conservation interest known to occur in Steamboat Project Area

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>SD Rank*</th>
<th>Known Occurrences in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium minganense</td>
<td>NRUR</td>
<td>1</td>
</tr>
<tr>
<td>Botrychium virginianum</td>
<td>NRUR</td>
<td>3</td>
</tr>
<tr>
<td>Carex capillaris</td>
<td>S3</td>
<td>3</td>
</tr>
<tr>
<td>Carex granularis</td>
<td>NRUR</td>
<td>4</td>
</tr>
<tr>
<td>Carex leptalea</td>
<td>S3</td>
<td>10**</td>
</tr>
<tr>
<td>Circaea lutetiana var. canadensis</td>
<td>NRUR</td>
<td>1</td>
</tr>
<tr>
<td>Cypripedium parviflorum (R2 Sensitive Plant)</td>
<td>S3?</td>
<td>19</td>
</tr>
<tr>
<td>Equisetum scirpoides</td>
<td>S2</td>
<td>11</td>
</tr>
</tbody>
</table>
Most, but not all, plant occurrences listed in Table 3-38 above are located within areas subject to design criteria to minimize impacts of project activities on SOLC and sensitive plants.

**Analysis of Effects**

The following apply to the analysis below:

- Potential habitat is defined as moist forested communities and riparian communities.
- Mechanical vegetation treatments are defined as commercial treatments involving the use of heavy equipment.

**Alternative A (No Action)**

**Direct and Indirect Effects**

There would be no direct effects to known occurrences of SOLC or R2 sensitive species or suitable habitat of moist forested and riparian communities under Alternative A, since no actions would occur. Ongoing activities such as recreation, fire suppression, and road maintenance would continue.

Management activities analyzed under other environmental documents would continue to occur. The no action alternative would maintain existing potential plant habitat and protect biodiversity in the short-term (next 20 years), although over time there may be indirect effects that cause changes in potential habitat (e.g. change in species composition due to succession, lack of disturbance, or changes from disturbance such as insect outbreaks and wildfires). The absence of treatments under Alternative A could contribute to indirect negative effects for SOLC and sensitive plants and their habitats due to continued and increased risk of insect outbreaks and high severity wildfires.

**Cumulative Effects**

The cumulative effects analysis considers the potential cumulative effects of the past, present and future foreseeable actions on sensitive plant species and their habitat. The cumulative effects area for the seven SOLC plants and six sensitive species analyzed in this section is potential plant habitat within the project area, defined as moist forested and riparian communities. The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years, as described in the 2005 Phase II FEIS. This temporal scale is based on the planning horizon (usually 50 years for a Forest plan), the biology of the species (e.g. generation time, response time to changed conditions, recolonization capability) and the time needed for the overall ecosystem to respond to proposed management (USDA-Forest Service 2005c).
Past, present and reasonably foreseeable activities within the Steamboat project area include timber harvest, timber stand improvement, post-sale KV activities, timber thinning, wildfire, grazing, temporary road construction and maintenance, noxious weed control, wildlife habitat improvement projects, mining, and developed and dispersed recreational use on both the public land and private land in the area. A list documenting known past and planned future activities for this area is included in Appendix D.

Soil disturbance, introduction of invasive species, removal of natural disturbance cycles, and changes in microsite moisture and hydrologic regimes can negatively affect SOLC and sensitive plant species and their habitats. Historical management in the Black Hills has created changes in moist forested and riparian areas from livestock grazing, road building, fire suppression, recreation, mining activities, water diversion, and near-extirpation of beaver which have likely decreased suitability of many of these habitats for sensitive plant species.

The absence of treatments under Alternative A could contribute to negative cumulative effects for SOLC and sensitive plant species and their habitats. Negative cumulative effects have been created from suppression of fire over the past 100 years. In the long-term, continuing fire suppression in the absence of other vegetation treatments would likely result in increased fuel loading and increase the wildfire susceptibility of stands adjacent to SOLC and sensitive plant species or their suitable habitat. This could create more intense wildfire conditions potentially resulting in wildfire spreading into areas of SOLC and sensitive plant habitat that would likely, under less intense conditions, act as a fuel break. In some cases, increased fuel loading could potentially cause a reduction in available water to SOLC and sensitive plant species habitats.

Under Alternative A, travel management would not be altered. No new roads, reconstructed roads, or decommissioned roads are proposed. Therefore, negative cumulative effects resulting from temporary or reconstructed roads included in Alternatives B, C, and D would not occur. In addition, beneficial effects from proposed watershed improvement activities under the action alternatives would not occur.

**Determinations**

Implementation of Alternative A would result in no direct or indirect effects on sensitive plant species or their habitats in the short term (next 20 years). In the long-term, there may be risks associated with the indirect and cumulative effects noted above. Therefore, implementation of Alternative A “may adversely impact individuals, but [is] not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” for the six R2 sensitive plant species with potential habitat in the project area analyzed in this section.

**Alternatives B, C and D**

**Direct and Indirect Effects – Mechanical Vegetation Treatments**

Mechanical equipment may be used to accomplish any of the commercial treatments proposed in the action alternatives.

Effects to SOLC and sensitive plants and their habitat from mechanical vegetation treatments would be similar under all action alternatives, since the activities proposed primarily differ in the amount of acres
treated. Hence, the action alternatives vary in the extent of such effects (Table 3-37). With design criteria in place, it is anticipated that there would be minimal direct effects from mechanical vegetation treatments to potential sensitive plant habitat of moist forested and riparian communities under all action alternatives because most sites would be avoided (i.e., subject to design criterion, no mechanical treatment would occur in suitable plant habitat). Refer to the listing of design criteria in Appendix C.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total acres subject to design criteria</td>
<td>0</td>
<td>323</td>
<td>624</td>
<td>301</td>
</tr>
<tr>
<td>Acres of potential plant habitat subject to design criterion-no mechanical treatment</td>
<td>0</td>
<td>174</td>
<td>475</td>
<td>152</td>
</tr>
<tr>
<td>Acres of potential plant habitat subject to design criterion-consult with botanist, no equipment in area to be designated (i.e., mechanical treatments would take place in a portion of plant habitat)</td>
<td>0</td>
<td>149</td>
<td>149</td>
<td>149</td>
</tr>
</tbody>
</table>

Areas of potential SOLC and sensitive plant habitat, including areas occupied by R2 sensitive species *Cypripedium parviflorum*, are proposed for various treatments designed to address the purpose and need of the Steamboat Project under all action alternatives. The area of potential SOLC and sensitive plant habitat affected under all action alternatives is approximately 149 acres. Treatments include non-commercial thinning, individual tree selection, commercial thinning, product-other-than-log, understory thinning, commercial and non-commercial meadow enhancement, and commercial and non-commercial hardwood enhancement. See Appendix C for a listing of these areas by stand number.

These treatments target smaller diameter (i.e., less than nine inches DBH) ponderosa pine trees growing in mixed stands along drainages. In some areas, pine growth has contributed to high wildfire risk. Treatments would reduce the fire risk to SOLC and sensitive plants in these areas. Mechanical treatments aren’t likely to directly impact SOLC plants since they are not known to exist in the project area, but mechanical treatments could impact known populations of *Cypripedium parviflorum*, an R2 sensitive species that is present in some of the areas proposed for treatment. Effects include trampling or crushing of habitat and individual plants from machinery running through habitat and over individuals. Ground disturbance and soil compaction are possible to potential habitat in mechanical units resulting from heavy equipment entering and being used in the area.

In order to mitigate these potential effects from mechanical vegetation treatment activities occurring in potential SOLC and sensitive plant habitat, design criteria require the botanist’s involvement in project implementation. *Cypripedium parviflorum* populations are scattered where treatments are proposed, therefore, known sites would be marked clearly, given a sufficient buffer, and avoided during project activity. This would protect any currently unknown SOLC plant populations that may be co-occurring with *Cypripedium parviflorum*.

For all remaining areas of potential SOLC and sensitive plant habitat, no mechanical vegetation treatments would take place. However, the possibility still exists for a small amount of overlap with potential plant habitat and adjacent mechanical treatment units due to differences in accuracy in mapping and human error. Effects would be similar to those described above including crushing of individual SOLC or sensitive plants and surrounding shading vegetation, ground disturbance, and soil compaction. These effects, while unknown in size, have the most potential to occur in Alternative C,
where 624 acres of potential plant habitat subject to design criteria overlap with proposed vegetation treatments. Alternatives B and D have less potential for this effect to occur, with 323 and 301 acres of overlap, respectively.

Therefore, while direct impacts to unknown SOLC plant occurrences and habitat are possible from 12,336 acres of mechanical treatment in Alternative B, 17,970 acres of mechanical treatment in Alternative C, or 9,394 acres of mechanical treatment in Alternative D, the risk of direct effects resulting from mechanical treatments is expected to be low due to the following:

1. The project area has been surveyed for SOLC and R2 sensitive plant species and potential habitat.
2. Design criteria have been incorporated to reduce the risk of potential negative impacts.
3. Potential overlap, if it occurs, will most likely be a small percentage (in ecotones between plant communities) of the total estimated potential plant habitat in the project area.
4. Risk is further reduced to riparian areas and moist soils (where most sensitive plants occur) through protective measures associated with Forest Service Manual 2509.25 - Watershed Conservation Practices Handbook.

**Direct Effects – Prescribed Fire**

Prescribed burning could occur in 242 of the 931 total acres of potential SOLC and sensitive plant habitat in the project area. Activities associated with prescribed fire treatments may result in direct impacts to habitat or to individuals, such as crushing or burning of habitat and individual plants. Light ground disturbance is likely in burn units due to fire and personnel entering the area. Design criteria call for newly constructed control line to be located outside of potential SOLC and sensitive plant habitat. Existing roads are generally utilized as control lines where possible.

The areas of potential SOLC and sensitive plant habitat within the Steamboat project area are generally found in cool, moist drainages and on northerly aspects. The location of this habitat creates areas where wildland fuels are exposed to more moisture (higher relative humidity, retention of snow pack) and cooler temperatures due to shading. Because of this, potential plant habitat will not typically carry a fire even during summer months when other locations are susceptible to fire. The prescribed burning proposed in this project would be conducted in the spring (May) or fall (mid-September-January) to take advantage of moderate daytime temperatures, low night time temperatures, higher relative humidity, increased chance of precipitation, lower fuel temperatures and higher fuel moisture content. These conditions may result in less impact to SOLC and sensitive plant habitat associated with prescribed fire.
Indirect Effects – Mechanical Vegetation Treatments and Prescribed Fire

There may be beneficial indirect effects to rare plant species and potential plant habitat through implementation of prescribed fire proposed in the action alternatives. Reducing fuels directly adjacent to these species through mechanical treatments and prescribed burning may decrease the risk of intense wildfires. This would benefit the species and their habitat.

Ecotones between potential plant habitat and adjacent pine stands themselves may have a strong influence on the health of potential habitat, particularly relative to fuel loads and wildfire susceptibility. Heavy fuel loading may lead to widespread, high severity wildfires that could negatively affect moist forested communities and riparian communities which, under less intense conditions, may act as fuel breaks. Reducing fuels in the project area via mechanical treatments and prescribed burns could, in the case of a wildfire, cause crown fires to drop to the ground before burning into potential habitat. This could reduce the likelihood of stand-replacing events impacting moist forested and riparian communities.

Management that includes prescribed burning and selective thinning of adjacent conifer stands could maintain a mosaic of seral stages, increase available moisture and decrease the potential for widespread crown fires (Hornbeck et al. 2003). Resulting patches of paper birch, and other moist communities, may act as natural fuel breaks. As a forest type, paper birch stands are one of the least flammable. The canopy often has high moisture content and lush understory. Crown fires in coniferous stands often stop at the boundary of large paper birch stands or become slow-moving ground fires (Uchytil 1991).
Another potential indirect effect that is difficult to predict and quantify and could be negative or positive depending on magnitude and location is changes in soil moisture and hydrologic function of the area and changes in water and nutrient uptake by vegetation resulting from a reduction of vegetation in adjacent pine stands via silvicultural treatments and prescribed burns (USDA-Forest Service 1997). It is possible that an increase in available moisture could occur and that increase would improve or expand potential plant habitat.

Indirect effects to potential plant habitat under Alternatives B, C, and D include the possibility for degradation of habitat by invasion or spread of noxious weeds resulting from adjacent or immediate disturbances (e.g. mechanical vegetation treatments or prescribed burning). Standards and guidelines present in the Forest Plan, and applicable to this project, and the Noxious Weed Management Plan will help reduce indirect effects on SOLC and sensitive plant occurrences and potential habitat due to the spread of weeds. Noxious weeds may out-compete desired plant species, and spray from herbicides used to help control weeds can also have negative effects on sensitive and SOLC plants.

There is also the risk that prescribed fire may behave differently than anticipated or result in patchy areas of higher severity burning. The possibility of escape of a prescribed burn, while greatly minimized by the precautions taken, could negatively impact potential plant habitat in a manner similar to wildfire. Small patches of higher severity burning may also occur, and could have adverse impacts to potential plant habitat, including removal of shading overstory, disruption of soil micro-organisms, invasion of noxious weeds or non-native plant species, and destruction of the seed bank due to consumption or high soil temperatures.

Finally, any vegetation treatments that remove or reduce shading from the overstory could negatively impact SOLC and sensitive plant habitat by creating warmer, drier, more exposed conditions for plants on the forest floor. Some plant SOLC, such as *Listera convallarioides*, *Lycopodium annotinum*, and *Polysticium lonchitis* are found on shaded or partially shaded sites.

**Direct and Indirect Effects – Meadow Enhancement and Hardwood Enhancement Treatments**

The objective of these proposed treatments is to maintain aspen, paper birch, bur oak, and meadow communities by reducing competition from ponderosa pine. Commercial hardwood enhancement treatments would involve the removal of pine trees greater than nine inches in diameter. The commercial treatments would use heavy machinery for the removal of these larger trees. With the non-commercial hardwood and meadow enhancements (both non-mechanized treatments), smaller trees would be removed from aspen and meadow areas.

Direct effects to SOLC and sensitive plants and potential habitat are likely to be minimal where the “no mechanical treatment” design criterion applies. However, the possibility still exists for a small amount of overlap with potential habitat and adjacent mechanical treatment. Possible effects include trampling of individual plants, ground disturbance and soil compaction resulting from use of heavy equipment.

Similar effects could result to unknown occurrences of SOLC or sensitive plants and their habitat under all action alternatives where treatment of ponderosa pine would occur in potential habitat, as described above.
Indirect effects to SOLC and sensitive plant occurrences and potential plant habitat under Alternatives B, C, and D include the possibility for degradation of habitat by invasion or spread of noxious weeds resulting from adjacent or immediate disturbances. It is anticipated that more disturbance will result from commercial hardwood enhancements than with non-commercial (hand) treatments of meadow and hardwood enhancements. Standards and guidelines present in the Forest Plan, and applicable to this project, and the Noxious Weed Management Plan will help reduce indirect effects on sensitive and SOLC plant occurrences and potential habitat due to the spread of weeds. Noxious weeds may out-compete desired plant species, and spray from herbicides used to help control weeds can also have negative effects on sensitive and SOLC plants.

**Direct and Indirect Effects – Transportation System Changes**

The transportation system included as part of the action alternatives includes segments of new, converted, temporary and reconstructed roads that cross potential sensitive plant habitat (Table 3-39). New road construction (totaling approximately 2.77 miles) would pass through potential plant habitat under Alternative C only.

There are possible negative impacts from road related activity to potential plant habitat primarily from disturbance of native vegetation and potential for spread of noxious weeds. Standards and guidelines present in the Forest Plan and the Noxious Weed Management Plan will help reduce indirect effects on sensitive plant occurrences and potential habitat due to the spread of weeds. Design criteria to limit the spread of noxious weeds are included in all action alternatives.

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<thead>
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<tbody>
<tr>
<td>Convert (non-system to system) (miles)</td>
<td>0</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Reconstruction (miles)</td>
<td>0</td>
<td>17.0</td>
<td>19.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Temporary (estimated miles)</td>
<td>0</td>
<td>0.50</td>
<td>0.82</td>
<td>0.35</td>
</tr>
<tr>
<td>New construction (miles)</td>
<td>0</td>
<td>0</td>
<td>2.77</td>
<td>0</td>
</tr>
</tbody>
</table>

Road construction or maintenance in or adjacent to potential habitat may result in direct effects to individual SOLC or sensitive plants and potential plant habitat under Alternatives B, C, or D. There is the potential for heavy equipment to crush or kill individual SOLC or sensitive plants, which are currently not known to exist, or to degrade or destroy habitat. These effects are reduced for road reconstruction, since any potential plant habitat is likely already degraded or destroyed due to past road construction and maintenance activities.

Road construction or maintenance in or adjacent to potential habitat may result in indirect effects to any unknown SOLC and sensitive plant occurrences and potential plant habitat under Alternatives B, C, and D. There is the potential for degradation of habitat by invasion or spread of noxious weeds resulting from road building disturbances. Roads act as corridors for the dispersal of invasive weeds and weeds are one of the greatest risks to SOLC and sensitive plant species, particularly for those found in riparian areas and wetlands due to the concentration of a variety of management activities and uses that occur in these habitats (USDA-Forest Service 1999).
Standards and guidelines present in the Forest Plan and the Noxious Weed Management Plan will help reduce indirect effects on sensitive and SOLC plant occurrences and potential habitat due to the spread of weeds. Noxious weeds have the potential to out-compete desired plant species, and spray from herbicides used to help control weeds can also have negative effects on sensitive and SOLC plants.

**Cumulative Effects**

The cumulative effects area for the seven SOLC and six R2 sensitive plan species analyzed in this section is potential habitat within the project area, which is defined as moist forested and riparian communities. The cumulative effects analysis for species persistence is bounded in time as the next 50 years, as described in the Phase II Amendment FEIS. This temporal scale is based on the planning horizon (usually 50 years for a Forest plan), the biology of the species, and the time needed for the overall ecosystem to respond to proposed management (USDA-Forest Service 2005c). Past actions considered in this analysis are described in Appendix D.

Soil disturbance, introduction of invasive species, increased fuel loading, and changes in micro site moisture and hydrologic regimes can negatively affect potential plant habitat. Historical management in the Black Hills has created changes in suitable plant habitat from livestock grazing, road building, recreation, fire suppression, mining activities, water diversion, and near-extirpation of beaver, all of which have decreased suitability of many areas as habitat for sensitive and SOLC plant species.

Furthermore, private lands in the project area have historic and ongoing uses that decrease the capability of these lands to support SOLC and sensitive plant species. Private lands in the project area frequently include streams and riparian areas important to SOLC and sensitive plant species. These activities include residential development, grazing, timber harvest, water development or diversion, and other activities. These activities add incrementally to effects such as habitat loss, soil erosion and compaction, noxious weed introduction and spread, and removal or degradation of native riparian vegetation.

Implementation of Alternative B, C, or D could contribute to the spread of invasive species and noxious weeds resulting from soil disturbing activities in the proximity of SOLC or sensitive plants. These activities include mechanical treatments associated with logging, fuel reduction, commercial hardwood enhancements, prescribed burning, and road building and reconstruction. Invasive species, especially noxious weeds, have the ability to out-compete desired plants, and spray from herbicides, used to help control weeds, can also have negative effects on sensitive and SOLC plants and their habitats. Adherence to standards and guidelines present in the Forest Plan and the Noxious Weed Management Plan would likely reduce cumulative effects of weed spread and new establishment.

Transportation system changes proposed in the project area may also add to present adverse impacts from motorized vehicle use. Routes currently in use under the Black Hills National Forest Travel Management Plan traverse SOLC and sensitive plant habitat in the project area. Effects include vehicle tracks and associated removal of vegetation (USDA-Forest Service 2009).

Treatments focused on the reduction of unnaturally heavy fuel loads due to the suppression of fire over the past 100 years have the potential to contribute beneficial effects to potential plant habitat. Management that includes prescribed burning and selective thinning of adjacent conifer stands could maintain a mosaic of seral stages, increase available moisture, and decrease the potential for
widespread crown fires. Resulting patches of paper birch would provide firebreaks due to the low flammability of the birch type. Birch firebreaks can greatly alter the spread of fire across the landscape, causing crown fires to drop to the ground or even stop. In addition to slowing the spread of crown fires, landscape patchiness resulting from small-scale disturbances would provide a strategy whereby both fire-adapted sensitive and SOLC species are more likely to be maintained (USDA-Forest Service 2005c).

**Determinations**

A determination of “may adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing” is made for *Carex alopecoidea* (foxtail sedge), *Cypripedium parviflorum* (yellow lady’s slipper), *Lycopodium complanatum* (trailing clubmoss), *Platanthera orbiculata* (large round-leaved orchid), *Sanguinaria canadensis* (bloodroot), and *Viburnum opulus var. americanum* (highbush cranberry) for implementation of Alternatives B, C, or D based on the following:

1. The Steamboat project area was surveyed specifically for sensitive plant species and potential sensitive plant habitats.
2. Design criteria are in place for potential habitat under all action alternatives.
3. Existing occurrences are not knowingly planned to be impacted by this project. Furthermore, the two species with known occurrences in the project area, *Cypripedium parviflorum* and *Viburnum opulus var. americanum*, are considered to be relatively secure in the Black Hills at this time based on the large number of occurrences that are widely distributed across the Forest (USDA-Forest Service 2005c).
4. Viability determinations were made at the Forest level in the Phase II FEIS assuming that conservation measures (objectives and protective standards and guidelines) are applied and implemented as written. Standards and guidelines are being followed for all action alternatives in the Steamboat project area.

**Risks and Determination for Botrychium campestre and Botrychium lineare**

**Risks**

There is much uncertainty regarding risks to *Botrychium campestre* and *Botrychium lineare*. Disturbances and land management activities may create and maintain potential habitat or may negatively impact existing populations depending on the disturbance intensity and frequency (USDA-Forest Service 2005c).

**Determinations**

Because limited information is available for both *Botrychium* species in the Black Hills and in the Rocky Mountain Region, it is difficult to assess whether the activities associated with the Steamboat Project would have no effect, a potential adverse effect, or a potential beneficial effect on *B. campestre* and *B. lineare*. Based on the information that is available, a determination of “may adversely impact individuals, but not likely to result in a loss of viability on the Planning Area, nor cause a trend toward federal listing” is made for *Botrychium campestre* and *Botrychium lineare* for Alternatives A, B, C and D based on the following rationale:

1. The known occurrences of *Botrychium campestre* and *Botrychium lineare* are not located within the Steamboat project area and would not be disturbed by the
activities associated with this project. While the full extent of the distribution of *Botrychium campestre* and *Botrychium lineare* in the Black Hills is currently unknown, the appearance of above-ground sporophytes at the known sites is indicative of viable populations with extensive supporting underground biomass (including mycorrhizae) (Farrar 2004). Therefore, while loss of individuals may occur in any currently unknown sites, if any exist, in the Steamboat project area, the viable populations at the known occurrence sites outside the project area would not be affected by this project.

2. Typically, moonworts are long-lived (i.e., 10 to 15 years) colonizing plants that may require disturbed sites to become established (USDA-Forest Service 2005c). This is consistent with several of the *Botrychium campestre* and *Botrychium lineare* occurrence conditions from the Black Hills where low levels of ongoing disturbance occurs (USDA-Forest Service 2005c, Farrar et al. 2006). If there is an unknown site occurrence in the Steamboat project area, it is possible that it could expand, if present, or site conditions could be altered as a result of some level of disturbance from the vegetation treatments and prescribed burning in Alternatives B, C, and D (i.e., creating earlier successional conditions including tree/shrub shade reduction, disturbed site conditions, opening up of the canopy, and changes in plant competition patterns) that would be favorable for colonization by *Botrychium* spp. spores, as long as associated mycorrhizae and other microsite conditions are present. Conversely, activities that take place when the ground is not frozen could result in below-ground disturbance that may impact some unknown individuals (USDA-Forest Service 2005c).

3. Despite the fact that aboveground stems may be negatively affected (if even present), beneficial short and long-term effects may be realized by the prescribed burning in Alternatives B, C, and D. Prescribed fire may provide the disturbance needed for site colonization and persistence (i.e., maintaining open sunny conditions). When an occurrence has aboveground growth, a fast moving fire may not negatively impact it. The fire may remove aboveground stem portions, but would not be expected to affect belowground individuals or parts. Prescribed fires would most likely occur between mid September through January for fall burns, and May for spring burns (less likely to occur than fall burns) when it is cooler and more moisture is present. Although unknown, an intense fire (from wildfires or a high intensity prescribed burn) that may have high severity effects, such as deep soil heating could potentially negatively affect both the belowground and aboveground portions of *Botrychium* individuals (USDA-Forest Service 2005c). If unknown occurrences exist in the project area, creation or maintenance of low crown-fire hazard conditions would reduce the likelihood of occurrence loss associated with a high intensity fire.

4. There is no data suggesting a direct impact of weeds to *Botrychium* species, but their mutual affinity for disturbance may cause *Botrychium* species and their habitats to be vulnerable to negative impacts from weeds. Weeds are often an indirect effect that can be expected from any type of ground disturbance and could result from implementing this project. Although uncertainty exists, weed competition as well as herbicide application are considered to be potential risks to *Botrychium* species (USDA-Forest Service 2005c).
Complete distribution, abundance, microhabitat needs, and disturbance regimes optimal for persistence of \textit{B. campestre} and \textit{B. lineare} are unknown. This lack of information makes it difficult to predict what the cumulative effects to these species would be. Past, present, and foreseeable future actions (as well as natural disturbances) likely have and could be expected to continue to have both beneficial or negative effects on some of these individuals or entire occurrences; at the same time they could contribute to site conditions suitable for colonization by \textit{Botrychium campestre} or \textit{Botrychium lineare}, or helping to conserve or maintain existing habitat (USDA-Forest Service 2005c).

### 3.6 Noxious Weeds

#### 3.6.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for noxious weeds. It summarizes the Steamboat Project Range and Weeds Report (Jons 2011), which is located in the Steamboat project file.

#### 3.6.2 Existing Conditions

The most recent monitoring report prepared for the Black Hills National Forest suggested that about 180,000 acres of National Forest System land within the boundaries of the Black Hills National Forest are infested by noxious weeds (USDA-Forest Service 2010). Weed inventories conducted in the Steamboat project area indicate approximately 4,877 acres within the project area that contain noxious weed infestations. Some areas contain multiple noxious weed species. Species identified in the inventory include the following:

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Acres in the Steamboat Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada thistle</td>
<td>\textit{Cirsium arvense}</td>
<td>4,509</td>
</tr>
<tr>
<td>Common mullein</td>
<td>\textit{Verbascum thapsus}</td>
<td>91</td>
</tr>
<tr>
<td>Common tansy</td>
<td>\textit{Tanacetum vulgare}</td>
<td>15</td>
</tr>
<tr>
<td>Houndstongue</td>
<td>\textit{Cynoglossum officinale}</td>
<td>186</td>
</tr>
<tr>
<td>Musk thistle</td>
<td>\textit{Carduus nutans}</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Oxeye daisy*</td>
<td>\textit{Chrysanthemium leucanthemum}</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Spotted knapweed</td>
<td>\textit{Centaurea maculosa}</td>
<td>&lt;1</td>
</tr>
<tr>
<td>St. Johnswort</td>
<td>\textit{Hypericum perforatum}</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Yellow toadflax</td>
<td>\textit{Linaria vulgaris}</td>
<td>74</td>
</tr>
</tbody>
</table>

*These species are not currently listed as either a Local or State Noxious Weeds by the State of South Dakota.

#### 3.6.3 Environmental Consequences

Ground disturbing activities within or adjacent to areas infested by noxious weeds can encourage the establishment and spread of noxious weeds. Many noxious weeds out compete native and other desirable species because: a) they are early successional species, b) they can be allelopathic, c) they
produce abundant seeds, d) they grow rapidly, or e) they have the ability to exploit the soil profile for nutrients and water. Many noxious weed species have no natural enemies and are not palatable to grazing animals (Sheley and Petroff 1999). Left untreated, weeds can continue to spread, resulting in establishment of new weed populations in adjacent areas.

Historically, disturbed areas such as roads, skid trails, landings and burn piles have been the areas most susceptible to infestation. A review of timber sales indicates that we can expect three percent of the total treated acres in a timber sale to be infested by noxious weeds. For each road, an area including the width of the road and approximately five feet on either side of its running surface is capable of supporting noxious weeds until revegetation occurs. Of the total miles of road constructed, it is estimated that approximately 12 percent will actually become infested with weeds.

The design criteria listed in Appendix C would allow effective management of noxious weeds throughout project implementation. These criteria would meet amended Forest Plan objectives 230 and 231 as they relate to eradication, control and prevention of noxious weeds. The effects analysis presented below assumes that relevant weed prevention practices will be implemented.

**Alternative A (No Action)**

**Direct and Indirect Effects**
Mature stands of timber are common in the project area; they comprise large contiguous areas of forest that are similar in structure. This creates the potential for wildfire and beetle infestation, both of which could play a role in the spread of noxious weeds. An increase in dead and down trees resulting from beetle kill could increase the potential for wildfires to spread and burn with increased intensity. This would lead to large areas of bare ground on which weeds could become established and compete with more desirable species. As trees mature and canopy cover and needle cast increases, existing grass/forb communities may decrease in health and vigor as light needed for photosynthesis is reduced. This hampers the ability of these communities to recover from intense fires. When the canopy cover is opened up due to wildfire or beetle kill, grass/forb communities may not be able to out compete noxious weeds in areas where infestations already exist. As a result, these infestations are likely to increase.

**Cumulative Effects**
No disturbance creating activities would occur as a result of the Steamboat Project under Alternative A, so there would be no accumulation of effects with past, present or reasonably foreseeable future actions.

Under Alternative A, the inventory and treatment of noxious weeds would continue. Roads and trails would continue to be avenues for spread of noxious weeds. Off-road use of recreation vehicles would continue to promote the spread of noxious weeds by providing a means of transport. Seeds can collect in wheel-wells and grills of off-highway vehicles and may be dispersed as machines travel. In areas where bare soil is exposed, opportunities exist for the establishment of new infestations.
Alternative B (Proposed Action)

Direct and Indirect Effects
Alternative B includes approximately 12,336 acres of commercial and non-commercial vegetation treatment. It also calls for 10,608 acres of prescribed fire with an additional 84 acres of fuels treatments. In addition, this alternative proposes the construction, reconstruction and maintenance of approximately 100 miles of NFS roads.

Noxious weed infestations are expected to increase under this alternative. Commercial and non-commercial timber harvest activities often provide mechanisms for the introduction, establishment, and spread of noxious weeds. Anywhere soil disturbance occurs, the potential for the establishment of noxious weeds exists. The potential for noxious weed establishment is even greater in disturbed areas adjacent to existing weed populations. The movement of equipment in and out of these areas also facilitates weed establishment. Roads create a network of corridors through which seed dispersal can occur. Based on the acres of treatment and miles of road construction proposed, it is anticipated that Alternative B would result in approximately 382 acres of new noxious weed infestation.

Cumulative Effects
The cumulative effects analysis area for noxious weeds is the project area plus private land inholdings. The time period considered for analysis is 20 years total from 10 years in the past through 10 years into the future.

Previous and foreseeable activities such as timber harvest, off-road vehicle use, road construction and maintenance, and disturbed areas around water resources have resulted in a cumulative effect of infestation by several noxious weed species. Weeds appear to be scattered across the cumulative effects analysis area, and concentrations are known to exist in certain locations, such as some log landings, roadsides, and disturbed areas around water developments. Activities and effects on private land appear to be much the same as those on NFS lands. The recently signed travel management plan for the Black Hills National Forest would hopefully reduce the amount of off road travel that occurs off of designated routes within the project area. This should reduce the chances of weed infestations away from the designated travel routes.

Noxious weeds have been and would continue to be treated under previous and ongoing projects. An increase in infested acres would have negative impacts both ecologically and economically. An increase in acres of infestation means a direct increase in treatment costs. Ecologically, noxious weeds indirectly affect wildlife and livestock as they displace native vegetation and reduce the ability of ecosystems to function properly. This impacts mostly grass/forb communities, specifically riparian areas, upland grasslands, and meadows. When these areas become infected with noxious weeds, forage for wildlife and livestock is reduced.

Alternative B is likely to add to the cumulative effects on weed infestation. Proposed design criteria and weed treatment would reduce the likelihood of introduction of new species and substantial spread of existing infestations. However, with the level of treatment proposed and probable resulting ground disturbance, weeds are likely to appear in new areas. The persistence of these new and existing infestations depends in large part on availability of funding for treatment.
Alternative C

**Direct and Indirect Effects**
Alternative C includes approximately 18,049 acres of commercial and non-commercial vegetation treatment. It also calls for 10,608 acres of prescribed fire with an additional 84 acres of fuels treatments. In addition, this alternative proposes the construction, reconstruction and maintenance of approximately 132 miles of NFS roads.

Noxious weed infestations are expected to increase under this alternative. Commercial and non-commercial timber harvest activities often provide mechanisms for the introduction, establishment, and spread of noxious weeds. Anywhere soil disturbance occurs, the potential for the establishment of noxious weeds exists. The potential for noxious weed establishment is even greater in disturbed areas adjacent to existing weed populations. The movement of equipment in and out of these areas also facilitates weed establishment. Roads create a network of corridors through which seed dispersal can occur. Due to the increased amount of treatments and roads proposed under Alternative C, it would have the potential for a higher level of noxious weed infestation than Alternatives B or D. Based on the acres of treatment and miles of road construction proposed, it is anticipated that Alternative C would result in approximately 556 acres of new noxious weed infestation.

**Cumulative Effects**
The cumulative effects of Alternative C would be similar to those described under Alternative B above. Due to the increased level of timber harvest and road construction under Alternative C, the magnitude of the cumulative effects would be slightly higher.

Alternative D

**Direct and Indirect Effects**
Alternative D includes approximately 9,394 acres of commercial and non-commercial vegetation treatment. It also calls for 10,608 acres of prescribed fire with an additional 84 acres of fuels treatments. In addition, this alternative proposes the construction, reconstruction and maintenance of approximately 74 miles of NFS roads.

Noxious weed infestations are expected to increase under this alternative. Commercial and non-commercial timber harvest activities often provide mechanisms for the introduction, establishment, and spread of noxious weeds. Anywhere soil disturbance occurs, the potential for the establishment of noxious weeds exists. The potential for noxious weed establishment is even greater in disturbed areas adjacent to existing weed populations. The movement of equipment in and out of these areas also facilitates weed establishment. Roads create a network of corridors through which seed dispersal can occur. Due to the decreased amount of proposed timber harvest and the absence of new road construction, the potential for noxious weed infestation under Alternative D would be lower than under Alternatives B or C. Based on the acres of treatment proposed, it is anticipated that Alternative D would result in approximately 290 acres of new noxious weed infestation.
Cumulative Effects
The cumulative effects of Alternative D would be similar to those described under Alternative B above. Due to the reduced level of timber harvest and absence of new road construction in Alternative D, the magnitude of the cumulative effects would be lower.

3.7 Range

3.7.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat Project Area for range management. It summarizes the Steamboat Project Range and Weeds Report (Jons 2011), which is located in the Steamboat project file.

3.7.2 Existing Conditions

The Steamboat Project Area contains all or portions of two different grazing allotments and approximately 1,228 acres of primary grazing area. Six water developments and 14.5 miles of fence are also located within the project area. The names of the allotments, along with a brief description of each, are provided below:

Elk Allotment
The Elk Allotment consists of 18,772 acres, 15,555 acres of which fall within the project area. Currently this allotment is vacant with no permitted livestock.

Little Elk Allotment
The Little Elk Allotment consists of 9,479 acres, 3,479 acres of which fall within the project area. Currently there are two permittees that graze 63 pair from June 6th through September 30th each year in a two pasture deferred rotation grazing system.

3.7.3 Environmental Consequences

The effects of cattle grazing on the allotments included in the Steamboat project were analyzed and documented in the Livestock Grazing Environmental Assessment (EA) (USDA-Forest Service 1997b) and are not repeated here because the Steamboat Project would not alter the size of the grazing allotments, the season of their use or the number of livestock allowed upon them. Therefore, the analysis in the Livestock Grazing EA is still applicable. The Livestock Grazing EA is available upon request.

3.8 Hydrology and Soils

3.8.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat Project Area for hydrology and soils. It summarizes the Steamboat Project Hydrology and Soils Reports (Dempsey 2011), which is located in the Steamboat project file.
3.8.2 Existing Conditions

Field Surveys

Limited field surveys were completed between 2008 and 2010 within the Steamboat project area. The primary objectives of the field work were to locate any Connected Disturbed Areas (CDA) that may be present, classify streams, identify any potential watershed problem areas, and inventory road-stream crossings. CDAs are “high runoff areas like roads and other disturbed sites that have a continuous surface flow path into a stream or lake” (USDA-Forest Service 2005c). Stream classification consists of identifying whether a stream is perennial, intermittent, or ephemeral. Any watershed problems need to be identified so appropriate correction measures can be identified. Road-stream crossings were reviewed for aquatic passage. Most of the blue line United States Geologic Survey (USGS) streams were visited in the field. This information was compiled into an Excel spreadsheet and the points into a Geographic Information System (GIS) shapefile to identify these locations. Areas visited for the soils assessment were distributed throughout the Steamboat project area. Some soils identified from the soil survey that were identified as having a high erosion hazard were visited. Soil information was used to assess the condition of the soils from past activities and to address cumulative effects. Field surveys were also conducted in areas prone to mass movement to assess signs of instability.

Watersheds

Watershed boundaries used in this review were developed from the USDA-Forest Service Region 2 (R2) watershed GIS layer based upon the Hydrologic Unit Code (HUC) seventh-level watersheds. These watersheds are generally 5,000 to 10,000 acres in size. Seventh-level HUC watersheds are nested within sixth-level HUC watersheds. Sixth-level watersheds, which are generally 10,000 to 50,000 acres in size, are the watersheds that were analyzed in the Forest Plan FEIS (USDA-Forest Service 1996).

The review of watershed features conducted for the Steamboat project area was completed on HUC 7 watersheds. The smaller HUC 7 watersheds are being used instead of entire HUC 6 watersheds because large areas of the HUC 6 watersheds are outside of the Steamboat project area. The Steamboat project area boundary encompasses portions of four HUC 6 watersheds. Because a large area of the HUC 6 watersheds are outside the project area, conducting the analysis on HUC 7 watersheds is appropriate; the Steamboat project area boundary was delineated in part by following the HUC 7 boundaries.

Since the Forest Plan was issued, watershed boundaries have been revised in some instances to conform to national standards. A crosswalk of the old sixth-level Forest Plan watersheds, new sixth-level HUC watersheds, and the revised seventh-level watersheds for the Steamboat project area are provided in Table 3-41 below. Note that the total watershed acres are greater than the acres within the Steamboat project area because portions of the watersheds are located outside the project area boundary.
### Watershed Condition Class

Watershed classes were assigned to sixth-level watersheds during revision of the Forest Plan (USDA-Forest Service 1996). The determination of class was accomplished by comparing natural sensitivity, impact index and monitoring information. The sensitivity and impact index are explained in Appendix J of the Forest Plan FEIS. Table 3-42 below presents the watershed condition class information from the Appendix J. The watershed uses for watershed condition assessments are different than those used today. The information generated for the Forest Plan is adequate and will not be recalculated for this project area.

<table>
<thead>
<tr>
<th>Watershed Name</th>
<th>Watershed Number</th>
<th>Condition Class</th>
<th>Watershed Total Acreage</th>
<th>Total acres of Project area within watershed (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Elk Creek</td>
<td>8802</td>
<td>III</td>
<td>11,624</td>
<td>6,837 (59%)</td>
</tr>
<tr>
<td>Piedmont Creek</td>
<td>8803</td>
<td>III</td>
<td>2,825</td>
<td>1,305 (46%)</td>
</tr>
<tr>
<td>Stagebarn Canyon</td>
<td>8804</td>
<td>III</td>
<td>17,598</td>
<td>8,587 (49%)</td>
</tr>
<tr>
<td>Lower Boxelder Creek</td>
<td>8903</td>
<td>III</td>
<td>41,193</td>
<td>7,032 (17%)</td>
</tr>
</tbody>
</table>
Watersheds categorized as Condition Class III are described as being of high concern (USDA-Forest Service 1996). Forest Plan direction states that management activities can still occur in these watersheds, but that watershed improvement projects or other activities that would improve the health of the watershed must be a part of the project planning (USDA-Forest Service 1996). All of the watersheds within the project area are categorized as Class III watersheds. The Black Hills National Forest has determined that management activities can occur in a Class III watershed as long as they meet the following requirements:

- the activities do not further degrade the watershed,
- the activities demonstrate that watershed improvement is targeted by successfully eliminating some of the existing CDA known to occur within the project area,
- the activities and their design result in overall improvement in the health of the watershed, and
- watershed improvement project needs are identified during the project data gathering or planning process and, if feasible, are considered for inclusion in the project.

Opportunities were identified for watershed improvement activities within the Steamboat project area. Improving the road conditions, especially at the stream crossings, is one activity that would help improve watershed conditions through reducing the number of CDA. Repairing these crossings would disconnect a current sediment source (e.g. roads) from streams and improve water quality. Several meadows and riparian areas are being encroached by pine trees; removal of pine from these areas would also improve watershed health.

**Streams**

Approximately 93 miles of mapped streams exist within the Steamboat project area. Approximately 54 miles (58%) of stream were assessed in 2009 and 2010 to determine if the streams were perennial, intermittent, or ephemeral.

Of the 93 miles of stream within the Steamboat project area:

- 43 miles are ephemeral streams
- 33 miles are intermittent streams
- 17 miles are perennial streams

During the 2009 and 2010 surveys, some streams were reclassified as ephemeral streams from intermittent streams. After two years of higher than average precipitation in 2009 and 2010, there was no evidence of flow in the streams. Most ephemeral streams within the Steamboat project area are well defined and have a corridor of hardwoods and shrubs around them showing higher water content. The majority of the ephemeral streams have limestone bedrock. The high porosity of the limestone could cause these streams to consist of losing reaches, which lose surface water to the groundwater aquifers.

Approximately 35% of streams within the Steamboat project area were classified as intermittent. These streams did flow for part of either 2009 or 2010 surveys or had vegetative indicators that these streams do have flowing surface water. Sometimes, intermittent streams were impacted by upstream impoundments.
Only 18% of the streams within the Steamboat project area are classified as perennial streams. Two primary streams make up this 18%: Boxelder Creek and Little Elk Creek. Some tributaries to Boxelder Creek and Little Elk Creek are also perennial. A short reach of Stagebarn Canyon and a tributary of Stagebarn Canyon are classified as perennial.

<table>
<thead>
<tr>
<th>HUC7 Watershed</th>
<th>Stream Names</th>
<th>Total Miles of Stream</th>
<th>Miles of Stream Across Private Land (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1012011020105</td>
<td>Upper Little Elk Creek</td>
<td>26 miles total</td>
<td>3.8 miles (15%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ephemeral-7 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent – 10 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial- 9 miles</td>
<td></td>
</tr>
<tr>
<td>1012011020201</td>
<td>Stagebarn Canyon</td>
<td>35.7 miles total</td>
<td>2.4 miles (7%)</td>
</tr>
<tr>
<td></td>
<td>South Stagebarn Canyon</td>
<td>Ephemeral- 23.3 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent- 12.2 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial- 0.2 miles</td>
<td></td>
</tr>
<tr>
<td>1012011020202</td>
<td>Lower Stagebarn Canyon</td>
<td>1 mile total</td>
<td>0 miles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent- 0.3 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial- 0.7 miles</td>
<td></td>
</tr>
<tr>
<td>1012011020203</td>
<td>Elk- Priest Canyon</td>
<td>5.6 miles total</td>
<td>0.5 miles (9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ephemeral-0.6 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent- 0.1 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial- 2.9 miles</td>
<td></td>
</tr>
<tr>
<td>1012011010202</td>
<td>Estes</td>
<td>4.9 miles total</td>
<td>2.3 miles (47%)</td>
</tr>
<tr>
<td></td>
<td>Boxelder Creek</td>
<td>Ephemeral- 0.2 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estes Creek</td>
<td>Intermittent- 1.9 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial- 2.8 miles</td>
<td></td>
</tr>
<tr>
<td>10120110010204</td>
<td>Boxelder-Erskine</td>
<td>12.7 miles total</td>
<td>4.1 miles (32%)</td>
</tr>
<tr>
<td></td>
<td>Boxelder Creek</td>
<td>Ephemeral- 8.9 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erskine Gulch</td>
<td>Intermittent- 3.3 miles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial – 0.5 miles</td>
<td></td>
</tr>
<tr>
<td>1012011010301</td>
<td>Boxelder-Doty</td>
<td>3.4 miles total</td>
<td>0 miles</td>
</tr>
<tr>
<td></td>
<td>None named within project area</td>
<td>Ephemeral- 3.4 miles</td>
<td></td>
</tr>
</tbody>
</table>

**Streamflow Regime**

Peak flows in the Black Hills result from both rainfall and snowmelt. An examination of annual peak flows by the USGS indicates that rainfall-only peaks account for 90 percent of the peak flows in the Black Hills (USDA-Forest Service 2005c). Thus, most site-altering floods in the Black Hills are due to high-intensity spring and summer thunderstorms. The Boxelder Creek stream gauging station near Nemo, SD is on the boundary of the Steamboat project area. This stream gauging station has been in operation since 1945 (USGS 2011). The records for discharge verify that high flows usually fall between the months of April and June (USGS 2011).
**Road-Stream Crossings**

Road-stream crossings were assessed in 2008 and 2010 to determine if they were contributing sediment into streams. In total, 102 road stream-crossings were assessed. Of these, 21 are culverts, 2 are box culverts, 2 are bridges, 76 are low-water crossings, and 1 was over a berm. Observations at 35 of these crossings showed that the road was contributing sediment to the stream (i.e., the crossing represented a connected disturbed area, or CDA). Twenty-one of these crossings are on ephemeral streams, 12 are on intermittent streams, and 2 are on perennial streams. Crossing were rated for fish passage with ‘green’ representing crossing passable to fish and ‘red’ representing impassable crossings.

<table>
<thead>
<tr>
<th>Stream Type</th>
<th>Crossing Type</th>
<th>Total Surveyed</th>
<th>Connected Disturbed Areas</th>
<th>Fish Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephemeral</td>
<td>Culvert</td>
<td>12</td>
<td>4</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Berm</td>
<td>1</td>
<td>0</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Low Water Crossing</td>
<td>70</td>
<td>26</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Intermittent</td>
<td>Culvert</td>
<td>8</td>
<td>3</td>
<td>1 Grey 7 Red</td>
</tr>
<tr>
<td></td>
<td>Low Water Crossing</td>
<td>4</td>
<td>0</td>
<td>1 Green 3 Red</td>
</tr>
<tr>
<td>Perennial</td>
<td>Box Culvert</td>
<td>2</td>
<td>0</td>
<td>2 Green</td>
</tr>
<tr>
<td></td>
<td>Bridges</td>
<td>2</td>
<td>1</td>
<td>2 Green</td>
</tr>
<tr>
<td></td>
<td>Low Water Crossing</td>
<td>1</td>
<td>0</td>
<td>1 Green</td>
</tr>
<tr>
<td>Spring Brook Channels</td>
<td>Culvert</td>
<td>1</td>
<td>0</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Low Water Crossing</td>
<td>1</td>
<td>1</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Road-stream crossings were also assessed to determine their aquatic passage. Only 17 crossings have the potential to affect aquatic passage because they are along perennial or intermittent streams. The two spring brook channels are perennial at the road crossing. However; the water infiltrates back into the soils and groundwater below the road. A total of 10 road crossings were assessed as being impassable to aquatic organisms and rated as a ‘red’. All of these occurred on intermittent streams. Only one was indeterminable for aquatic passage, so it was rated as ‘grey’. Six road crossings were assessed as passable for aquatic organisms and rated as ‘green’.

**Water Quality**

Water quality refers to the physical, chemical, and biological composition of a given streamflow and how these components affect beneficial uses. The existing water quality of the drainages within the project area is a result of the natural characteristics of the watersheds along with the management activities (e.g. timber, grazing, recreation) and the private activities (e.g. grazing, construction, mining) that have occurred there. Water quality parameters that may be affected by forest management activities include sedimentation to stream channels and changes in water temperature. Changes in these parameters can adversely affect the support of beneficial uses if watershed conservation practices are not implemented.

None of the streams within the Steamboat project area are identified by the state of South Dakota as not meeting the water quality requirements for their associated beneficial uses (SDDENR 2010).
**Beneficial Uses**

The South Dakota Department of Environment and Natural Resources (SDDENR) assigns water quality standards on the beneficial uses of each water body as part of the requirements of the Clean Water Act (CWA). All streams within South Dakota are assigned the beneficial uses of irrigation, fish and wildlife propagation, recreation, and stock watering (SD Administrative Code 74:51:03:01). SDDENR assigned additional beneficial uses to seven streams located within the project area (Table 3-45).

<table>
<thead>
<tr>
<th>Stream Name</th>
<th>Watershed(s)</th>
<th>Beneficial Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boxelder Creek</td>
<td>Boxelder-Wilson (10120111010201)</td>
<td>Coldwater permanent fish life propagation waters;</td>
</tr>
<tr>
<td></td>
<td>Estes (101201111010202)</td>
<td>Limited-contact recreation waters</td>
</tr>
<tr>
<td></td>
<td>Boxelder-Erskine (10120111010204)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boxelder-Doty (10120111010301)</td>
<td></td>
</tr>
<tr>
<td>Estes Creek (T3N,R6E, Sec. 7)</td>
<td>Estes (101201111010202)</td>
<td>Coldwater marginal fish life propagation water;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited-contact recreation waters</td>
</tr>
<tr>
<td>Little Elk Creek (T3N,R5E, Sec. 4)</td>
<td>Little Elk (10120111020105)</td>
<td>Coldwater permanent fish life propagation waters;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited-contact recreation waters</td>
</tr>
<tr>
<td>Stagebarn Canyon</td>
<td>Stagebarn (10120111020201)</td>
<td>Coldwater marginal fish life propagation waters;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited contact recreation waters</td>
</tr>
</tbody>
</table>

All streams and headwater areas of streams within this project area are assumed to be meeting their beneficial uses, unless stated otherwise by the SDDENR (SDDENR 2010). Every two years, the SDDENR publishes a water quality assessment of the state for EPA. *The 2010 South Dakota Integrated Report for Surface Water Quality Assessment* shows the status of the water quality of the streams within the state. The most current report is from 2010 and does not identify any streams within the project area as impaired for water quality or as not meeting their beneficial uses (SDDENR 2010). Only Boxelder Creek (the entire reach within the project area) has been assessed to determine whether it is meeting its beneficial uses. SDDENR states that Boxelder Creek is fully supporting its beneficial uses (SDDENR 2010).

**Stream Health Surveys**

Stream health surveys were conducted along Boxelder Creek, Erskine Gulch, and Little Elk Creek. These streams are the main perennial streams within the Steamboat project area. Boxelder Creek is in good condition. Some thistle is present but a diverse riparian area exists around the stream. Boxelder Creek has more sediment than it moves through the system leaving a veneer of fine-sized sediment on top of the cobble and gravel stream bottom. Development within the Boxelder watershed (within and outside of the project area) could be the cause of the extra sediment within Boxelder Creek.

Erskine Creek is entirely within the Steamboat project area. Some private land is located along the Erskine Creek that has impacted the stream through damming and agriculture. The stream is now
classified as intermittent within most of the private land just above the confluence with Boxelder Creek. Downstream of the lower crossing with FSR 145.1, Erskine Creek is a perennial stream with a defined riparian corridor. The stream in that area is controlled by bedrock (limestone) and has very little sedimentation along the bottom of the stream. The condition of Erskine Creek greatly improves along this short stretch.

The condition of Little Elk Creek is different upstream and downstream of Dalton Lake. Upstream of Dalton Lake, the riparian area is wider and more diverse. Also, more trees and shrubs are present along Little Elk Creek above Dalton Lake. Upstream of Dalton Lake, bedrock and boulders are the most common form of coarse material within the stream. A veneer of fine sediment covers the stream bottom, primarily within the pools, eddies, and other low flow areas. Downstream of Dalton Lake, the riparian corridor is narrow and primarily composed of sedges and rushes, which do not shade the stream very well. The amount of algae located within the stream suggests an increased water temperature (due to the lack of stream shading) below Dalton Lake. Some areas are dominated by fine sediment along the stream bottom; however, the film veneer across the reach does not exist as in stretch above Dalton Lake. The stream is still forming itself downstream of Dalton Lake, which is evidenced by the wider stream channel, presence of mid-channel bars, and less diverse riparian area. Springs do occur along the base of some hills and terrace slopes along the stream corridor. Waite Gulch disappears just before it flows into Little Elk Creek; however, following the stream path are a series of six springs that flow out of the streambank in that same area. These springs are probably the waters from Waite Gulch. Streamflow of Waite Gulch could be affected by the recreation residences in that area, their access road, or FSR 226 (Waite Gulch Road).

Wetlands

Wetlands are defined as “lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or land is covered by shallow water” (Cowardin 1979). Wetlands are protected under the Executive Order 11990 and through wetland protection practices with the Watershed Conservation Practices Handbook, FSH 2509.25 (USDA-Forest Service 2006a). Wetlands are protected during implementation through the Watershed Conservation Practices, Management Measure 3 “In the water influence zone next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.” (USDA-Forest Service 2006a).

From the USFWS National Wetland Inventory (NWI), there were 17 wetlands mapped within the Steamboat project area, covering a total of 11.4 acres. Seven of these wetlands occur on NFS land. Field review in 2010 identified two additional wetlands. These areas were mapped and will be protected through wetland protection practices within the Watershed Conservation Practices Handbook, FSH 2509.25.

Wetlands to be protected with a 100-foot buffer are located in stands: 089902-01, 089902-02, 081509-005, 081509-075, 081509-69, 081508-31, and 081708-70. Wetlands that were part of the NWI layer, but were dry in 2010 do not need the 100-foot buffer, but still need protection from heavy equipment. These wetlands are located in stands: 081506-113, 081506-118, 089904-43, 089904-81, and 089904-86.
Springs

Springs are defined as “place where ground water flows naturally from a rock or the soil onto the land surface or into a body of surface water.” (Glossary of Hydrology 1998). Springs are managed as a subset of wetlands due their unique characteristics. Also, springs are a primary factor for determination of a groundwater dependent ecosystem. A total of 46 springs were identified, confirmed, and mapped within the Steamboat project area.

Springs are protected during implementation through the Watershed Conservation Practices, Management Measure 3 “In the water influence zone next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition” (USDA-Forest Service 2006a). On page 14, the Watershed Conservation Practices state “Avoid any loss of rare wetlands such as fens and springs” (USDA-Forest Service 2006a).

Floodplains

Floodplains are defined as “the flat area adjoining a river channel constructed by the river in its present climate and overflowed at times of high discharge” (Dunne and Leopold 1978). Periodic flooding in this area encourages the growth of riparian vegetation, which in turn slows erosion and traps sediment. Floodplains within the Steamboat project area vary in size from where streams are small and steep to where streams are wide and broad such as Boxelder Creek. Three mapped 100-year floodplains are located in or adjacent to the Steamboat project area, encompassing approximately 430 acres. Floodplains that are mapped under Executive Order 11988 are Boxelder Creek, Estes Creek, and Little Elk Creek. These floodplains are mapped on both private and NFS lands. Estes Creek is only on private lands within the Steamboat project area.

Lakes

Dalton Lake is within the project area along Little Elk Creek. Dalton Lake was approved for dredging under the Dalton Lake Recreation Facility Maintenance Project in 2009. Dredging activities are proposed to begin fall 2011.

SDDENR has assigned the following beneficial uses to Dalton Lake: fish and wildlife propagation, recreation, stock watering, immersion recreation, contact recreation, and coldwater permanent fish life propagation (SD AR 74:51:02:01, SD AR 74:51:02:43).

Dalton Lake is assumed to be meeting its beneficial uses because it has not been identified by the SDDENR as not meeting its beneficial uses (SDDENR 2010).

Meadows

During 2010, twenty meadows were visited to determine the meadow health (i.e., if there was pine encroachment). Of these, only five meadows had a moderate to high level of pine encroachment. Logging has been used within 14 meadows to thin out past pine encroachment. Remnant stumps, slash piles, and felled trees provide evidence of past thinning. One meadow also showed evidence of past burning. Overall, the meadows within the Steamboat project area have some pine encroachment along
their edges. Most meadows have either a spring or ephemeral stream within the meadow. In areas where the ground table is higher, the vegetation is dominated by shrubs. In other areas, meadows are predominantly grasses and forbs. Some meadows show evidence of past roads.

**Soils**

Soils are an integral component of the watershed and serve as an indicator of watershed health. Soil is defined as “unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants” and “has been subjected to and shows the effects of genetic and environmental factors of climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time” (Soil Science Society of America 2010).

Soils can be affected by human activities including road and trail construction and use, timber harvest activities, mining, fires, and livestock grazing (Allen 2005). Compaction, erosion, removal of nutrients, and soil heating can result which may limit or reduce long-term productivity of forested sites. The long-term maintenance of site productivity is one goal of the Forest Plan (USDA-Forest Service 2005c). These factors are summarized by the Natural Resources Conservation Service (NRCS) Soil Data Mart Database (USDA-NRCS 2011).

Furthermore, soils with a large amount of fine clay particles are more vulnerable to disturbance by activity. When these soils are at a high moisture content, the individual soil particles compress together easier than in drier conditions. Thus, activities that take place during high moisture conditions could result in compaction to detrimental levels (USDA-Forest Service 2006a). Also, fine-textured soils have slow water permeability. On steep slopes, this causes rapid runoff and high erosion hazard ratings (USDA-NRCS 2011).

A soil map unit (SMU) is “a conceptual group of one to many delineations identified by the same name in a soil survey that represent similar landscape areas comprised of either:

- The same kind of component soil, plus inclusions
- Two or more kinds of component soils, plus inclusions
- Component soils and miscellaneous area, plus inclusions
- Two or more kinds of component soils that may or may not occur together in various delineations but all have similar, special use and management, plus inclusions
- A miscellaneous area and included soils” (USDA-NRCS 2011).

A total of 40 SMUs are present in the Steamboat project area. Twenty units comprise greater than one percent of the project area and are shown in Table 3-46. Twenty additional units comprise less than one percent of the project area, but together represent two percent of the project area. Soil map units which comprise more than one percent of the Steamboat project area were used to address compaction, platy structure, erosion, nutrient removal, soil heating, and regeneration hazards.
### Table 3-46. Major Soil Map Units in the Steamboat Project Area

<table>
<thead>
<tr>
<th>Soil Map Unit Symbol</th>
<th>Soil Map Unit Name</th>
<th>Percent Slope</th>
<th>Acres of FS Land within the Steamboat Project Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>190E, 193F</td>
<td>Vanocker-Citadel Complex</td>
<td>10-60</td>
<td>6445 (27%)</td>
</tr>
<tr>
<td>CtE</td>
<td>Citadel Association, Hilly</td>
<td>----</td>
<td>5085 (21%)</td>
</tr>
<tr>
<td>VaE</td>
<td>Vanocker-Citadel Association, Steep</td>
<td>----</td>
<td>4515 (19%)</td>
</tr>
<tr>
<td>202G</td>
<td>Vanocker-Sawdust-Rock Outcrop Complex</td>
<td>40-80</td>
<td>2229 (9%)</td>
</tr>
<tr>
<td>PaE, 116E</td>
<td>Paunsaugunt-Rock Complex</td>
<td>3-40</td>
<td>2072 (9%)</td>
</tr>
<tr>
<td>161F</td>
<td>Rockoa-Rock Outcrop Complex</td>
<td>25-60</td>
<td>636 (3%)</td>
</tr>
<tr>
<td>159E</td>
<td>Rockoa-Lakoa-Rock Outcrop Complex</td>
<td>10-40</td>
<td>490 (2%)</td>
</tr>
<tr>
<td>24C</td>
<td>Citadel-Vanocker Complex</td>
<td>2-12</td>
<td>332 (1%)</td>
</tr>
<tr>
<td>6C</td>
<td>Bullflat-Cordeston Silt</td>
<td>2-9</td>
<td>284 (1%)</td>
</tr>
<tr>
<td>12E</td>
<td>Buska-Rock Outcrop Complex</td>
<td>10-40</td>
<td>254 (1%)</td>
</tr>
<tr>
<td>40B</td>
<td>Cordeston-Marshbrook Loams</td>
<td>0-6</td>
<td>179 (1%)</td>
</tr>
<tr>
<td>3B, 3D</td>
<td>Bullflat Silt Loam</td>
<td>3-15%</td>
<td>155 (1%)</td>
</tr>
<tr>
<td>199C</td>
<td>Vanocker-Paunsaugunt Complex</td>
<td>2-12</td>
<td>154 (1%)</td>
</tr>
<tr>
<td>McB, 92C</td>
<td>Marshbrook-Cordeston Loams</td>
<td>2-9</td>
<td>145 (1%)</td>
</tr>
<tr>
<td>51E</td>
<td>Grizzly-Grizzly, Moderately Deep Complex</td>
<td>10-40</td>
<td>126 (1%)</td>
</tr>
<tr>
<td>82C</td>
<td>Maitland Loam</td>
<td>2-10</td>
<td>108 (1%)</td>
</tr>
<tr>
<td>Misc</td>
<td>20 Additional SMUs*</td>
<td>0-80</td>
<td>574 (2%)</td>
</tr>
</tbody>
</table>

*The remaining soils are present in the project area, but less than 1% individually. These SMUs were combined to show the amount of acreage represented in the Steamboat project area.

### Soil Disturbance Assessments

Soil disturbance assessments were completed in 2008 and 2009. Soil transects were conducted in areas where management activities occurred previously (disturbed) and in areas where no management activities were documented to occur (undisturbed). The Forest Soil Disturbance Monitoring Protocol was used during field surveys (Napper et al. 2009 and Page-Dumroese et al. 2009). Under this protocol, each location within a transect is assigned a soil disturbance class rating ranging from 0 to 3 (0 = undisturbed, 1 = lightly disturbed, 2 = moderately disturbed, and 3 = severely disturbed). Each soil disturbance class is characterized by specific soil features and structure, although not all of these characteristics need to be present to classify a location as a specific soil disturbance class. Soil disturbance class 0 is defined by having no evidence of past equipment, intact forest floor layers, no soil displacement, no soil compaction, and no platy soils. Soil disturbance class 1 is defined by having faint evidence of past equipment, intact forest floor layers, no soil displacement, shallow soil compaction, low burn severity, and non-continuous platy structure. Soil disturbance class 2 is defined by having evidence of past equipment, partially intact or missing forest floor layers, soil displacement, soil compaction present to mineral soil, moderate burn severity, and continuous platy structure. Soil disturbance class 3 is defined by having evidence of past equipment, missing forest floor layers, soil displacement, deep soil compaction, high burn severity, and continuous platy structure with no penetration of roots.

Each SMU was surveyed with transects of 30 soil pits spaced approximately 30 meters apart in both an undisturbed and disturbed (recently logged) location (if possible). A total of 34 transects were completed for the Steamboat project area; 15 transects were surveyed in disturbed areas and 19
transects were surveyed in undisturbed areas. Table 3-47 summarizes each transect according to the
number of sites that included evidence of compaction or platy structure, erosion, and topsoil-subsoil
mixing.

Twenty-seven transects were classified as a soil disturbance class 0 (undisturbed) or a soil disturbance
with at least one site rated as a soil disturbance class 2 (moderately disturbed). Six of these transects
(24C, 193F, 199C, McB, and VaE) were located within the Cavern and Windy timber sale units, which had
a sale year of 1999 and 2004, respectively. There were no sites rated as a soil disturbance class 3
(severely disturbed). Two transects showed disturbance due to burning. These two transects, which had
a soil condition class 1, were present in an undisturbed area and thus showed minimal soil disturbance
in terms of compaction, soil erosion, and topsoil-subsoil mixing.

Table 3-47. Soil Disturbance Assessments for the Steamboat Project Area.

<table>
<thead>
<tr>
<th>Soil Map Unit</th>
<th>Disturbed or Undisturbed Site</th>
<th>Associated Timber Sale (if applicable)</th>
<th>Number of Sites on Transect with Evidence of:</th>
<th>Number of Sites per Soil Disturbance Class‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Compaction or Platy Structure</td>
<td>Soil Erosion</td>
</tr>
<tr>
<td>6C</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td>24C</td>
<td>Disturbed</td>
<td>Cavern 14 Windy 2</td>
<td>9 0 0</td>
<td></td>
</tr>
<tr>
<td>24C</td>
<td>Disturbed</td>
<td>Cavern 14</td>
<td>3 2 6</td>
<td></td>
</tr>
<tr>
<td>43C</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>0 2 0</td>
<td></td>
</tr>
<tr>
<td>116E</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>0 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>124C</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>1 1 2</td>
<td></td>
</tr>
<tr>
<td>193F</td>
<td>Disturbed</td>
<td>Windy 14</td>
<td>8 7 13</td>
<td></td>
</tr>
<tr>
<td>193F</td>
<td>Disturbed</td>
<td>Windy 14</td>
<td>9 2 10</td>
<td></td>
</tr>
<tr>
<td>199C</td>
<td>Disturbed</td>
<td>Windy 14</td>
<td>8 3 15</td>
<td></td>
</tr>
<tr>
<td>199C</td>
<td>Disturbed</td>
<td>Windy 14</td>
<td>4 0 5</td>
<td></td>
</tr>
<tr>
<td>219G</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td>219G</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>3 6</td>
<td></td>
</tr>
<tr>
<td>CtE</td>
<td>Disturbed</td>
<td>Cavern 18</td>
<td>14 1 5</td>
<td></td>
</tr>
<tr>
<td>HtG</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>6 4 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McB</td>
<td>Disturbed</td>
<td>Cavern 18</td>
<td>4 7 12</td>
<td></td>
</tr>
<tr>
<td>RnG</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>VaE</td>
<td>Disturbed</td>
<td>Windy 6</td>
<td>4 3 6</td>
<td></td>
</tr>
<tr>
<td>VaE</td>
<td>Undisturbed</td>
<td>N/A</td>
<td>0 3 1</td>
<td></td>
</tr>
</tbody>
</table>

‡Only sites with at least one site with a soil disturbance class greater than 0 were documented in this table. A complete list of
sites can be found in the project record.
* Not all SMUs were surveyed; this was because either the SMU had too small of an area represented within the project area or
was inaccessible due to private lands and/or the absence of right-of-way.

θ Transects with a high number of Class 1 sites were due to burning.

Soil Compaction and Platy Structure

Soil compaction results in an increase of soil bulk density and a decrease in soil porosity. Platy structure is commonly related to soil compaction and is identified as flat-lying or tabular structure (Napper et al. 2009). Water, air, and soil fauna move through the soil in pore spaces; thus the reduction of pore spaces results in the reduction of these components. This furthermore results in excessive runoff, erosion, nutrient loss, inhibition of plant growth, and possible water quality problems (Muckel 2004). The WCPH states that no more than 15% of any individual harvest unit can have cumulative detrimental soil disturbance (USDA-Forest Service 2006a).

Soils susceptible to compaction are characterized by having high water capacity and low strength. Twelve of the major SMUs (those comprising over 1% of the project area) are characterized as low strength. These SMUs are: CtE, McB, VaE, 3B, 3D, 6C, 12E, 24C, 40B, 82C, 92C, and 116E (USDA-NRCS 2011). These SMUs comprise 44% of the project area, or 10,876 acres. In addition, six of these SMUs with low strength also have a high water capacity, making them highly susceptible to compaction. These SMUs are 24C (Citadel-Vanocker complex), 40B Cordeston-Marshbrook loams), 82C (Maitland loam), 92C (Marshbrook-Cordeston loams), CtE (Citadel association), and McB (Marshbrook-Cordeston loams) and comprise approximately 24% of the project area, or 5,849 acres (USDA-NRCS 2011). Previous soil monitoring in BHNF has shown that timber harvest activities on moist or wet soils has resulted in compaction and high soil bulk density levels, whereas activities on these soils when they are dry has resulted in no or limited compaction and lower soil bulk density levels. It is unknown how long a detrimentally compacted soil will decrease to a level below this threshold, but it is hypothesized that those soils which undergo active freeze-thaw conditions or develop a flush of herbaceous vegetation growth can cause a decline in soil bulk density levels (USDA-Forest Service 2010a).

Soil Erosion

Soil Erosion

Soil erosion is the removal of material from the surface soil by water, ice, wind, or gravity (Muckel 2004, Napper et al. 2009). Signs of erosion include the presence of rills or gullies, pedestaling of rocks or plants, erosion pavement, and lighter-colored soil horizons present at the surface (Napper et al. 2009). The NRCS provides ratings for SMUs for off-road soil erosion potential.

The ratings for ‘Hazard of Off-Road or Off-Trail Erosion’ are based on slope and the soil erosion factor K. Soil loss occurs when 50% to 75% of the surface has been exposed by management activities and sheet or rill erosion occurs. A rating of ‘slight’ means that erosion is unlikely, ‘moderate’ means that some erosion is likely and erosion control measures may need to be present, ‘severe’ means that erosion is very likely and that erosion control measures are suggested, and ‘very severe’ means that significant erosion is expected with loss of soil productivity and off-site damage will occur and erosion control measures would be impractical (USDA-NRCS 2011). Sixteen out of the 20 major SMUs are classified with a slight or moderate rating. Three of the SMUs with a moderate rating (12E, 116E, and 159E) have rock outcrop as a secondary component of the soil with a very severe rating. These rock outcrops comprise less than 25% of the SMU and are not considered a concern for erosion. Soil map units 161F, 193F,
202G, and VaE are characterized as severe and comprise 9,669 acres, or 39%, of the project area. These are soil map units of concern for Steamboat project area.

The ratings for ‘Hazard of Erosion on Roads and Trails’ are based on slope, the soil erosion factor K, and the amount of rock fragments present. These ratings apply to native surface roads or trails. A rating of ‘slight’ means little or no erosion is likely, ‘moderate’ means some erosion is likely and occasional maintenance and simple erosion control measures may be needed, ‘severe’ means that significant erosion is expected and frequent maintenance and erosion control measures are needed, and ‘very severe’ means that significant erosion is expected with loss of soil productivity and off-site damage will occur and erosion control measures would be impractical (USDA-NRCS 2011). Twelve out of the 20 major SMUs are classified with a slight or moderate rating. Soil map units 159E and 190E are classified as moderate in the primary soil component and severe and very severe in the secondary soil components. Soil map units 12E, 116E, 161F, 193F, 202G, CtE, PaE, and VaE are characterized as severe and comprise 17,080 acres, or 69%, of the project area. Four of these SMUs (12E, 116E, 161F, and 202G) have secondary soil components with a very severe rating and comprise 3,208 acres, or 13%, of the project area.

Nutrient Removal

“Soil fertility depends on organic matter and nutrients. Soil productivity can be degraded if humus and topsoil, or even excess leaves and limbs, are taken off site” (USDA-Forest Service 1996). Forest Plan standard 1102 sets requirements for soils with organic matter content less than two percent and those soils with an effective rooting depth of less than 15 inches (USDA-Forest Service 2005c). None of the major SMUs have less than two percent organic matter in the topsoil. Two SMUs contain soils with a rooting depth that may be less than 15 inches. Soil map units 116E, 124C, and PaE have soil type Paunsaugunt as a primary component which has a rooting depth between 10 and 20 inches. Collectively these SMUs comprise 2,072 acres, or 8%, of the project area. Five SMUs have rock outcrop as a secondary soil component, which has a rooting depth less than 15 inches. Since activity is unlikely to occur on rock outcrops, these SMUs are not included as subject to nutrient removal.

Soil Heating

“Soil heating is caused by severe fires that occur when humus and large fuels are dry and are consumed near the ground. Soil heating sterilizes the soil, alters soil physics, consumes organic matter, and removes much of the site’s nutrients” (USDA-Forest Service 1996). The NRCS (2011) rates soils for “Potential for Damage to Soil by Fire”. These ratings are based on the texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. Soil map units are rated as low, moderate, or high in response to prescribed fires or wildfires of moderate intensity. “Moderate intensity” relates to a fire that is hot enough to remove the duff layer and consume organic matter in the surface layer. All SMUs have a rating of low or moderate within the Steamboat project area. Five SMUs have rock outcrop as a secondary soil component which has a high rating for potential for damage to soil by fire. These components comprise less than 25% of the individual SMU and are therefore not included as subject to damage by soil heating.
Regeneration Hazards

“Forests must be restocked within 5 years after harvest. Regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors” (USDA-Forest Service 1996). Typically the Black Hills has not experienced problems maintaining sufficient ponderosa pine regeneration and no problems with regeneration are noted for this area. The NRCS (2011) rates soils for ‘potential for seedling mortality.’ These ratings are based on flooding, ponding, depth to water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. Three SMUs (40B, 92C, and McB) are characterized as high for seedling mortality due to the wetness nature of the soil. Soil map unit 6C is characterized as low for seedling mortality in the primary soil component, but high in the secondary soil component due to the wetness nature of the soil. These SMUs comprise of approximately 609 acres or two percent of the project area. Five SMUs have rock outcrop as a secondary soil component which has a high rating for seedling mortality due to the carbonate content of the outcrop. The rock outcrop can affect the primary soil component by causing that component to have a moderate rating due to soil reaction, carbonate content, or available water. These SMUs (116E, 159E, 161F, 202G, and PaE) with a moderate rating in the primary soil and a high rating in the rock outcrop secondary soil component comprise for approximately 5,413 acres or 22% of the project area.

Geological Hazards

Mass movement is defined as the ‘dislodgement and downslope transport of soil and rock material as a unit under direct gravitational stress’. Mass movement can indicate ‘slow displacements such as creep and solifluction and rapid movement such as landslides, rock slides and falls, earthflows, debris flows, and avalanches’ (Soil Science Society of America 2010). The primary cause of mass movement is related to water. Intense rainfall, snowmelt, changes in ground-water levels and surface-water levels can trigger soil to move. Human-induced factors can also trigger mass movement to occur by disturbing or changing drainage patterns, destabilizing slopes, and removing vegetation (Highland and Bobrowsky 2008). In addition, the placement of roads is a concern for triggering mass movement because they can potentially overload or undercut the slopes.

Forest Plan guideline 1108 suggests that slopes over 30 percent on Citadel, Lakoa, Larkson, Rockoa, and Mathias soils and on slopes greater than 55 percent of every soil type should have an on-site examination prior to management activities. Citadel and Rockoa soil types are present in seven of the major SMUs in the Steamboat project area: 190E, 193F, CtE, VaE, 161F, 159E, and 24C. These SMUs, which are present on slopes greater than 30%, comprise approximately 17,470 acres (71%) of the project area.

Slope stability or mass movement potential surveys were conducted from 2008 to 2010 in areas with 30 percent or greater slopes with either Citadel or Rockoa soils. Signs of instability were noted and included hummocky areas, pistol butt and bent trees, and scarping. Locations which showed these signs were noted in GIS and a rating of stable, caution, or unstable was given to each area. Stable areas showed no signs of instability or the area was stabilized from previous movement activity. Caution areas showed some signs of instability, but activities could occur in these areas as long as precautions were taken to remove as little vegetative coverage as possible and activity was kept minimal. Unstable
areas showed many signs of instability and further activities in these areas would lead to mass movement.

Slope stability investigations were conducted between 2008 and 2010. Slope stability surveys were conducted on approximately 9,901 acres total within the Steamboat project area. This corresponds to 40 percent of the project area. Surveys during the fall of 2008 covered approximately 1,166 acres. Surveys found two areas that were rated as unstable, covering 101 acres and three areas were rated as “signs of instability” or caution, covering 249 acres. Surveys in summer of 2009 covered 8,717 acres. These surveys found six areas that were rated as unstable, covering 1,667 acres and 20 areas that were rated as caution, covering 2,978 acres. Surveys in the summer of 2010 covered 18 acres for three areas. These surveys found one area that was rated unstable, covering six acres and another site was rated caution, covering nine acres. The final site surveyed in 2010 was rated as stable.

### 3.8.3 Environmental Consequences

The cumulative effects area for soils is the project area. This area was selected because direct and indirect effects on soils would be limited to this area. The time span for the cumulative effects analysis of soils is from 2001 to 2021 to allow for completion of all recent, ongoing and foreseeable activities.

The cumulative effects area for water resources is the HUC 7th level watersheds that overlap the project area. The total area of these watersheds is 62,110 acres, including 41,125 acres of NFS lands (or 66 percent of the watersheds). This area was selected because effects on water would not be expected to be discernable beyond the 7th-level watershed due to the distance from proposed activities and lack of surface water. The time span for the cumulative effects analysis for water resources is 2001 through 2031 to account for effects of recent, ongoing, and foreseeable activities.

### Water Quality

<table>
<thead>
<tr>
<th>Location</th>
<th>Type of Crossing</th>
<th>Alternative</th>
<th>Sensitivity Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2N, R6E, Section 7</td>
<td>New construction</td>
<td>B and C</td>
<td>Along intermittent reach just above where it enters a meadow.</td>
</tr>
<tr>
<td>T3N, R5E, Section 13-Waite Gulch</td>
<td>Road conversion</td>
<td>B, C, and D</td>
<td>Just above the confluence of two intermittent tributaries for Waite Gulch. Between the two sets of springs that are the source water for Waite Gulch.</td>
</tr>
<tr>
<td>T4N, R5E, Section 33-Perennial tributary to Little Elk Creek</td>
<td>Temporary Road Crossing</td>
<td>B, C, and D</td>
<td>Just below a spring and wetland. At the end of a meadow. Most sensitive of all of the proposed crossings due to the wetland and the stream switches to perennial just below the crossing.</td>
</tr>
<tr>
<td>T3N, R5E, Section 1-Intermittent tributary to Little Elk Creek</td>
<td>New construction</td>
<td>C</td>
<td>Near springs that are source water for the tributary to Little Elk Creek.</td>
</tr>
</tbody>
</table>
Alternative A (No Action)

Direct and Indirect Effects
This alternative would not include any new activities although existing approved projects are expected to be completed. Sediment delivered to the streams would remain at current levels and would not increase as the result of this alternative. The risk of a wildfire within Steamboat project area would remain high. The risk of a wildfire in the project area would generally be expected to increase over time (Rafferty and Gies 2011). If a wildfire were to occur, sediment would be delivered to the streams. Large amounts of sediment would occur the first year after the fire and would decrease over the next three to five years as the vegetation and ground cover becomes reestablished. This was observed on the Jasper Fire area (Keyser et al. 2006).

Alternative A would not improve any of the culverts where a direct sediment source into streams exists as the result of past actions. Roads would continue to serve as a sediment source to streams at the 35 CDAs within the project area. Sedimentation levels within streams would either stay at current levels or increase with the selection of Alternative A. Meadows and hardwood stands would continue to be encroached by pine. Encroachment of pine into meadow and hardwood stands would continue, eventually leading to a reduction in meadow and hardwood acres.

Because no new activities are proposed under Alternative A, the four sensitive new road crossings included in the action alternatives (Table 3-48) would not be constructed. These areas would remain undisturbed. This alternative has the least impact on these sensitive areas.

The use of chemicals, pathogens, and pesticides would be lower in this alternative than in any of the action alternatives. Only vehicle servicing areas would be exposed within the past timber sale areas where KV activities are ongoing. There would be less equipment within the Steamboat project area and, therefore, less chance for a spill to occur. The only areas where pesticide use would occur are within past timber sale areas and in areas where county weed crews apply pesticides (primarily near private lands). For these reasons, Alternative A has the least risk to water quality from chemical, pathogen, and pesticide use as compared to the action alternatives.

Cumulative Effects
No new activities would commence under Alternative A. Harvest and post-harvest activities would continue on active sales and recently closed sales. No roads are currently planned for decommissioning. CDAs in the area would not be rehabilitated. Current grazing activities would continue under existing allotment management plans, with activities including maintenance of water development, cattle guards, and fences, and spraying weeds with herbicides. There are no known concentrated pollutant sources or chemical applications near water bodies in the Steamboat Project Area from the past or expected in the future.

Past activities, usually road related, in the project area, can contribute the largest amount of sediment to the streams. Thirty-five CDAs were identified within the Steamboat project area and all would
continue to contribute sediment until grid maintenance (every five to ten years) occurs. The number of stream crossings in the Steamboat project area would remain unchanged.

Cumulative impacts from sediment could occur if a large wildfire were to occur. At first, there would be a large flush of sediment moving downstream. The large flush of sediment would come from hillsides and roads. Sediment and ash would be deposited along floodplains and within streams. This could cause streams to change the majority size class of stream bed sediments. Usually, there is a layer of fine-sized sediment (two millimeters or less) is deposited along point bars. If there is a large flow event post-fire, mid-channel bars could develop or streambank erosion could occur. Sediment would choke the system for about three years and then start tapering off depending upon the precipitation events.

Alternative B (Proposed Action)

Direct and Indirect Effects
This alternative would treat approximately 12,456 acres (57 percent of the project area) with the intent of reducing fire hazard, reducing the risk of mountain pine beetle infestation and increasing structural diversity. Commercial and non-commercial timber harvest would be utilized to modify stand structure and reduce stand density. Harvest methods would be dependent on the terrain and include ground based and cable logging systems. Prescribed fire would be utilized to reduce the amount of available ground fuels and to mimic natural disturbance.

Commercial timber harvest proposes to treat up to 219 acres within the watershed influence zone (WIZ) under Alternative B (Table 3-49). Commercial activities would generally be limited within the WIZ. Limited mechanical entries would reduce the potential for sediment to reach streams. Activities that would occur within the WIZ are prescribed burning, designated road-stream crossings, and limited timber activities. The limited timber activities could be more aggressive around meadows. This would allow for limiting the reestablishment of pine within the meadows. These activities could occur within the 100 foot WIZ. Minimal sediment may be generated from the commercial activities, but by implementing the Forest Plan standards and guidelines, which include WCPs and BMPs, very little to no sediment would be generated and should not have an impact on the aquatics. With the full implementation of the standards and guidelines, the amount of sediment from harvest, post-harvest (KV), and fuel treatment activities is not expected to result in a significant impact on water quality. Timber harvest would have little to no effect, with a minor effect from road use compared to Alternative A.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Timber</td>
<td>0</td>
<td>219</td>
<td>628</td>
<td>156</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-commercial</td>
<td>0</td>
<td>55</td>
<td>48</td>
<td>55</td>
</tr>
<tr>
<td>Timber Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescribed Fire</td>
<td>0</td>
<td>347</td>
<td>347</td>
<td>347</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>454</td>
<td>824</td>
<td>398</td>
</tr>
</tbody>
</table>

1. There is some overlapping of prescribed burning with commercial and commercial timber activities. This number does not separate it out, but is the reason why the total activities do not sum up in the table.
There are 55 acres of non-commercial treatments within the WIZ (Table 3-49). Implementation of meadow enhancements, hardwood enhancements, and fuels treatments near Waite Gulch could cause some short-term increases of sediment into streams, primarily because these projects are within the WIZ. Approximately 206 acres are proposed for either commercial or non-commercial meadow enhancement. This would remove the small and large encroaching pines within the meadow. Approximately 630 acres are proposed for hardwood enhancement to remove pine from hardwood stands. As a result, the seed source for the trees would be further from the meadows to help negate the ability of pine encroachment into the future. This should also help maintain meadows as areas where the floodplain is wide during high flow events (i.e., during spring snowmelt and runoff) and water would be able to spread over a larger area.

All action alternatives propose 347 acres of prescribed burning within the WIZ (Table 3-49). There should be only minor sediment produced as a result of the prescribed burning because the following design criteria (WCP 13c) will be used: “conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives. This is usually done when the soil and duff are moist” (USDA-Forest Service 2006b). There may be small pockets where the soil is exposed but with organic material over most of the landscape, erosion and sedimentation should not be a problem. Implementing the WCPs would ensure that minimal sediment would reach streams especially when a thunderstorm happens after a prescribed burn.

The risk of a large wildfire would be reduced with this alternative as compared to Alternative A. As a result of the proposed treatments, a fire may not get as large as it might under Alternative A because of the large number of acres with less biomass on them and the reduced amount of accumulated fuel on the ground. The risk for a large fire to occur would still be present in the non-treated areas, which would still have a large accumulation of fuels. If a wildfire were to occur in the Steamboat project area, the size would more than likely be smaller and control efforts would be easier due to the reduction of biomass. In theory, this would mean less sediment introduced to the streams than in Alternative A and fewer impacts to the aquatic ecosystems if a large wildfire were to occur.

Approximately 20 miles of new road construction, 5 miles of road conversion, and 10 miles of temporary roads would provide access to the harvest activities. In addition to road maintenance along existing routes, road activities would be expected to contribute to erosion of the road itself and to soils located near the road. This erosion would be of varying degrees and limited to those soils near the road. Erosion can occur on cut and fill slopes, the surface of the road, or the ditch paralleling the road. The amount of erosion is affected by road surfacing, cross-drainage off the road surface, soil material of the road, and cut and fills slopes material (USDA-Forest Service 1996). Implementation of BMPs and WCPs would reduce the amount of sediment that could reach streams from the road activities.

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td>0</td>
<td>2.4</td>
<td>2.6</td>
<td>2.4</td>
</tr>
<tr>
<td>New Construction, Converted, Temporary</td>
<td>0</td>
<td>0.7</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Existing</td>
<td>9.3</td>
<td>7.1</td>
<td>6.8</td>
<td>7.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9.3</strong></td>
<td><strong>10.2</strong></td>
<td><strong>11.4</strong></td>
<td><strong>10.0</strong></td>
</tr>
</tbody>
</table>
Maintenance and temporary use of roads within the WIZ and at road-stream crossings has the potential to increase sediment. Between road conversion, proposed temporary roads, and new road conversion; there are varying amounts of new road-stream crossing. Alternative B has nine new road-stream crossings. See Table 3-50 for the miles of roads used within the WIZ for the alternatives and Table 3-51 for the number of road-stream crossings used for the alternatives. With activities at road-stream crossings and roads in the WIZ, there would be some sediment produced. It is extremely difficult to quantify how much sediment would be produced, so the amount of activity within the WIZ is used as a comparison for the alternatives. With the implementation of the standards and guidelines, the amount of sediment being introduced into streams should be minimal under Alternative B. There would be a slight increase of sediment entering the streams with the additions of 10 new stream crossings and 0.9 miles of roads within the WIZ. This should not result in a major impact to aquatic ecosystems under Alternative B, but the impact would be greater impact than Alternative A.

### Table 3-51. Road-Stream Crossings

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Routes</td>
<td>102</td>
<td>96</td>
<td>93</td>
<td>97</td>
</tr>
<tr>
<td>New Construction</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Road Conversion</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Temporary Roads</td>
<td>0</td>
<td>7</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>102</td>
<td>112</td>
<td>122</td>
<td>108</td>
</tr>
</tbody>
</table>

1. This is based on the 102 road-stream crossings surveyed in the field and there probably were some that were missed. Some of these crossings are on routes that will be converted into new system road or will be used as a temporary road.

Alternative B includes approximately 20 miles of new roads, 5 miles of unclassified routes added to the NFS, and 10 miles of temporary roads constructed to provide access to the harvest area. Approximately 10 new road-stream crossings would result from the building of new roads, conversion of unclassified routes to system roads, or temporary roads (Table 3-51). Six of these proposed road-stream crossings already exist on the ground from unclassified routes. Some of these new road-stream crossings have the potential to become CDAs. Four of these crossings were previously assessed as a CDA, but on ephemeral streams. Three of these crossings would be improved through the conversion of the routes into system roads. One existing CDA is proposed as a temporary road crossing. Closure of this route post-harvest should repair the road-stream crossing so that it is no longer a sediment contributor. All existing crossings that are a CDA are located on NFS roads. Only roads that would be used for timber harvest activities would be improved before harvest activities start. Other roads would be placed on the maintenance list for the Forest construction and maintenance crew and would be maintained as funds become available. This alternative would reduce the amount of current CDAs within the project area and, therefore; would reduce the amount of sediment that could enter the stream from roads and their stream crossings.

The design of the new road-stream crossings is expected to fully implement Forest Plan standards and guidelines, including the WCPs and BMPs. Therefore, construction of new road-stream crossings would result in no additional CDAs. During road construction activities, a short-term contribution of sediment to streams would occur. This would be minimized by following the road construction WCPs and BMPs and would last until vegetative cover is established on the cut and fill slopes and along the side of the road. The direct effect of these actions would be to reduce the number of CDAs in the project area and indirectly decrease the potential of sediment reaching the streams from roads (Table 3-52).
### Table 3-52. Number of CDAs within the Project Area.

<table>
<thead>
<tr>
<th>Watershed (HUC 7s)</th>
<th>Alternative A Existing Condition</th>
<th>Alternative B Proposed to be fixed (remaining)</th>
<th>Alternative C Proposed to be fixed (remaining)</th>
<th>Alternative D Proposed to be fixed (remaining)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10120111020105-Upper Little Elk Creek</td>
<td>3</td>
<td>0 (3)</td>
<td>1 (2)</td>
<td>0 (3)</td>
</tr>
<tr>
<td>10120111020201-Stagebarn Cyn</td>
<td>20</td>
<td>19 (1)</td>
<td>19 (1)</td>
<td>18 (2)</td>
</tr>
<tr>
<td>10120111020202-Lower Stagebarn Cyn</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10120111020203-Elk- Priest Cyn</td>
<td>2</td>
<td>0 (2)</td>
<td>2 (0)</td>
<td>0 (2)</td>
</tr>
<tr>
<td>10120111010201-Boxelder-Wilson</td>
<td>1</td>
<td>1 (0)</td>
<td>1 (0)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>10120111010202-Estes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10120111010204-Boxelder-Erskine</td>
<td>3</td>
<td>3 (0)</td>
<td>3 (0)</td>
<td>3 (0)</td>
</tr>
<tr>
<td>10120111010301-Boxelder-Doty</td>
<td>6</td>
<td>5 (1)</td>
<td>5 (1)</td>
<td>5 (1)</td>
</tr>
</tbody>
</table>

1. All routes are with a CDA located on them is either a Forest Service road or an undetermined route on NFS lands.

With the full implementation of the standards and guidelines the amount of sediment from harvest, post-harvest (KV), and fuel treatment activities is not be expected to have a negative impact on water quality for an extended amount of time past implementation. Timber harvest would have little to no effect, with a minor effect from road use compared to Alternative A.

Potential sediment yield to streams associated with all action alternatives would be less than Alternative A primarily due to the reduction of CDAs. A total of 35 CDAs occur on NFS roads within the Steamboat project area. Of these 35, 28 are proposed to be fixed under Alternative B and 7 would not be fixed. Four of the CDAs that are not proposed for repair come from undeveloped routes within the project area. These undeveloped routes are not necessary to implement the proposed activities. The remaining four CDAs not proposed for repair under Alternative B are NFS roads that do not have proposed maintenance for implementation of proposed activities. These CDAs would be fixed when the NFS roads appear on the annual maintenance list or when other funding becomes available.

All watersheds within the Steamboat project area are Condition Class III. In Condition Class III watersheds, existing CDAs would be designed such that they would no longer be CDAs. Hence, all 35 CDAs occur in a Condition Class III watershed with 28 of these CDAs proposed for repair under Alternative B (Table 3-52). Three of the CDAs proposed for repair occur on an unclassified route that would be converted to a NFS road. In addition, the design and construction of new roads would follow design criteria, including the WCPs and BMPs. New road-stream crossings on these new roads would be constructed so that they would not become sediment contributors. The Condition Class III watersheds will have 80% of the existing CDAs repaired through the implementation of timber activities. The remaining seven CDAs would be repaired; however, on a longer timescale than the other 28 CDAs. This is one trend that would help move the watersheds from Condition Class III to Condition Class II.
Overall, the impacts from sediment with this alternative would be reduced over existing conditions if no wildfires occur. There would be a slight increase in sediment in the short-term (less than 5 years) by timber harvesting, road use, repair of road-stream crossings, meadow enhancements, hardwood enhancements, fuel treatments, and prescribed burning. There should be a decrease in the long term (over 5 years) because vegetation would become established on skid trails and most CDAs within the project would be repaired. Implementation of Alternative B should not cause streams within the Steamboat project area to not meet their beneficial uses.

Alternative B includes activities that require the use of chemicals, pathogens, or pesticides. As discussed earlier, all use of these hazardous substances would be in compliance with Forest Plan standards and guidelines, WCPs, and BMPS. Therefore, the risk to water quality is reduced. However, the risk is greater in Alternative B than in Alternative A because more equipment is necessary to treat larger areas.

**Cumulative Effects**

The cumulative effects include past management activities on NFS lands and activities on private lands. The past effects of management on federal lands created minimal increases in sediment yield, except for the CDAs that have been created by road-stream crossings. Management of private lands has also created some localized impacts. There would be only minor amounts of management activity occurring in the same time and space as Alternative B. Therefore, the cumulative impacts would be very similar to the direct and indirect impacts discussed above. With the full implementation of the Forest plan standards and guidelines, which include the WCPs and BMPs, the amount of increased sediment from harvest activities would not be expected to result in a significant impact on water quality.

All watersheds within the Steamboat project area are rated as Condition Class III. These watersheds would benefit from implementation of the Steamboat Project through reduction in the number of CDAs within the project area. Continued implementation of the Forest-wide travel management plan would benefit the watersheds because fewer roads and trails would be created from cross-country travel. Conversely, ten new stream crossings are proposed under Alternative B, which could become sediment sources to streams. In addition, road construction would not benefit the watersheds in the project area. Overall, all Class III watersheds would remain at that level.

Sediment into streams could increase from the harvest activities that occur along unstable hillslopes and have a low residual basal area. If the hillslopes move into streams, a new sediment source would be created. Effects would similar to what is described under Alternative A for a large fire event for increased sediment. However, the sediment effects would be on a shorter time scale than a large fire event. As with a fire, a long-term change could occur from the increase of fine-sized sediment within the stream channel.

The likelihood of suppressing a high intensity wildfire is expected to be greater under Alternative B as compared to Alternative A. More than 9,000 acres would change from high or very high fire risk to low or moderate fire risk within the Steamboat project area under Alternative B. The hydrologic effects of intense wildfires are discussed under cumulative impacts of Alternative A. If a wildfire did occur within the Steamboat project area, the risk of adverse effects and increased sediment yield would be reduced due to implementation of Alternative B. Therefore, Alternative B is expected to have a lower risk of increased sediment yield from intense wildfires.
Current grazing activities would continue under existing allotment management plans with activities including maintenance of water development, cattle guards, and fences and spraying weeds with herbicides. There are no known concentrated pollutant sources from the past or expected in the future and no known harmful chemical applications near water bodies in the past or expected in the future within the Steamboat project area.

The potential exists for 29 different small mining operations within the Steamboat project area, although only one mining operation is currently active. By following the BMPs, sediment from the active mine should be minimal. If any of the 29 mining claims become active, BMPs would be recommended to reduce sediment that could enter the creek when Plans of Operations for the mining activities are submitted to the Forest Service.

The implementation of BMPs and WCPs would reduce or eliminate the potential for sedimentation of streams. With application of appropriate design criteria, sediment and runoff would not be expected to enter stream channels in amounts likely to adversely impact the beneficial uses of a stream. Current projects and foreseeable activities that could affect sediment yield would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.

Alternative C

Direct and Indirect Effects
This alternative would treat approximately 18,169 acres (83 percent of the project area) with the intent of reducing fire hazard, reducing the risk of mountain pine beetle infestation and increasing structural diversity across the Steamboat project area. Commercial and non-commercial timber harvest would be utilized to modify stand structure and reduce stand density. Harvest methods would be dependent on the terrain and include ground based and cable logging systems. Prescribed fire would be utilized to reduce the amount of available ground fuels and to mimic natural disturbance.

Commercial timber harvest is proposed on up to 628 acres within the WIZ under Alternative C (Table 3-51). Commercial activities would be limited within the WIZ. Limited mechanical entries would reduce the potential for sediment to reach streams. However, with 628 acres proposed for commercial activities the potential for impacts within the WIZ buffer is higher. Activities proposed in the WIZ include prescribed burning, road-stream crossings, road building, and limited timber activities. Timber activities are limited to pulling merchantable timber out from the WIZ. However, more aggressive harvesting could occur in the commercial meadow and hardwood enhancements. In these areas, heavy equipment would operate within the WIZ at some locations. Minimal sediment should be generated by timber activities by following the Forest Plan standards and guidelines, WCPs, and BMPs. The potential for sediment to reach streams is higher under Alternative C than Alternative B due to nearly three times more proposed timber activities within the WIZ under Alternative C. This level of activity would result in a sediment pulse.

Forty-eight acres of non-commercial treatments are proposed within the WIZ (Table 3-49). Implementation of meadow enhancements, hardwood enhancements, and fuels treatments could cause some short-term increases of sediment into streams, primarily because these projects are within the WIZ. Alternative C proposes the same amount of meadow and hardwood enhancement as Alternative B. The level of proposed fuels treatments are also the same in Alternative C as in Alternative B.
Potential for sediment to reach streams through implementation of these activities would the similar to what is described under Alternative B above.

Prescribed burning is proposed on the same areas in Alternative C as in Alternative B. The effects from prescribed burning would be similar to what is described under Alternative B.

The risk of a large wildfire would be reduced the most in Alternative C as compared to all other alternatives. This is due to the large amount of acreage that is proposed for treatment and the subsequent lowering of the fire hazard in treated stands. The risk for a large fire would still exist, but the spatial extent and burn severity is expected to be lowest in Alternative C. Therefore, less sediment would have the potential to reach streams and cause a major negative impact to streams and their aquatic ecosystems as the result of a large wildfire.

Approximately 41 miles of new road construction, 10 miles of road conversion, and 13 miles of temporary roads would provide access to the harvest activities. In addition, road maintenance along existing routes is expected to contribute to erosion of the road itself and of soils located near the road. Alternative C includes two miles of new road, conversion, or temporary roads within the WIZ, the amount of any alternative. As described above, under Alternative B, erosion would vary and be limited near roads. However, due to the double amount of new construction, Alternative C would have a higher sediment load entering streams from roads than Alternative B. Road design would incorporate BMPs and WCPs to reduce sediment entering nearby streams. Alternative C proposes 11 more miles of new road construction, 5 more miles of new road conversion, and 3 more miles to temporary roads compared to Alternative B. It is expected that more sediment would enter streams from implementation of Alternative C as compared to Alternative B.

The design of the new road-stream crossings is expected to fully implement Forest Plan standards and guidelines, WCPs and BMPs, resulting in no additional CDAs. During road construction activities, short-term contribution of sediment to streams would occur. Sedimentation would also be minimized by following the road construction WCPs and BMPs and would occur until vegetative cover is established on the cut and fill slopes and along the sides of the road. The direct effect of these actions would be to reduce the number of CDAs in the project area and indirectly decrease the potential of sediment reaching the streams from roads. The potential for sediment to reach streams via roads is greater under Alternative C than any other alternative.
A total of 35 CDAs occur on NFS roads within the Steamboat project area. Of these 35, thirty would be repaired under Alternative B. Three of the CDAs that are not proposed for repair come from undeveloped routes within the project area. These undeveloped routes would not be used for the proposed activities. The remaining two CDAs that are not proposed for repair under Alternative C are on NFS roads that do not have proposed maintenance for implementation of proposed activities. These CDAs would be fixed when the roads appear on the annual maintenance list or when other funding becomes available.

All watersheds within the Steamboat project area are Condition Class III. Hence, all 35 CDAs occur in a Condition Class III watershed with 30 of these CDAs proposed for repair under Alternative C (Table 3-52). Repaired CDAs would no longer be sediment contributors. Three of the CDAs proposed for repair occur on an unclassified route that would be converted into a NFS road. In addition, the design and construction of new roads would follow design criteria, WCPs and BMPs. New road-stream crossings on these new roads would be constructed in a manner that prevents them from becoming sediment contributors. The Condition Class III watersheds would have 86% of the existing CDAs repaired through the implementation of timber activities and associated road maintenance. The remaining five CDAs could eventually be fixed in time, but not in association with the Steamboat Project. Repair of CDAs would help move the watersheds from Condition Class III to Condition Class II.

Overall the impacts from sediment with this alternative would be reduced over existing conditions if no wildfires occur. There would be a slight increase in sediment in the short-term (less than 5 years) from timber harvesting, road use, repair of road-stream crossings, meadow enhancements, hardwood enhancements, fuel treatments, and prescribed burning. There would be a decrease in sedimentation in the long term (greater than 5 years) once vegetation becomes established on skid trails and the majority of CDAs are repaired. Implementation of Alternative C should not cause streams within the Steamboat project area to not meet their beneficial uses.

Almost three times more commercial activity is proposed within the WIZ under Alternative C when compared to Alternative B (Table 3-49). Almost four times more commercial activity is proposed within the WIZ in Alternative C than in Alternative D. Alternative also includes 1.4 more miles of routes within the WIZ under Alternative C as compared to Alternative D (Table 3-50). With full implementation of the standards and guidelines, WCPs and BMPs the amount of sediment from harvest, post-harvest (KV) and fuel treatment activities is not be expected to result in a negative impact on water quality. Timber harvest would have a negative effect due to sediment entering the stream from the high acreage of proposed treatment within the WIZ. Construction of 41 miles of road, 10 miles of road conversion, and 13 miles of temporary road use would result in sediment entering streams at a higher amount compared to Alternative B. Specifically, Alternative C proposes two miles of new road construction within the WIZ. Furthermore; all four of the sensitive road-stream crossings (Table 3-48) would be used under Alternative C. Alternative C would have the greatest potential for sedimentation of streams that could impair water quality, despite implementation of WCPs and BMPs.

Alternative C includes activities that require the use of chemicals, pathogens, or pesticides. As discussed earlier, all use of these hazardous substances would be compliant to Forest Plan standards and guidelines, WCPs, and BMPs. As a result, there would be a reduced risk to water quality from the use of these hazardous substances. Alternative C has a greater risk for hazardous substances to impair water
quality when compared to Alternative A because Alternative A is limited to the existing timber sale areas and identified noxious weed areas by the counties. The risk is greater in Alternative C than in Alternatives B or D because of the greater number of acres treated and, consequently, areas in need of pesticide application.

**Cumulative Effects**
Cumulative effects for Alternative C would be similar to what is described under Alternative B for grazing, mining operations, and large fire events.

All watersheds within the Steamboat Project are rated as Condition Class III. Under Alternative C, 31 road-stream crossings that are CDAs would be fixed. However, 20 new road-stream crossings are proposed under Alternative C. The benefit from improving the current CDAs would be negated by the building of 20 more stream-crossings. Implementation of Alternative C would not improve the watersheds within the Steamboat Project because of the road building and the potential increased sediment yield from harvesting on unstable hillsides.

Alternative C proposes to thin nine additional stands, as compared to Alternative B, that have been surveyed as unstable. Seven of the stands border streams or have streams flowing through them. If thinning occurs followed by a wet year, there would be a greater potential for mass movement from these hillsides. If mass movement occurs, there could be adverse cumulative effects downstream of the landslide due to the sediment increase. However, the stream would be able to redefine its morphology and stabilize in less time than compared to a large-scale fire event (i.e., in months instead of years).

The risk for a large fire event should be lower under this alternative because of the increased acres that are proposed for treatment as compared to all other alternatives. The potential for a cumulative impact from fire should be less, however; if a fire does occur the results would be the same as described under Alternative B.

The implementation of BMPs and WCPs would reduce sediment potential. With application of appropriate design criteria, sediment and runoff would not be expected to enter stream channels in amounts likely to adversely impact the beneficial uses of a stream. Current projects and foreseeable activities that could affect sediment yield would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.

**Alternative D**

**Direct and Indirect Effects**
This alternative would treat approximately 9,514 acres (43 percent of the project area) with the intent of reducing fire hazard, reducing the risk of mountain pine beetle infestation and increasing structural diversity. Commercial and non-commercial timber harvest would be utilized to modify stand structure and reduce stand density. Harvest methods would be dependent on the terrain and include ground based and cable logging systems. Prescribed fire would be utilized to reduce the amount of available ground fuels and to mimic natural disturbance.

Commercial timber harvest proposes to treat up to 156 acres within the WIZ under Alternative D (Table 3-49). Commercial activities would be limited within the WIZ. Limited mechanical entries would reduce
the potential for sediment to reach streams. Alternative D proposes the least amount of acreage to be
treated within the WIZ. This would greatly reduce the potential for sediment to reach streams.
Activities occurring in the WIZ include prescribed burning, road-stream crossings, road building, and
limited timber activities. The limited timber activities are constrained to pulling merchantable timber
out of the WIZ. However, more aggressive harvesting would occur in the commercial meadow and
hardwood enhancements. In these areas heavy equipment would be within the WIZ at some locations.
Minimal sediment should be generated by timber activities by following the Forest Plan standards and
guidelines, WCPs, and BMPs. Alternative D has the lowest risk of any action alternatives for sediment to
reach streams from the proposed activities. The risk of sediment to reach streams is only slightly
greater than Alternative A, the no action alternative. The potential sediment that could reach streams
would be almost negligible as compared to Alternative A, making Alternative D the least impactful action
alternative for aquatic ecosystems in relation to timber activities.

Fifty-five acres of non-commercial treatments are proposed within the WIZ (Table 3-49).
Implementation of meadow enhancements, hardwood enhancements, and fuels treatments could cause
some short-term increases of sediment into streams, primarily because these projects are within the
WIZ. Alternative D proposes the same amount of meadow and hardwood enhancement as Alternative
B. Fuels treatments are also the same in Alternative D as in Alternative B. Potential for sediment to
reach streams through implementation of these activities would the similar to what is described under
Alternative B. Prescribed burning is also proposed on the same areas as in Alternative B as in
Alternative D; the effects from prescribed burning would be similar to what is described under
Alternative B.

The risk of a large fire would be reduced the least under Alternative D as compared to all other action
alternatives. However, fire risk would be lower as compared to Alternative A. In relation to a large fire,
Alternative D has the highest potential of any action alternative to provide sediment to streams as a
result of a large wildfire, impacting aquatic ecosystems.

Approximately four miles of road conversion and eight miles of temporary roads would provide access
to the harvest units. No new road construction is proposed with Alternative D. Only 0.7 miles more of
system or temporary road would be used within the WIZ in this alternative compared to Alternative A.
Alternative D adds the least amount of road of any action alternative within the WIZ. As describe above,
under Alternative B, erosion would vary and be limited to areas near roads. The majority of erosion
from roads occurs during new construction. Because Alternative D does not include any new road
construction, the potential for sedimentation is much lower than it is for Alternatives B or C. The level
of sedimentation under Alternative D would be similar to Alternative A. Alternative D is the least
impactful alternative for sediment reaching streams. Levels of sediment would remain at or near
existing levels under Alternative D and a sediment pulse resulting from new construction would not
occur.

Under Alternative D, approximately four miles of non-system routes would be added to the NFS and
eight miles of temporary roads would be used to provide access to the harvest units. Approximately six
new road-stream crossings would be created from conversion of unclassified routes to system roads or
temporary roads (Table 3-51). Three of these proposed road-stream crossings already exist on the
ground along non-system routes. Some of these new road-stream crossings have the potential to
become CDAs. Three of these crossings were previously assessed as a CDA, but on ephemeral streams.
Two of these crossings would be improved through the conversion of the routes into system roads. One existing CDA is proposed to be a temporary road crossing. Closure of this route post-harvest should repair the road-stream crossing so that it is no longer a sediment contributor. All existing crossings that are a CDA are located on NFS roads. Furthermore, only two crossings would be used that are sensitive watershed areas (Table 3-48). Only roads that would be used for timber harvest activities would be improved before harvest activities start. Other roads would be placed on the maintenance list and fixed as funds become available. This alternative would reduce the amount of current CDAs within the project area and, therefore, would reduce the amount of sediment that could enter the stream from roads and stream crossings.

New road-stream crossings are expected to fully implement standards and guidelines, WCPs and BMPs, which would avoid the creation of additional CDAs. The effect of the proposed road conversion and maintenance activities would be a reduction in the number of CDAs and a decrease in the potential for sediment to reach the streams from roads. This is the lowest under Alternative D as compared to the other action alternatives. Potential for sediment to reach streams would be only slightly higher under Alternative D than Alternative A.

A total of 35 CDAs occur on NFS roads within the Steamboat project area. Of these 35, twenty-seven are proposed for repair under Alternative D. Two of the CDAs that are not proposed for repair come from undeveloped routes within the project area. These undeveloped routes would not be used for the proposed activities. The remaining six CDAs that are not proposed for repair under Alternative D are on NFS roads that are not proposed for maintenance and are not needed for implementation of proposed activities. These CDAs could be repaired at a future date when they appear on the annual maintenance list or when other funding becomes available.

All watersheds within the Steamboat project area are Condition Class III. Hence, all 35 CDAs occur in a Condition Class III watershed with 27 of these CDAs proposed for repair under Alternative D (Table 3-52). These existing CDAs would no longer be sediment contributors. Two of the CDAs proposed for repair occur on an unclassified route that would be converted into a NFS road and one would be fixed during temporary road closure. New road-stream crossings would be constructed so that they would not become sediment contributors. The Condition Class III watersheds would have 77% of the existing CDAs repaired under Alternative D, helping move the watersheds from Condition Class III to Condition Class II.

Overall the impacts from sediment under this alternative would be reduced over existing conditions if no wildfires occur. There would be a slight increase in sediment in the short-term (less than 5 years) by timber harvesting, road use, repair of road-stream crossings, meadow enhancements, hardwood enhancements, fuel treatments, and prescribed burning. There would be a decrease in sediment in the long term (greater than 5 years) because vegetation will become established on skid trails and 27 CDAs will be repaired. Implementation of Alternative D would not cause streams within the Steamboat project area to not meet their beneficial uses.

Alternative D proposes the least amount of commercial activity within the WIZ as compared to Alternative B and Alternative. There are 0.7 new miles of routes within the WIZ under Alternative D as compared to Alternative A. This is the least amount of new roads within the WIZ of all action alternatives. With full implementation of the Forest Plan standards and guidelines, WCPs and BMPs, the
amount of sediment from harvest, post-harvest (KV), and fuel treatment activities is not expected to result in a negative impact on water quality and should mirror existing conditions. Timber harvest would result in a minimal increase of sediment entering streams due to the low acreage proposed for treatment within the WIZ. Erosion would not occur from road construction, the largest sediment contributor, because no new roads would be built. Alternative D proposes only four miles of road conversion and eight miles of temporary road use. This lower mileage would dramatically lower the sediment pulse, especially compared to Alternative C. Temporary roads would be rehabilitated during post-harvest cleanup. Also, only two of the sensitive crossings would be used under Alternative D (Table 3-48). The protection of these sites is one of the biggest benefits of Alternative D. Alternative D would have the lowest potential of any action alternative for sediment entering streams that could impair water quality.

Alternative D includes activities that require the use of chemicals, pathogens, or pesticides. As discussed above, all use of these hazardous substances would comply with Forest Plan standards and guidelines, WCPs, and BMPS. These guidelines would result a reduced risk to water quality from the use of these hazardous substances. Alternative D has the lowest potential for impairment of water quality from hazardous substances as compared to Alternative B or Alternative C.

**Cumulative Effects**

Cumulative effects for Alternative D would be similar to what is described under Alternative B for grazing, mining operations, and a large fire event.

Again, all watersheds within the Steamboat Project are rated as Condition Class III or impaired watersheds. Under Alternative D, 27 road-stream crossings that are CDAs would be fixed. Six new road-stream crossings are proposed under Alternative D. The benefit from improving the current CDAs would be about the same as the impact of building six new road-stream crossings. Implementation of Alternative D would not improve the watersheds within the Steamboat Project because of the road activities and the potential increased sediment yield from harvesting on unstable hillsides.

Alternative D proposes to thin fewer stands that have been surveyed as unstable as compared to the other action alternatives. Only two stands (081708-90, 081510-35) have a proposed commercial thinning activity where the entire stand is rated unstable. Alternative D has the lowest potential to have increase sediment to reach streams from mass movement because there is less potential for mass movement to occur from timber activities.

The risk for a large fire event should be lower under this alternative as compared to Alternative A. However, the fire risk would be this highest as compared to the other action alternatives. This is due to the lower amount of acreage that is proposed for treatment compared to the other action alternatives. The potential for a cumulative impact from fire could be higher. If a fire does occur, the results would be the same as described under Alternative B.

The implementation of BMPs and WCPs would reduce sediment potential. With application of appropriate design criteria, sediment and runoff would not be expected to enter stream channels in amounts likely to adversely impact the beneficial uses of a stream. Current projects and foreseeable activities that could affect sediment yield would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.
**Bed and Bank Stability**

**Alternative A (No Action)**

**Direct and Indirect Effects**
Existing timber harvest, post-harvest activities (KV), travel management, grazing, and mining activities would continue under this alternative. Also, private lands within the forest continue to develop. If private lands near streams continue to develop this would affect the stream bank and bank stability through structure encroachment into the floodplain and road-stream crossings (including culverts and other crossing structures). Road maintenance would still occur under this alternative. Road-stream crossings would only be repaired when the road came up on the annual work schedule (approximately every five to seven years). This alternative does not propose any new activities within the Steamboat project area, so bed and bank stability would not be affected and would generally be expected to remain similar to the existing condition.

**Cumulative Effects**
Past activities in the Steamboat project area that have contributed to bank instability are primarily from cattle grazing, as well as road and trail construction and mining. Grazing impacts on stream bank stability have been noted in stream health surveys that were conducted for this project or that overlapped with the Livestock Grazing Environmental Assessment (USDA-Forest Service 1997). Changes to grazing management are not part of this decision. Currently, the Elk allotment is vacant. Bed and bank stability should be recovering from past cattle grazing and little bed and bank stability is expected in the future. There would be no additional cumulative impacts on bed and back stability in the Steamboat project area with this alternative because no new activity is proposed.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**
Alternative B includes commercial and non-commercial vegetation management. The proposed activities as part of this alternative would not have an impact on bed and bank stability because the project activities would occur away from stream banks. Perennial and intermittent streams have a WIZ restriction (100 feet on each side from bank full) where no mechanical activities could occur. Ephemeral streams are also protected under the WCPH Management Measure 3(c) “Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings” (USDA-Forest Service 2006b).

Meadow enhancements, hardwood enhancements, and fuel treatments would occur within the WIZ. However, these activities should not disturb any riparian vegetation that is immediately adjacent to the stream banks. This would allow stream banks to remain undisturbed from these proposed activities.

Existing road-stream crossings and proposed new road-stream crossings would disturb stream banks either permanently or temporarily. The nine new road-stream crossings to become system roads would be permanently altered. The seven proposed temporary roads should affect stream banks temporarily (i.e., about 10 years) until the stream and riparian vegetation could re-establish the stream bank. These crossings would occupy a very small area in those streams where they would be constructed. These new road-stream crossings would be designed and constructed to follow the Forest Plan standards and
guidelines, which include WCPs and BMPs, and the design criteria. Therefore, these new crossings would have a limited effect on streambed and bank stability.

Alternative B includes reconditioning the stream crossing of Little Elk Creek by FSR 224.1B. This would positively benefit Little Elk Creek downstream of the crossing. Downstream streambanks would become more stable because less erosion of streambanks at the crossing would occur. Streambanks would be affected by new roads at three sites (Table 3-48). If the road crossings are built to engineering standards and follow the WCPs and BMPs, then the effect of the instable banks at these sensitive crossings would be lessened. The most sensitive crossing, located in T4N, R5E, Section 33, is proposed for a temporary road crossing. The streambank would be affected there until harvest activities cease and sufficient time has passed for the stream to recover (about 5-10 years). This streambank may not fully recover to its existing condition due to the loss of riparian vegetation and subsequent soil compaction from the temporary road.

Streambank stability would be affected by 10 additional stream crossings proposed in Alternative B as compared to Alternative A. However, fixing some of the existing bad crossings (such as FSR 224.1B) would improve streambank stability in areas where it is currently affected by roads.

**Cumulative Effects**

There would be a positive cumulative impact on bed and bank stability in the Steamboat project area with Alternative B through repair of the CDAs. The only negative impact would be the construction of 10 new road-stream crossings. No other impacts are expected because activities near streambanks would be limited through the implementation of the WIZ buffer. The overall impact on bed and bank stability would be positive.

Streambank stability would be impacted at a limited number of sites (Table 3-48). If the WCPs and BMPs are followed at these sites, negative impacts would not occur. However, if the WCPs and BMPs are not followed the potential exists for impacts to the stream bed and bank stability at these locations.

**Alternative C**

**Direct and Indirect Effects**

Alternative C includes commercial and non-commercial vegetation management. The proposed activities as part of this alternative would not have an impact on bed and bank stability because the project activities would be away from stream banks. Perennial and intermittent streams have a WIZ restriction (100 feet on either side from bank full) where no mechanical activities could occur. Ephemeral streams are also protected under the WCPH Management Measure 3(c) “Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings” (USDA- Forest Service 2006b)

Meadow enhancements, hardwood enhancements, and fuel treatments would occur within the WIZ. However, these activities should not disturb any riparian vegetation that is immediately adjacent to the stream banks. This would allow stream banks to remain undisturbed from these proposed activities.

Existing road-stream crossings and proposed new road-stream crossings would disturb stream banks either permanently or temporarily. The 19 new road-stream crossings on system roads would be
permanently altered. The 10 proposed temporary roads would affect stream banks temporarily (about 10 years) until the stream and riparian vegetation becomes reestablished on the stream bank. The effects of the new road crossings would be the greatest under Alternative C as compared to the other action alternatives.

Alternative C includes reconditioning the stream crossing of Little Elk Creek by FSR 224.1B. This would positively benefit Little Elk Creek downstream of the crossing. Effects of repairing this crossing would be the same as described in Alternative B. Alternative C includes four sensitive stream crossing sites where streambanks would be affected from new roads (Table 3-48). If the road crossings are built to engineering standards and follow the WCPs and BMPs, the effects to instable banks at these sensitive crossings would be lessened. The most sensitive crossing, located in T4N, R5E, Section 33, is proposed for a temporary road crossing. Effects at this stream crossing would be the same as described under Alternative B. Alternative C would have the greatest effect on streambank stability at the sensitive sites.

Streambank stability would be affected by the 20 additional stream crossings proposed in Alternative C as compared to Alternative A. However, repair of some existing bad crossings (such as FSR 224.1B) would improve streambank stability in areas where it is currently affected by roads.

**Cumulative Effects**

There would be a positive cumulative impact on bed and bank stability in the Steamboat project area with Alternative C because of the repair of CDAs with a corresponding negative impact from the construction of 20 new road-stream crossings under Alternative C. Due to implementation of the WIZ buffer, no other impacts to stream bed and bank stability are expected.

Streambank stability would be impacted at the sites identified in Table 3-48. If the WCPs and BMPs are followed at these sites, no impacts contributing to cumulative effects should occur. However, if the WCPs and BMPs are not followed the potential exists for impacts to stream bed and bank stability at these locations.

**Alternative D**

**Direct and Indirect Effects**

Alternative D includes commercial and non-commercial vegetation management. The proposed activities as part of this alternative would not have an impact on bed and bank stability because the project activities would occur away from stream banks. Perennial and intermittent streams have a WIZ restriction (100 feet on either side from bank full) where no mechanical activities could occur. Ephemeral streams are also protected under the WCPH Management Measure 3(c) “Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings” (USDA-Forest Service 2006a).

Meadow enhancements, hardwood enhancements, and fuel treatments would occur within the WIZ. However, these activities would not disturb any riparian vegetation that is immediately adjacent to the stream banks. This would allow stream banks to remain undisturbed from these activities.

Existing road-stream crossings and proposed new road-stream crossings would disturb stream banks either permanently or temporarily. The four new road-stream crossings to become system roads would
be permanently altered. The seven proposed temporary roads would affect stream banks temporarily (about 10 years) until the stream and riparian vegetation could re-establish the stream bank. The effects of these stream crossings would be similar to what is described under Alternative B. However, there would be less of an effect on streambanks from the new system roads because there would be only four new system road crossings in Alternative D as compared to seven in Alternative B.

Alternative D includes reconditioning the crossing at FSR 224.1B and Little Elk Creek. Effects of this action would be the same as described under Alternative B. Two sites at sensitive stream crossings would be affected by newly converted roads. The effects of these two crossings would be the same as described under Alternative B.

Streambank stability would be affected by the six additional stream crossings proposed in Alternative D as compared to Alternative A. However, repair of existing bad crossings (such as FSR 224.1B) would improve streambank stability in areas where it is currently affected by roads.

Cumulative Effects
There would be a positive cumulative impact on bed and bank stability in the Steamboat project area under Alternative D through the repair of existing CDAs. The only negative impact would be the construction of six new road-stream crossings. No other expected impacts to stream bed and bank stability are expected due to implementation of the WIZ buffer. Overall, there would be a positive cumulative impact from the proposed activities on bed and bank stability.

Streambank stability would be impacted at the sites identified in Table 3-48. If the WCPs and BMPs are followed at these sites, impacts would not occur. However, if the WCPs and BMPs are not followed the potential exists for impacts to the stream bed and bank stability at these locations.

Flow Regimes

Alternative A (No Action)

Direct and Indirect Effects
Since no activities are associated with Alternative A, water flow volumes would remain dependent upon precipitation variability in the short term. Existing vegetation structures would persist until the next high-intensity wildfire. Until that time, vegetation growth may slightly diminish water yield due to the increase of interception and higher evapotranspiration rates (Neary et al. 2005).

Since no rehabilitation of CDAs would occur, the current road system would continue to support increased water yield since the drainage network extension would persist. Peak flows would remain at a higher level than they would be without a road network on the landscape, and the timing of those flows would continue to accelerate. Planned maintenance work on system roads, unrelated to the Steamboat Project, would improve some of the CDA problems along the stream channels. However, no improvement of unclassified roads would occur unless it is related to implementation of the Forest-wide travel management plan. National Forest System roads that need more work than annual maintenance provides would still have CDAs contributing sediment to the stream until this area came up on the grid maintenance schedule. As the private inholdings continue to be developed within the project area,
there is a chance that water yield could be affected from development and road building. This could also extend the drainage network from roads and could increase the timing and intensity of peak flows.

Wildfire could also play a role with flow regimes. The area has a high risk for large wildfires. If a large, high-severity fire were to occur, flow regimes would be positively affected by the destruction of live trees resulting in more water available for streamflow and ground water recharge.

This alternative would not result in any new activities within the project area. The result of not taking action is that biomass would continue to increase, which would generally reduce the amount of water available for streamflow and ground water recharge. However, in the Steamboat project area, the dense stands of timber have a high risk of mountain pine beetle infestation, which would reduce the live biomass. This would have a positive effect on the flow regime by making more water available for streamflow or ground water recharge that has been lost from increased evapotranspiration rates.

**Cumulative Effects**

Past activities and fire suppression policies within the Steamboat project area have influenced flow regimes. Fire suppression has reduced water available for streamflow through increased biomass and subsequent higher evapotranspiration. The existing flow regimes would continue under this alternative. The project area also has a high risk for fire due to this succession. Increases in runoff and peakflow events following wildfire can be of concern where watershed features permit a higher probability of flooding and debris flows (Driscoll et al. 2004). If a large high intensity wildfire occurs in the future, flow regimes could be impacted from reduced infiltration rates. Alternative A would have no cumulative impacts on flow regimes unless a high-intensity wildfire occurs.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

Minimal increases in streamflow volume would result from timber harvest, post-harvest activities (KV), road management, and fuels treatment activities proposed under Alternative B. All treatments (including prescribed fire) are designed to leave some level of vegetation on the landscape. Regeneration and accelerated growth of remaining vegetation would balance the loss of evapotranspiration from harvested trees within several years.

This alternative includes commercial and non-commercial vegetation management. Timber activities would have the greatest effect on the flow regime. The commercial timber harvest of up to 10,048 acres and the non-commercial treatment of another 2,408 acres (including prescribed burning-only treatments) in this alternative would have a positive effect on flow regime by the removal of live vegetation from the landscape, which would be beneficial in comparison to Alternative A. However, if a large wildfire was to occur under Alternative A, this statement would not be correct and Alternative A would have the most effect on flow regime. The commercial and non-commercial treatments would also reduce the risk of a large wildfire, but large areas with dense timber susceptible to fire would still remain. Wildfires may not grow as large under this alternative due to the reduction in biomass. This would, in turn, move the flow regime back towards levels prior to the era of fire suppression but at levels lower than pre-settlement conditions. The non-commercial timber activities would have a short-term positive effect because of the reduction in biomass, but as the remaining trees grow, the space
that was occupied by the harvested trees would be eliminated. Overall, this alternative is more beneficial than Alternative A for restoring flow regimes, even if a large wildfire was to occur.

The greatest potential for increasing water yield comes from increasing soil compaction, which decreases water movement into the soil causing soil runoff where it did not occur previously. Alternative B proposes a total of 454 acres of activity (e.g. timber harvest and prescribed burning) within the WIZ. The potential effects would be mitigated by keeping the disturbed soil area below 15 percent of each unit area and leaving the WIZ undisturbed. This should occur except at areas proposed for non-mechanical non-commercial thinning, meadow enhancement, hardwood enhancement, and prescribed burning to buffer streams from ground disturbance. The WIZ is a minimum of 100 feet from stream banks for all perennial and intermittent streams (USDA-Forest Service 2006a). The WIZ in perennial and some intermittent streams typically contains a riparian ecosystem that transitions into terrestrial vegetation. The vegetation in this zone is important for filtering flow and sediment, providing shade to the stream, and providing large woody debris necessary for aquatic habitat and channel stability.

Prescribed burning is proposed for 10,068 acres under Alternative B. Prescribed burning may cause the removal of forest vegetation as well as the duff layer that covers the forest floor. Duff removal is not expected to be widespread, as burn intensities are not high enough and residence times are not long enough. However, burning activities would expose pockets of bare mineral soil. These pockets are generally small and dispersed enough to prevent detrimental runoff and hillslope erosion from occurring. Attempts would be made to retain as much duff as possible on steep slopes in the Steamboat project area. This would reduce harmful runoff and sedimentation (Neary et al. 2005). The proposed stand thinning and fuels treatments in this alternative would reduce the risk of high-intensity wildfire and the adverse effects to the streamflow regime often associated with such an event.

New road construction of 20 miles and 10 miles of temporary road use would increase road density in all watersheds in the Steamboat project area. No new stream crossings on perennial streams are proposed under Alternative B. Three proposed stream crossings on intermittent streams are included in Alternative B. Three crossings that would occur along sensitive areas along intermittent streams are included (Table 3-50). These are located near springs, wetlands, or meadows. In particular, the Little Elk Creek tributary in T4N, R5E, Section 33 is the most sensitive crossing. This is due to the proximity downstream of a spring-wetland complex and upstream of the switch from intermittent to perennial stream flow. The other four road-stream crossings are on ephemeral streams and still could affect the amount of CDAs within the project area. Roads can convert subsurface runoff into surface runoff which would then flow to stream channels, increasing peak flows (USDA-Forest Service 1996). To minimize soil and water effects from road construction, road design and construction would follow design criteria, WCPs, and BMPs. Flow regimes do not appear to be adversely affected by dense road networks in the Black Hills (USDA-Forest Service 1996). However, increased road density could have some impacts to stream flow regimes within the project area.

Under Alternative B, the greatest increase in road density would be in the Boxelder-Doty watershed, increasing by 1.9 mi/sq mi, (Table 3-53). Both the Lower Stagebarn watershed and Boxelder Wilson watersheds increase their road density by 1.8 mi/sq mi. These three watersheds would have the biggest impact to streamflow regime under Alternative B. The remaining watersheds have an increase in road density ranging from 0.4 mi/sq mi (in Upper Little Elk Creek Watershed) to 1.4 mi/sq mi in Boxelder-Erskine. No watersheds decreased their road density because no roads were proposed for...
decommissioning under the Steamboat Project. Construction of the new roads would occur in all watersheds. Again the proposed new roads would be constructed following design criteria, WCPs, and BMPs.

### Table 3-53. Road Density Alternative Comparison

<table>
<thead>
<tr>
<th>Watershed (HUC7)</th>
<th>Watershed Size – acres (mi²) Within project area</th>
<th>Existing Road Density / Alternative A (mi/sq mi)</th>
<th>Alternative B New roads Potential road density (change)</th>
<th>Alternative C New roads Potential road density (change)</th>
<th>Alternative D New roads Potential road density (change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10120111020105-Upper Little Elk Creek</td>
<td>7187 (11.2 mi²)</td>
<td>55.2 mi 4.9 mi/mi²</td>
<td>59.2 mi 5.3 mi/mi² ↑0.4</td>
<td>62.8 mi 5.6 mi/mi² ↑0.7</td>
<td>55.6 mi 5 mi/mi² ↑0.1</td>
</tr>
<tr>
<td>10120111020201-Stagebarn Cyn</td>
<td>8302 (13 mi²)</td>
<td>36.9 mi 2.8 mi/mi²</td>
<td>48.2 mi 3.7 mi/mi² ↑0.9</td>
<td>58.4 mi 4.5 mi/mi² ↑1.7</td>
<td>42.3 mi 3.3 mi/mi² ↑0.5</td>
</tr>
<tr>
<td>10120111020202-Lower Stagebarn Cyn</td>
<td>208 (0.4 mi²)</td>
<td>1.4 mi 3.5 mi/mi²</td>
<td>2.1 mi 5.3 mi/mi² ↑1.8</td>
<td>2.8 mi 7 mi/mi² ↑3.5</td>
<td>2.1 mi 5.3 mi/mi² ↑1.8</td>
</tr>
<tr>
<td>10120111010201-Elk-Priest Cyn</td>
<td>993 (1.6 mi²)</td>
<td>3.6 mi 2.3 mi/mi²</td>
<td>4.9 mi 3.1 mi/mi² ↑0.8</td>
<td>7.6 mi 4.8 mi/mi² ↑2.5</td>
<td>4.7 mi 2.9 mi/mi² ↑0.6</td>
</tr>
<tr>
<td>10120111010202-Boxelder-Wilson</td>
<td>1496 (2.3 mi²)</td>
<td>4.9 mi 2.1 mi/mi²</td>
<td>8.9 mi 3.9 mi/mi² ↑1.8</td>
<td>9.3 mi 4 mi/mi² ↑1.9</td>
<td>6.4 mi 2.8 mi/mi² ↑0.7</td>
</tr>
<tr>
<td>10120111010202-Estes</td>
<td>910 (1.4 mi²)</td>
<td>3 mi 2.1 mi/mi²</td>
<td>4.3 mi 3.1 mi/mi² ↑1</td>
<td>4.7 mi 3.4 mi/mi² ↑1.3</td>
<td>3.3 mi 2.4 mi/mi² ↑0.3</td>
</tr>
<tr>
<td>10120111010204-Boxelder-Erskine</td>
<td>3742 (5.9 mi²)</td>
<td>17.1 mi 2.9 mi/mi²</td>
<td>25.1 mi 4.3 mi/mi² ↑1.4</td>
<td>30.9 mi 5.2 mi/mi² ↑2.3</td>
<td>18.5 mi 3.1 mi/mi² ↑0.2</td>
</tr>
<tr>
<td>10120111010301-Boxelder-Doty</td>
<td>873 (1.4 mi²)</td>
<td>4.8 miles 3.4 mi/mi²</td>
<td>7.4 mi 5.3 mi/mi² ↑1.9</td>
<td>7.6 mi 5.4 mi/mi² ↑2</td>
<td>6.2 mi 4.4 mi/mi² ↑1</td>
</tr>
</tbody>
</table>

All watersheds within the Steamboat project area are rated as Condition Class III watersheds. Appendix J of the Revised Forest Plan FEIS explains the rationale for Condition Class ratings for watersheds (USDA-Forest Service 1996). Roads are an important factor for rating the sensitivity of the watershed and the base impacts to the watershed. Alternative B proposes to increase the road density in all watersheds. This would increase the watershed sensitivity and impact index. Implementation of Alternative B would move the watersheds further away from being rated as a Condition Class II watershed because the road impact index would increase in all watersheds.

**Cumulative Effects**

Past activities and fire suppression policies in the Steamboat project area have influenced flow regime. The cumulative effect of Alternative B on flow regimes would be similar to Alternative A. The only difference would be that while high-intensity crown fires would be possible under either alternative,
vegetative treatments implemented in Alternative B would generally be expected to lower the severity and extent of the effects associated with a wildfire event.

There would be a limited positive cumulative impact of water available for streamflow or ground water recharge. However, over time, biomass would continue to accumulate, making less water available for streamflow or groundwater recharge. If a wildfire were to occur, the live biomass would be reduced and more water would be available for streamflow or groundwater recharge. In the short term, the proposed action would help restore the flow regimes minimally by removing some biomass.

**Alternative C**

**Direct and Indirect Effects**

Again, minimal increases in streamflow volume would result from timber harvest, post-harvest activities (KV), road management, and fuels treatment activities proposed under Alternative C. All treatments (including prescribed fire) are designed to leave some level of vegetation on the landscape. Regeneration and accelerated growth of remaining vegetation would balance the loss of evapotranspiration from harvested trees within several years.

This alternative includes commercial and non-commercial vegetation management. Timber activities would have the greatest effect on the flow regime. The commercial timber harvest of up to 16,588 acres and the non-commercial treatment of another 1,581 acres (including prescribed burning-only treatments) in this alternative would have a positive effect on flow regime through the removal of live vegetation from the landscape. This alternative proposes treatment on more acres than Alternative B leading to a greater positive effect. The commercial and non-commercial treatments would also reduce the risk of a large wildfire but large areas of dense timber would remain susceptible to fire. Wildfires may not get as large under this alternative due to the reduction in biomass. This would move the flow regime back towards levels that existed prior to the era of fire suppression but at a level lower than pre-settlement conditions. The non-commercial timber activities would have a short-term positive effect because of the reduction in biomass, but as the remaining trees grow, the space that was occupied by the harvested trees would be eliminated. This alternative has the greatest effect in restoring flow regimes, even if a large wildfire was to occur.

The greatest potential for increasing water yield comes from increasing soil compaction, which decreases water movement into the soil causing soil runoff where it did not occur previously. Alternative C proposes a total of 824 acres of activity within the WIZ. The potential effects would be mitigated by keeping the disturbed soil area below 15 percent of each unit area and leaving the WIZ undisturbed. This should occur except at areas proposed for non-mechanical pre-commercial thinning, meadow enhancement, hardwood enhancement, and prescribed burning to buffer streams from ground disturbance. The WIZ is, at a minimum, 100 feet from stream banks for all perennial and intermittent streams (USDA-Forest Service 2006a). The WIZ in perennial and some intermittent streams typically contains a riparian ecosystem that transitions into terrestrial vegetation. The vegetation in this zone is important for filtering flow and sediment, providing shade to the stream, and providing large woody debris necessary for aquatic habitat and channel stability. Due to the high amount of acreage proposed for treatment within the WIZ under Alternative C, the risk of some soil compaction that could help increase overland flow reaching streams exists. Alternative C has the greatest risk of this occurring because of the high amount of acreage proposed for treatment within the WIZ.
Prescribed burning is proposed for the same acreage in Alternative C as in Alternative B. The effects of prescribed burning on streamflow regime should be the same under Alternative C as described above in Alternative B.

New road construction of 41 miles and 13 miles of temporary road use would increase road density in all watersheds in the Steamboat project area. No new stream crossings are proposed on perennial streams under Alternative C. Twelve stream crossings are proposed on intermittent streams in Alternative B. Four of these crossings would occur in sensitive areas along intermittent streams (Table 3-50). These are located near springs, wetlands, or meadows. In particular, the Little Elk Creek tributary in T4N, R5E, Section 33 is the most sensitive crossing, as described in Table 3-48. The other eight road-stream crossings are on ephemeral streams and could still affect the amount of CDAs within the project area. To minimize soil and water effects from road construction, road design and construction would follow design criteria, WCPs, and BMPs.

Under Alternative C, the greatest increase in road density would be in the Lower Stagebarn Watershed, increasing by 3.5 mi/sq mi (Table 3-53). Overall, four watersheds would increase their road density by over 2 mi/sq mi. These four watersheds would have the biggest impact to streamflow regime in respect to roads under Alternative C. The remaining watersheds would have an increase ranging from 0.7 mi/sq mi in Upper Little Elk Creek Watershed to 2.5 mi/sq mi in Elk-Priest Canyon Watershed. No watersheds would experience a decrease in their road density because no roads are proposed to for decommissioning. Construction of new routes would occur in all watersheds. Alternative C would have the most impact on stream flow regime by having more roads to divert overland flows to enter streams sooner; especially during times of high flow events (e.g. spring flooding).

All watersheds within the Steamboat project area are rated as Condition Class III watersheds. Appendix J of the Revised Forest Plan FEIS explains the rationale for Condition Class ratings for watersheds (USDA-Forest Service 1996). Roads are an important factor for rating the sensitivity of the watershed and the base impacts to the watershed. Alternative C proposes to increase the road density in all watersheds. This would increase the watershed sensitivity and impact index. Implementation of Alternative C would move the watersheds further away from Condition Class II conditions at a higher degree than Alternatives B or D.

**Cumulative Effects**

Past activities and fire suppression policies in the Steamboat project area have influenced flow regime. The cumulative effect of Alternative C on flow regimes would be similar to Alternatives A and B as described above.

**Alternative D**

**Direct and Indirect Effects**

Minimal increases in streamflow volume would result from timber harvest, post-harvest activities (KV), road management, and fuels treatment activities proposed under Alternative D. All treatments (including prescribed fire) are designed to leave some level of vegetation on the landscape. Regeneration and accelerated growth of remaining vegetation would balance the loss of evapotranspiration from harvested trees within several years.
This alternative includes commercial and non-commercial vegetation management. Timber activities would have the greatest effect on the flow regime. The commercial timber harvest of up to 7,106 acres and the non-commercial treatment of another 2,408 acres (including prescribed burning-only treatments) in this alternative would have a positive effect on flow regime by the removal of live vegetation from the landscape. This alternative proposes to treat the least amount of acres compared to the other action alternatives. The commercial and non-commercial treatments would reduce the risk of a large wildfire, but large areas with dense timber susceptible to fire would still exist. Wildfires may not get as large under this alternative due to the reduction in biomass. This, in turn, would keep the flow regime closer to current levels. Non-commercial timber activities would have a short-term positive effect because of the reduction of biomass, but as the remaining trees grow, the space that was occupied by the harvested trees would be eliminated. This alternative is the least effective action alternative for restoring flow regimes.

The greatest potential for increasing water yield comes from increasing soil compaction, which decreases water movement into the soil, causing soil runoff where it did not occur previously. Alternative D proposes a total of 398 acres of activity within the WIZ (Table 3-49). The potential effects would be mitigated by keeping the disturbed soil area below 15 percent of each unit area and leaving the WIZ undisturbed. This should occur except at areas proposed for non-mechanical non-commercial thinning, meadow enhancement, hardwood enhancement, and prescribed burning to buffer streams from ground disturbance. Potential exists for soil compaction under Alternative D, but the risk is less than Alternatives B or C. Alternative D proposes almost half the amount of disturbance proposed under Alternative C, greatly reducing the possibility of soil compaction within the WIZ.

Prescribed burning is proposed for the same acreage in Alternative D as in Alternatives B and C. The effects of prescribed burning on streamflow regime should be the same under Alternative D as described above under Alternative B.

Alternative D proposes no new road construction, but does include eight miles of temporary road use and four miles of road conversion. These two actions would increase road density in all watersheds in the project area (Table 3-53). No new stream crossings are proposed on perennial streams under Alternative D. Five proposed stream crossings would occur on intermittent streams in Alternative D. Two of these crossings would occur in sensitive areas along intermittent streams (Table 3-48). These are located near springs, wetlands, or meadows. In particular, the Little Elk Creek tributary in T4N, R5E, Section 33 is the most sensitive crossing, as described in Table 3-48. This alternative would affect the least amount of sensitive watershed areas. The other road-stream crossing is on an ephemeral stream. All new crossings could affect the amount of CDAs within the project area. To minimize soil and water effects from road construction, road design and construction would follow design criteria, WCPs, and BMPs.

Under Alternative D, the greatest increase in road density would be in the Lower Stagebarn watershed, increasing by 1.8 mi/sq mi, (Table 3-55). Only one other watershed would increase its road density by at least one mile (Boxelder-Doty). The rest of the watersheds have an increase ranging from 0.1 mi/sq mi (Upper Little Elk Creek) to 0.7 mi/sq mi (Boxelder-Wilson). No watershed would have a decreased road density because no roads are proposed for decommissioning. Construction of the new routes would
occur in all watersheds. Alternative D would have greater impacts on flow regime than Alternative A, but it would be the least impactful of the action alternatives.

All watersheds within the Steamboat project area are rated as Condition Class III. Appendix J of the Revised Forest Plan FEIS explains the rationale for Condition Class ratings for watersheds (USDA-Forest Service 1996). Roads are an important factor for rating the sensitivity of the watershed and the base impacts to the watershed. Alternative D proposes to increase the road density in all watersheds. This would increase the watershed sensitivity and impact index. Implementation of Alternative D would move the watersheds further away from being rated as a Condition Class II watershed because the road impact index would go up in all watersheds. Because Alternative D proposes the least amount of new routes compared to the other action alternatives, the road density increases are not as high. Alternative D most closely maintains current watershed conditions compared to the other action alternatives.

**Cumulative Effects**

Past activities and fire suppression policies in the Steamboat project area have influenced flow regime. The cumulative effect of Alternative D on flow regimes would be similar to Alternatives A and Alternatives B as described above.

**Temperature and Oxygen**

**Alternative A (No Action)**

**Direct and Indirect Effects**

This alternative would not initiate any new activities within the Steamboat project area. If the biomass continues to increase, this would affect stream temperature and oxygen by making less water available for streamflow because of increased evapotranspiration. Less water in the stream would mean increased water temperature and decreased oxygen. Mountain pine beetle have infected areas neighboring the Steamboat project area and would likely expand their range into the Steamboat area, causing a decrease in live biomass. Also, wildfires may burn within the Steamboat project area, causing a decrease in live biomass. Currently, some reforestation is occurring within the Boxelder, Little Elk, and Ricco fire areas. These areas have less timber and more grasses, which affects interception and evapotranspiration rates. Less live biomass results in less evapotranspiration and lower interception rates and more water available for streamflow or groundwater recharge to help maintain or improve the current water temperature and oxygen regime. The results or changes of this alternative are variable, and generally less dramatic than the action alternatives.

An indirect impact to the stream temperature that is not very noticeable is the result of increased biomass with the Steamboat project area. This increased biomass has resulted in an increase in evapotranspiration and less water available for groundwater recharge and streamflow, resulting in reduced base streamflows. These reduced base streamflows can result in increased stream temperature and less oxygen available due to less water, but this change is slow to occur and happens over decades. Past timber activities have helped slow biomass increase and insect or disease activity also has the capability of reducing the biomass.

Currently, the meadow below the Dalton Lake dam has minimal shade. Little Elk Creek does show signs of increased stream temperature and low dissolved oxygen levels from algal blooms in this area. This is
localized from the Dalton Lake dam to the trailhead for Little Elk Creek Canyon trail. Below that, stream shading is more apparent with a good riparian corridor. Stream shading is not an issue currently at the four sensitive watershed crossings proposed.

None of the streams within the Steamboat project area are listed under The 2010 South Dakota Integrated Report for Surface Water Quality Assessment with temperature the reason that the streams are not meeting their beneficial uses. Boxelder Creek is the only stream for which SDDENR has completed water quality assessments with the project area (SDDENR 2010). From the water quality assessments, Boxelder Creek is meeting all of its assigned beneficial uses. Because no new activities are associated with Alternative A, it is assumed that implementation of Alternative A would not cause any streams to not meet their assigned beneficial uses. Also, temperature would not increase from harvesting from within the WIZ; therefore, dissolved oxygen levels would maintain at current levels.

**Cumulative Effects**

Increased biomass in the Steamboat project area has had an impact on the upland areas. Stream shading has not been impacted, except in local areas on private lands. Under Alternative A, all streams would continue to fully support their beneficial uses and their temperature requirements. Stream temperature would remain at existing levels.

Cumulative impacts from this alternative could occur in two separate scenarios. In the first, there would be a cumulative impact over time if the biomass continues to increase. As a result, lower streamflows would increase stream temperatures and oxygen would decrease due to increased evapotranspiration. In the second scenario, there would be positive cumulative impacts from beetle or fire-killed trees. This would maintain or reduce the live biomass and more water would be available for streamflow or groundwater recharge. Increased streamflows would help maintain or decrease stream temperature and improve dissolved oxygen levels.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

This alternative includes commercial and non-commercial vegetation management activities. The effects of the treatments on low flows are uncertain because of the lack of noticeable changes in flow regimes through project implementation. Riparian vegetation that provides critical shade to perennial and intermittent streams, springs, and wetlands would be protected through the WCPs and BMPs. The primary areas that riparian vegetation would be disturbed are on the six new road-stream crossings on intermittent streams. Ten new crossings are proposed on nine creeks in this alternative. None of these would cross perennial streams. Six crossings are proposed for intermittent streams, and the remaining four are proposed for three ephemeral streams. These stream crossings are small localized areas (i.e., usually less than 20 feet in width) and should not contribute a loss of shade to impact stream temperature and dissolved oxygen levels.

A critical loss of riparian vegetation would occur that could affect stream shading at the three sensitive crossings proposed under Alternative B. Although these crossings are small in size, the loss of riparian vegetation at these sensitive sites could impact stream temperature and dissolved oxygen levels. The most sensitive crossing is in T4N, R5E, Section 33 and would lose its riparian vegetation during the
duration of harvest and post-harvest activities. It would take years for the riparian vegetation to reestablish itself to a level that would provide shade at current levels.

This alternative includes commercial and non-commercial vegetation management. Reducing the stand density on 57 percent of the project area under Alternative B with timber and prescribed burning activities would have a positive but limited effect on stream temperature and oxygen. Biomass would be reduced, resulting in more water available for streamflow. Increased water availability would help maintain stream temperatures. This alternative would have greater positive effect on water temperature and oxygen then Alternative A.

A WIZ of 100 feet would be in place at all perennial and intermittent streams, springs, and wetlands. This would protect the riparian vegetation that provides shading for streams. However, streams would also be shaded by nearby tall ponderosa pine trees. Pollack et al. (2009) saw an increase in stream temperature from harvest activities within watersheds where 25 percent to 100 percent of the overstory was harvested. However, in these study areas harvest occurred within the riparian areas. Alternative B proposes 219 acres of commercial treatments within the WIZ. Trees removed within the WIZ would be limited by the ability to be able to line pull or reach by mechanical equipment. By following the WIZ buffer, removal of trees within the riparian corridors would be limited to fuels reduction treatments, meadow enhancements, and hardwood enhancements. Therefore, the increase of temperature would be low and would not affect the beneficial uses assigned to streams within the Steamboat project area.

Currently, the meadow below the Dalton Lake dam has minimal shade. Little Elk Creek does show signs of increased stream temperature and low dissolved oxygen levels from algal blooms. This is localized from the Dalton Lake dam to the trailhead for Little Elk Creek Canyon trail. Below that, stream shading is more apparent with a good riparian corridor. The stands around Dalton Lake and just below are proposed for individual tree selection or group selection. These prescriptions would not occur in the meadow and should not affect the stream shading of Little Elk Creek in that section. Fuels treatments around the cabins near the confluence of Little Elk Creek and Waite Gulch could remove some trees that provide shading to Little Elk Creek. There would be minimal trees removed that would affect the stream shading here because more co-dominant trees would be targeted and there is a topographical break from the hillside near the cabins to the meadow surrounding Little Elk Creek. To protect Little Elk Creek, fuels treatments would be more focused on the uphill side of the cabins and further away from Little Elk Creek.

**Cumulative Effects**
There would be positive cumulative impacts to temperature and oxygen with this alternative because of the reduced stand density across the project area. This reduction in stand density would result in less water consumption and more water available for streamflow, helping maintain or improve stream temperature and oxygen.

**Alternative C**

**Direct and Indirect Effects**
Alternative C proposes 18,169 acres of total activity (i.e., timber harvest and prescribed burning). The effects of the treatments on low flows could be affected by changes on streamflow regime as discussed
above. Riparian vegetation that provides critical shade would be protected through the WCPs and BMPs. The primary areas that riparian vegetation would be disturbed are on the 12 new road-stream crossings on intermittent streams. Twenty new crossings are proposed on 16 creeks in this alternative. None of those crossings are on perennial streams. Twelve of the crossings are proposed for intermittent streams, and the remaining eight are on three ephemeral streams. These stream crossings are small localized areas (i.e., usually less than 20 feet in width) and should not contribute a loss of shade to impact stream temperature and dissolved oxygen levels. The 12 new road-stream crossings on intermittent streams would lead to a loss of stream shading that could affect stream temperature and dissolved oxygen levels in localized areas around the stream crossing and immediately downstream.

Four crossings in sensitive areas are proposed in Alternative C. These areas would show the most impact from road building with changes to stream temperature and dissolved oxygen levels. The three sites that would become system roads would have a permanent loss of riparian vegetation and, consequently, less stream shading. This could affect stream temperature and dissolved oxygen levels at these sites and immediately downstream until the streams enter a denser riparian corridor. The most sensitive stream crossing, located in T4N, R5E, Section 33, is also proposed as a temporary road crossing in Alternative C. The effects here would be the same as described under Alternative B.

This alternative would reduce the stand density on 83 percent of the project area. Timber harvest and prescribed burning activities would have a positive but limited effect on stream temperature and oxygen. Biomass would be reduced, resulting in more water being available for streamflow. Increased water availability would help maintain stream temperatures. This alternative would have greater positive effect on water temperature and oxygen and than Alternative A. Because more acres of land would undergo treatment under Alternative C than in Alternative B, Alternative C would have the highest positive effect on stream temperature and dissolved oxygen in relation to streamflow regime.

A WIZ of 100 feet would be in place at all perennial and intermittent streams, springs, and wetlands. This would protect the riparian vegetation that provides the shading for streams. However, streams would also be shaded by nearby tall ponderosa pine trees. Pollack et al. (2009) saw an increase in stream temperature from harvest activities within watersheds where 25 percent to 100 percent of the overstory was harvested. However, in these study areas there was harvest was conducted within the riparian areas. Alternative C proposes 628 acres of commercial treatments within the WIZ. Trees removed within the WIZ would be limited by the ability to line pull or reach the timber by mechanical equipment. By following the WIZ buffer, removal of trees within the riparian corridors would be limited to fuels reduction treatments, meadow enhancements, and hardwood enhancements. Therefore, the increase in temperature should be low and should not affect the beneficial uses assigned to streams within the Steamboat project area. Alternative C proposes almost three times as many acres for treatment than Alternative B. As a result, more loss of stream shading from commercial activities would occur as compared to Alternative B. Localized areas of warmer stream temperatures and higher dissolved oxygen levels as result of widespread removal of pine trees near riparian areas would occur under Alternative C.

Currently, the meadow below the Dalton Lake dam has minimal shade. Little Elk Creek does show signs of increased stream temperature and low dissolved oxygen levels from algal blooms. This is localized from the Dalton Lake dam to the trailhead for Little Elk Creek Canyon trail. Below that, stream shading is more apparent with a good riparian corridor. The stands around Dalton Lake and just below are
proposed for individual tree selection, group selection, or overstory removal. Group selection or individual tree selection prescriptions would not occur in the meadow and should not affect the stream shading of Little Elk Creek in the section. The stand slated for overstory removal (089902-025) could have enough trees removed that continuous shading along Little Elk Creek could be affected. Pine stands are close to the riparian corridor, which is narrow, and are a major source of stream shading for Little Elk Creek. Fuels treatments around the cabins near the confluence of Little Elk Creek and Waite Gulch could remove some trees that provide shading to Little Elk Creek. There would be a minimal number of trees removed that would affect the stream shading here because more co-dominant trees would be targeted and a topographical break exists from the hillside near the cabins to the meadow surrounding Little Elk Creek. To protect Little Elk Creek, fuels treatments should be more focused on the uphill side of the cabins and further away from Little Elk Creek.

**Cumulative Effects**
Cumulative effects related to Alternative C would be similar to those described under Alternative B above.

**Alternative D**

**Direct and Indirect Effects**
This alternative includes 9,514 total acres of timber harvest and prescribed burning activities. The effects of the treatments on low flows are uncertain because of the lack of noticeable changes in flow regimes through project implementation. Riparian vegetation that provides critical shade would be protected through the WCPs and BMPs. The primary areas that riparian vegetation would be disturbed are on the five new road-stream crossings on intermittent streams. Six new crossings are proposed on six creeks in this alternative. None of the crossings are proposed on perennial streams. Five crossings are proposed on intermittent streams, and the remaining crossing is proposed on an ephemeral stream. These stream crossings are small localized areas (i.e., usually less than 20 feet) and should not contribute to a loss of shade that would impact stream temperature and dissolved oxygen levels.

This alternative proposes only two crossings in sensitive stream areas, both of which are within the Upper Little Elk Creek watershed. Alternative D would affect stream temperature the least at these sensitive crossings because it would include the least amount of treatment. Alternative D proposes a temporary road crossing at the most sensitive crossing located in T4N, R5E, Section 33; effects at this crossing would the same as described under Alternative B.

Reducing the stand density on 43 percent of the project area under Alternative D with timber and prescribed burning activities would have a positive but limited effect on stream temperature and oxygen. Biomass would be reduced, resulting in more water available for streamflow. Increased water availability would help maintain stream temperatures. This alternative would have a greater positive effect on water temperature and oxygen than Alternative A. However, with respect to streamflow regime, Alternative D would have the least positive effect for stream temperature and dissolved oxygen as compared to Alternatives B and C.

A WIZ of 100 feet would be in place at all perennial and intermittent streams, springs, and wetlands. This would protect the riparian vegetation, which provides shading for streams. However, streams would also be shaded by nearby tall ponderosa pine trees. Pollack et al. (2009) saw an increase in
stream temperature from harvest activities within watersheds that had 25 percent to 100 percent of the overstory removed. However, in these study areas harvest occurred within the riparian areas. Alternative D proposes 156 acres of commercial treatments within the WIZ. Trees removed within the WIZ would be limited by the ability to line pull or reach timber by mechanical equipment. By following the WIZ buffer, removal of trees within the riparian corridors would be limited to fuels reduction treatments, meadow enhancements, and hardwood enhancements. Therefore, the increase of temperature should be low and should not affect the beneficial uses assigned to streams within the Steamboat project area. Alternative D proposes the least amount of activity within the WIZ and, therefore, would have the least affect on stream temperature and dissolved oxygen levels as compared to Alternatives B and D.

Currently, the meadow below the Dalton Lake dam has minimal shade. Little Elk Creek does show signs of increased stream temperature and low dissolved oxygen levels from algal blooms. This is localized from the Dalton Lake dam to the trailhead for Little Elk Creek Canyon trail. Below that, stream shading is more apparent with a good riparian corridor. The stands just below the dam are proposed for individual tree selection or group selection. However, these prescriptions would not occur in the meadow and should not affect the stream shading of Little Elk Creek in this section. The stand around Dalton Lake is not proposed for treatment under this alternative. Fuels treatments around the cabins near the confluence of Little Elk Creek and Waite Gulch could remove some trees that provide shading to Little Elk Creek. There would be a minimal number of trees removed that would affect the stream shading here because more co-dominant trees would be targeted and a topographical break exits from the hillside near the cabins to the meadow surrounding Little Elk Creek. To protect Little Elk Creek, fuels treatments would be more focused on the uphill side of the cabins and further away from Little Elk Creek. Alternative D would impact this sensitive reach of Little Elk Creek the least; current levels of stream shading would be nearly maintained. This alternative would have the least negative impact on this reach of Little Elk Creek.

**Cumulative Effects**
Cumulative effects related to Alternative D would be similar to those described under Alternative B above.

**Aquatic Life**

**Alternative A (No Action)**

**Direct and Indirect Effects**
This alternative would not include any new activities within the project area, so aquatic life, related to migration barriers and riparian damage, would not be affected.

**Cumulative Effects**
There would be no cumulative effects on aquatic life from the implementation of Alternative A.
Alternative B (Proposed Action)

Direct and Indirect Effects
This alternative includes commercial and non-commercial vegetation management. Potential indirect impacts to aquatic life relates to the amount of activity within the WIZ. Alternative B includes 621 total acres of possible activity in the WIZ. Approximately 10.2 miles of roads would be located within the WIZ. Through implementation of design criteria, Forest Plan standard 1301 (USDA-Forest Service 2005c) and WCPs (USDA-Forest Service 2006ba), no effects would occur to aquatic life.

Six proposed stream crossings are proposed on intermittent streams under this alternative. Some effects would occur during construction of these crossings with a short-term breakage of stream connectivity. This is primarily confined to the time of installation and stabilization of the road-stream crossing. At the temporary roads, it would occur during the time of timber harvest and post-harvest activities. It is possible that there could be at least four years of disconnected aquatic habitat as a result of road activities. The primary concern is the three sensitive road-stream crossings (Table 3-48). If construction of these four crossings does not follow the WCPs, BMPs, and Forest Plan standards and guidelines, permanent disconnection of the streams could occur at these crossings. The temporary road crossing along the perennial tributary of Little Elk Creek, near FSR 137.1A, is of most concern because this stream could be disconnected for the longest time period without a chance for the stream and riparian corridor to reestablish itself.

Cumulative Effects
There would be no negative cumulative impacts to aquatic life within the project area with Alternative B and the implementation of the design criteria above because no activities would occur that would decrease flow regimes, increase riparian damage, or affect sediment or chemical loads. There would be a cumulative increase of stream habitat accessible for aquatic life by the reducing the number of road-stream crossings that are impassible.

Alternative C

Direct and Indirect Effects
Alternative C includes a total of 1,023 acres of proposed timber harvest and prescribed burning treatments within the WIZ (Table 3-49). This alternative proposes the most amount of disturbance near streams through timber activities.

Under this alternative 20 new road-stream crossings are proposed with 12 of them on intermittent streams. If all of the Forest Plan standards and guidelines, WCPs, and BMPs are implemented, there would be minimal stream disconnection from these crossings during the lifespan of this project. Habitat fragmentation would occur at the proposed 12 intermittent stream crossings. Four of the proposed crossings are within sensitive areas for streams. To ensure connectivity for aquatic life at these critical places, the Forest Plan standards and guidelines, WCPs, and BMPs must be followed. Otherwise, there could be long-term disconnection of the streams and riparian habitat at these four sites.

Alternative C is the most impactful alternative for aquatic life and maintaining stream connectivity. This alternative would have more negative impacts to aquatic life than the other action alternatives. This alternative proposes a higher level of timber activities and road-stream crossings compared to
Alternatives B and D. Also, this alternative proposes to build either system or temporary roads near the most sensitive sites for streams, springs, and wetlands that provide habitat for aquatic life. Even by following Forest Plan standards and guidelines, WCPs, and BMPs, it is expected that the 12 new crossings on intermittent streams would cause some long-term disruption for aquatic life.

**Cumulative Effects**  
There would be no cumulative impacts to aquatic life under Alternative C that are not already described under Alternative B above.

**Alternative D**  
Alternative D includes a total of 558 acres of timber harvest and prescribed burning within the WIZ (Table 3-49). This alternative proposes the least amount of activity near streams of any action alternative. It proposes more acreage for prescribed burning than timber activities near streams. Prescribed burning should not have any effect on aquatic life assuming Forest Plan standards and guidelines, WCPs, and BMPs are followed.

Six new road-stream crossings are proposed through either road conversion or temporary road use. Five of the proposed crossings are along intermittent streams that need to maintain aquatic life connectivity to be consistent with Forest Plan Standard 1301 and the WCPs. Three crossings identified as sensitive must adhere to Forest Plan standards and guidelines, WCPs, and BMPs to ensure that they would not cause any disconnection except during installation.

Effects of Alternative D are similar to Alternative B, but to a lesser extent because Alternative D proposes a lower level of timber harvest and road management. Alternative D is the least impactful action alternative for aquatic life because less disruption would occur through installation of culverts or other stream crossing structures. As with Alternative B, three of the sensitive sites for road-stream crossings would be disturbed under this alternative.

**Cumulative Effects**  
There would be no cumulative impacts to aquatic life under Alternative D that are not already described under Alternative B above.

**Riparian Ecosystems**

**Alternative A (No Action)**

**Direct and Indirect Effects**  
Existing timber harvest, post-harvest activities (KV), fuels, grazing, and mining activities would continue under this alternative. Road maintenance activities would continue as they came up on the road maintenance cycle (approximately every five to seven years). Alternative A would have no new proposed activities within the Steamboat project area so there would be no direct or indirect effects to riparian areas. This alternative would have the least overall impact on riparian areas.

**Cumulative Effects**  
There would be no cumulative impacts to riparian ecosystems within the project area because no new activities are planned.
Alternatives B (Proposed Action)

Direct and Indirect Effects
Alternative B includes commercial and non-commercial vegetation management. However, none of the commercial activities would occur within riparian areas. The WIZ area of 100 feet on each side of the perennial and intermittent streams and springs would protect riparian areas. There would be some direct impacts to riparian areas through the construction of six new road-stream crossings on intermittent streams. None of the proposed road-stream crossings are on perennial streams. These road crossings would disturb the riparian area in the immediate area of the new road (usually less than 20 feet in width). These six road-stream crossings would comprise a relatively small area compared to the riparian areas of these streams. These areas would require some additional mitigation measures to reduce the impacts of the proposed roads. The proposed temporary crossing of the perennial tributary of Little Elk Creek, near FSR 137.1A, is of the greatest concern. This temporary road would be used for a few years and could impact the ability of the riparian vegetation to become reestablished along the stream. Implementation of the WCPs and BMPs would reduce the impact to riparian areas during implementation of Alternative B. Assuming the Forest Plan standards and guidelines, WCPs and BMPs are followed the direct and indirect effects of Alternative B would result in minimal impact to riparian areas.

Prescribed burning could occur within the riparian areas. No direct ignition would occur within riparian areas, but prescribed fire would be allowed to creep into the riparian areas. The wet soils and vegetation within the riparian area would act as a fire break, eliminating the need to construct a fire line. Arkle and Pilliod (2010) did not find any detectable changes within riparian habitats from spring prescribed burning. From this and past experience, there would be minimal disturbance to riparian areas when WCPs and BMPs are implemented. The area proposed for prescribed burning is the same for all three action alternatives and burns would be implemented over five to ten years.

There would be a direct impact on riparian areas during the implementation of hardwood and meadow enhancements. These projects are proposed within the WIZ and could impact some of the riparian vegetation. WCPs and BMPs would be followed during implementation activities. However, a loss of vegetation could still occur in the short-term. Typically, riparian vegetation will become reestablished on streambanks within three years. This short-term impact to the riparian areas would be compensated for by the long-term benefit to the riparian areas from removing encroaching pine from the hardwood and meadow stands.

Cumulative Effects
Currently, 39 road-stream crossings exist along intermittent and perennial streams. Alternative B proposes 10 new road-stream crossings within the Steamboat project area. Seven crossings that would be used for either new system roads or temporary roads currently exist on the ground as a non-system route. Road maintenance activities proposed in Alternative B would repair many of the existing CDAs, reducing the cumulative impact of the new road-stream crossings.

There could be detrimental impacts to the riparian areas that are listed in Table 3-48. These riparian areas are more sensitive as compared to other areas within the Steamboat project area. If the BMPs and WCPs are followed and the roads are closed post-harvest, there should not be any cumulative
effects to riparian areas. However, if BMPs and WCPs are not followed and these routes remain open
damage could occur to the riparian corridor that could potentially be permanent.

Vegetation treatments would not contribute to cumulative effects because they would not occur within
riparian areas through implementation of the WIZ buffer.

Alternative C

Direct and Indirect Effects
Alternative C includes commercial and non-commercial vegetation management. However, no
commercial activities would occur within riparian areas. The WIZ area of 100 feet on each side of the
perennial and intermittent streams and springs would protect riparian areas. There would be some
direct impacts to riparian areas from 12 new road-stream crossings on intermittent streams. None of
the proposed road-stream crossings occur on perennial streams. These road crossings would disturb
the riparian area in the immediate area of the new road (usually less than 20 feet in width). These
twelve road-stream crossings would comprise a relatively small area compared to the total riparian
areas of these streams. These areas would require some additional mitigation measures to reduce the
impacts of the proposed roads. Implementation of the WCPs and BMPs would lessen the impact to
riparian areas. Overall, the direct and indirect effects of Alternative C would result in some impact to
riparian areas from the new road-stream crossings.

Prescribed burning could occur within the riparian areas. No direct ignition would occur within riparian
areas, but prescribed fire would be allowed to creep into the riparian areas. The wet soils and
vegetation within the riparian area would act as a fire break, eliminating the need to construct a fire
line. Arkle and Pilliod (2010) did not find any detectable changes within riparian habitats from spring
prescribed burning. Based on this and past experience, there would be minimal disturbance to riparian
areas when WCPs and BMPs are implemented.

There would be a direct impact on riparian areas during the implementation of hardwood and meadow
enhancements. These projects are proposed within the WIZ and could impact some of the riparian
vegetation. WCPs and BMPs would be followed during implementation activities. However, a loss of
vegetation could still occur in the short-term. Typically, riparian vegetation will become reestablished
on streambanks within three years. This short-term impact to the riparian areas would be compensated
for by the long-term benefit to the riparian areas from removing encroaching pine from the hardwood
and meadow stands.

Alternative C would have the greatest negative impact on the riparian areas as compared to the other
two action alternatives due to the increased level of road construction activities and, consequently, the
increased number of road-stream crossings (twice the number included in Alternative B).

Cumulative Effects
Currently, 45 road-stream crossings exist along intermittent and perennial streams. Alternative C
proposes 20 new road-stream crossings. Nine crossings that would be used for either new system roads
or temporary roads currently exist on the ground as a non-system route. Road maintenance activities
proposed in Alternative C would repair many of the existing CDAs, reducing the cumulative impact of the
new road-stream crossings.
There could be detrimental impacts to the riparian areas that are listed in Table 3-48. These riparian areas are more sensitive as compared to other areas within the Steamboat project area. If the BMPs and WCPs are followed and the roads are closed post-harvest, cumulative effects to riparian areas should not occur. However, if BMPs and WCPs are not followed and these routes remain open damage could occur to the riparian corridor that could become permanent.

Vegetation treatments would not contribute to cumulative effects because they would not occur within riparian areas through implementation of the WIZ buffer.

**Alternative D**

**Direct and Indirect Effects**

Alternative D includes commercial and non-commercial vegetation management. However, no commercial activities would occur within riparian areas. The WIZ area of 100 feet on each side of the perennial and intermittent streams and springs would protect riparian areas. Some direct impacts to riparian areas would occur through the construction of five new road-stream crossings on intermittent streams. None of the proposed road-stream crossings are on perennial streams. These road crossings would disturb the riparian area in the immediate area of the new road (usually less than 20 feet in width). These five road-stream crossings would comprise a relatively small area compared to the total riparian areas of these streams. These areas would require some additional mitigation measures to reduce the impacts of the proposed roads. Implementation of the WCPs and BMPs would reduce the impacts to riparian areas. The direct and indirect effects of Alternative D would result in the least impact to riparian areas from the new road-stream crossings as compared to the other action alternatives.

Prescribed burning could occur within the riparian areas. No direct ignition would occur within riparian areas, but prescribed fire would be allowed to creep into the riparian areas. The wet soils and vegetation within the riparian area would act as a fire break, eliminating the need to construct a fire line. Arkle and Pilliod (2010) did not find any detectable changes within riparian habitats from spring prescribed burning. Based on this and past experience, there would be minimal disturbance to riparian areas when WCPs and BMPs are implemented.

There would be a direct impact on riparian areas during the implementation of hardwood and meadow enhancements. These projects are proposed within the WIZ and could impact some of the riparian vegetation. WCPs and BMPs would be followed during implementation activities. However, a loss of vegetation could still occur in the short-term. Typically, riparian vegetation will become reestablished on streambanks within three years. This short-term impact to the riparian areas would be compensated for by the long-term benefit to the riparian areas from removing encroaching pine from the hardwood and meadow stands.

Alternative D has the least impact of any action alternative on riparian areas because it proposes the least amount of disturbance.
Cumulative Effects

Currently, 38 road-stream crossings exist along intermittent and perennial streams. Alternative D proposes six new road-stream crossings. Five crossings that would be used for either new system roads or temporary roads currently exist on the ground as a non-system route. Road maintenance activities proposed in Alternative D would repair many of the existing CDAs, reducing the cumulative impact of the new road-stream crossings.

There could be detrimental impacts to the riparian areas that are listed in Table 3-48. These riparian areas are more sensitive as compared to other areas within the Steamboat project area. If the BMPs and WCPs are followed and the roads are closed post-harvest, cumulative effects to riparian areas should not occur. However, if BMPs and WCPs are not followed and these routes remain open damage could occur to the riparian corridor that could become permanent.

Vegetation treatments would not contribute to cumulative effects because they would not occur within riparian areas through implementation of the WIZ buffer.

Wetlands and Springs

Alternative A (No Action)

Direct and Indirect Effects
Wetlands and springs in the area are expected to either persist at existing conditions or degrade under Alternative A. They would remain vulnerable to existing roads, off-road vehicle traffic, grazing, mining, and stream channel downcutting. Alternative A does not include any new activities within the project area, so no new impacts to wetlands would occur.

Cumulative Effects
There would be no cumulative impacts to wetlands within the project area with this alternative because no activities are planned.

Alternative B (Proposed Action)

Direct and Indirect Effects
Alternative B has the potential to affect wetlands and springs that are associated with streams in the areas of proposed activities. Implementation of proposed activities would adhere to design criteria, WCPs, and BMPs. The 100 foot buffer around wetlands would minimize any of the potential effects on wetlands and springs due to the avoidance of the area or by following WCPs and BMPs where activities would be near the wetlands and springs. Therefore, avoidance or mitigation is expected to result in no or limited impacts under Alternative B.

This alternative includes commercial and non-commercial vegetation management. The actions that have the potential to affect wetlands are road management activities related to timber sales. Adherence to the WCPs and BMPs would ensure that no additional impacts would occur to wetlands during implementation. There is one proposed new road, one road to be converted back to system, and two temporary roads proposed that are in close proximity to wetlands. The two temporary roads are proposed to pass near two NWI wetlands. These two routes would be routed around the wetlands.
during implementation to be in compliance with E.O. 11990, WCPs, BMPs and the Clean Water Act (CWA). As long as the WCPs and BMPs are followed, impacts to wetlands would be minimal under this alternative.

The four sites listed in Table 3-48 are the most sensitive during the implementation of Alternative B. The proposed temporary stream crossing along the perennial tributary of Little Elk Creek off of FSR 137.1A is probably the most sensitive activity for all of the wetlands within the project area. This crossing is downstream of the wetland/spring complex as the stream transitions from intermittent to perennial. This area is along the edge of the meadow where the temporary road is proposed. Winter

<table>
<thead>
<tr>
<th>Stand Location</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>081506-71</td>
<td>Commercial Thin New Road Construction</td>
<td>Commercial Thin New Road Construction</td>
<td>No Treatment</td>
</tr>
<tr>
<td>081506-72</td>
<td>No Treatment</td>
<td>Commercial Thin</td>
<td>No Treatment</td>
</tr>
<tr>
<td>081506-113*</td>
<td>Individual Tree Selection Prescribed Burning</td>
<td>Individual Tree Selection Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td></td>
<td>Temporary road proposed to go through wetland</td>
<td>Temporary road proposed to go through wetland</td>
<td>Temporary road to go through the wetland</td>
</tr>
<tr>
<td>081506-118*</td>
<td>Commercial Thin New Road Construction</td>
<td>Commercial Thin New Road Construction</td>
<td>Commercial Thin New Road Construction</td>
</tr>
<tr>
<td></td>
<td>Temporary road proposed to go through the wetland</td>
<td>Temporary road proposed to go through the wetland</td>
<td>Temporary road to go through the wetland</td>
</tr>
<tr>
<td>081508-031</td>
<td>No Treatment, Use FSR 224 as is</td>
<td>No Treatment, Use FSR 224 as is</td>
<td>No Treatment, Use FSR 224 as is</td>
</tr>
<tr>
<td>081509-005</td>
<td>Understory thin</td>
<td>Understory thin Reconstruction of FSR 224.1A</td>
<td>Understory thin</td>
</tr>
<tr>
<td></td>
<td>Use FSR 224.1A as is</td>
<td></td>
<td>Use FSR 224.1A as is</td>
</tr>
<tr>
<td>081509-069</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td></td>
<td>Temporary road construction, Reconstruction</td>
<td>Temporary road construction, Reconstruction</td>
<td>Temporary road construction, Reconstruction</td>
</tr>
<tr>
<td></td>
<td>of FSR 137.1A</td>
<td>of FSR 137.1A</td>
<td>of FSR 137.1A</td>
</tr>
<tr>
<td>081509-075</td>
<td>Meadow Enhancement</td>
<td>Meadow Enhancement</td>
<td>Meadow Enhancement</td>
</tr>
<tr>
<td></td>
<td>Use FSR 224.1A and 224.1E as is</td>
<td>Reconstruction on FSR 224.1A, Use FSR 224.1E as is</td>
<td>Use FSR 224.1A and 224.1E as is</td>
</tr>
<tr>
<td>081708-070</td>
<td>Shelterwood cut, Reconstruction of FSR 149.2E,</td>
<td>Shelterwood cut, Reconstruction of FSR 149.2E,</td>
<td>Shelterwood cut, Reconstruction of FSR 149.2E,</td>
</tr>
<tr>
<td></td>
<td>Existing trail 8281</td>
<td>Existing trail 8281</td>
<td>Existing trail 8281</td>
</tr>
<tr>
<td>089902-001</td>
<td>Individual Tree Selection</td>
<td>Individual Tree Selection</td>
<td>No treatment</td>
</tr>
<tr>
<td></td>
<td>Use FSR 224.12 as is</td>
<td>Use FSR 224.12 as is</td>
<td>Use FSR 224.12 as is</td>
</tr>
<tr>
<td>089902-002</td>
<td>Understory thin</td>
<td>Understory thin</td>
<td>Understory thin</td>
</tr>
<tr>
<td></td>
<td>Convert road to system</td>
<td>Convert road to system</td>
<td>Convert road to system</td>
</tr>
<tr>
<td></td>
<td>Reconstruction on FSR 226.1</td>
<td>Reconstruction on FSR 226.1</td>
<td>Reconstruction on FSR 226.1</td>
</tr>
<tr>
<td>089904-043*</td>
<td>Commercial Thin</td>
<td>Commercial Thin</td>
<td>Commercial Thin</td>
</tr>
<tr>
<td></td>
<td>Reconstruction on FSR 144.2J</td>
<td>Reconstruction on FSR 144.2J</td>
<td>Reconstruction on FSR 144.2J</td>
</tr>
<tr>
<td>089904-081*</td>
<td>No treatment</td>
<td>POL (Products other than logs)</td>
<td>No treatment</td>
</tr>
<tr>
<td></td>
<td>Use FSR 144.2B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>089904-086*</td>
<td>No treatment</td>
<td>No treatment</td>
<td>No treatment</td>
</tr>
<tr>
<td></td>
<td>Reconstruction on FSR 144.2B</td>
<td>Reconstruction on FSR 144.2B</td>
<td>Use FSR 144.2B as is</td>
</tr>
</tbody>
</table>

*NWI identified wetlands that were dry in 2010. No 100-foot WIZ necessary if dry during implemention.
logging would be ideal for minimizing damage to the stream. The proposed treatment in Waite Gulch is an understory thin. This activity would be kept outside the wetland-spring complex by following the WIZ buffer. Two proposed temporary roads proposed near NWI wetlands will be rerouted around the wetlands during implementation.

Springs are usually smaller in size and scope than wetlands. They are normally spatially located near streams or wetlands and protected in their WIZ zones. Springs would be protected through adherence to design criteria, WCPs and BMPs. Table 3-55 shows the 30 stands that contain springs within the Steamboat project area. Four stands do not have any proposed activities under Alternative B.

<table>
<thead>
<tr>
<th>Stand Location</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>081506-054</td>
<td>Products other than logs, Non-commercial thin, Prescribed burning</td>
<td>Products other than logs, Non-commercial thin, Prescribed burning</td>
<td>Products other than logs, Non-commercial thin, Prescribed burning</td>
</tr>
<tr>
<td>081506-058</td>
<td>No treatment</td>
<td>No treatment</td>
<td>No treatment</td>
</tr>
<tr>
<td>081506-065</td>
<td>Prescribed burning</td>
<td>Commercial thin, Precommercial thin, Prescribe</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>081509-002</td>
<td>Shelterwood cut, Commercial hardwood enhancement, Non-commercial thin Prescribed Burning</td>
<td>Shelterwood cut, Commercial hardwood enhancement, Non-commercial thin Prescribed Burning</td>
<td>Shelterwood cut, Commercial hardwood enhancement, Non-commercial thin, Prescribed Burning</td>
</tr>
<tr>
<td>081509-005</td>
<td>Understory thin Prescribed Burning</td>
<td>Understory thin Prescribed Burning</td>
<td>Understory thin Prescribed Burning</td>
</tr>
<tr>
<td>081509-007</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>081509-009</td>
<td>Non-commercial thin</td>
<td>Commercial thin</td>
<td>Non-commercial thin</td>
</tr>
<tr>
<td>081509-069</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>081510-016</td>
<td>Commercial thin, Hardwood enhancement, Fuels treatment</td>
<td>Commercial thin, Hardwood enhancement, Fuels treatment</td>
<td>Commercial thin, Hardwood enhancement, Fuels treatment</td>
</tr>
<tr>
<td>081510-018</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
</tr>
<tr>
<td>081510-054</td>
<td>Prescribed Burning</td>
<td>Commercial thin, Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>081510-075</td>
<td>Commercial thin, Non-commercial thin</td>
<td>Commercial thin, Non-commercial thin</td>
<td>Commercial thin, Non-commercial thin</td>
</tr>
<tr>
<td>089901-003</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
<td>Individual tree selection, Non-commercial thin, Prescribed Burning</td>
</tr>
<tr>
<td>089901-018</td>
<td>Meadow enhancement, Prescribed Burning</td>
<td>Meadow enhancement, Prescribed Burning</td>
<td>Meadow enhancement, Prescribed Burning</td>
</tr>
<tr>
<td>089902-002</td>
<td>Understory thin, Fuels</td>
<td>Understory thin, Fuels</td>
<td>Understory thin, Fuels</td>
</tr>
<tr>
<td>Stand Location</td>
<td>Alternative B</td>
<td>Alternative C</td>
<td>Alternative D</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>089902-013</td>
<td>Individual tree selection, Hardwood enhancement, Non-commercial thin</td>
<td>Individual tree selection, Hardwood enhancement, Non-commercial thin</td>
<td>Individual tree selection, Hardwood enhancement, Non-commercial thin</td>
</tr>
<tr>
<td>089902-018</td>
<td>Group Selection, Non-commercial thin, Fuels treatment, Prescribed Burning</td>
<td>Group Selection, Non-commercial thin, Fuels treatment, Prescribed Burning</td>
<td>Group Selection, Non-commercial thin, Fuels treatment, Prescribed Burning</td>
</tr>
<tr>
<td>089902-025</td>
<td>No treatment</td>
<td>Overstory removal, Non-commercial thin</td>
<td>No treatment</td>
</tr>
<tr>
<td>089902-026</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin</td>
</tr>
<tr>
<td>089902-034</td>
<td>Group selection, Non-commercial thin, Prescribed Burning</td>
<td>Group selection, Non-commercial thin, Prescribed Burning</td>
<td>Group selection, Non-commercial thin, Prescribed Burning</td>
</tr>
<tr>
<td>089903-005</td>
<td>No treatment</td>
<td>No treatment</td>
<td>No treatment</td>
</tr>
<tr>
<td>089903-022</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>089903-050</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin, Prescribed Burning</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin, Prescribed Burning</td>
<td>Commercial thin, Hardwood enhancement, Non-commercial thin, Prescribed Burning</td>
</tr>
<tr>
<td>089903-091</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>089904-012</td>
<td>Meadow Enhancement, Prescribed Burning</td>
<td>Meadow Enhancement, Prescribed Burning</td>
<td>Meadow Enhancement, Prescribed Burning</td>
</tr>
<tr>
<td>089904-050</td>
<td>No treatment</td>
<td>No treatment</td>
<td>No treatment</td>
</tr>
<tr>
<td>089904-054</td>
<td>Prescribed Burning</td>
<td>Overstory removal, Planting, Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
<tr>
<td>089904-060</td>
<td>Non-commercial thin</td>
<td>Commercial Thin, Non-commercial thin</td>
<td>Non-commercial thin</td>
</tr>
<tr>
<td>089904-062</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
<td>Prescribed Burning</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

There would be no additional cumulative impacts to wetlands within the project area in relation to vegetative management because wetlands and springs would not be disturbed within the WIZ buffer. Three sites near wetlands or springs are proposed for either new system road or temporary road construction. If the WCPs and BMPs are not followed in these areas and they are used in the future, there is a potential for the loss of wetland vegetation.

**Alternative C**

**Direct and Indirect Effects**

Alternative C proposes more commercial activities near wetlands and springs than Alternatives B or D. Twelve stands (Table 3-54) have a proposed activity near wetlands and 27 stands (Table 3-55) have a proposed activity near springs. WCPs and BMPs would be followed to maintain compliance with the E.O. 11990 and the CWA, as described under Alternative B. The effects described under Alternative B
are similar to Alternative C. However, the magnitude of effects on wetlands and springs is greater under Alternative C due to the increased activity near wetlands and springs.

**Cumulative Effects**
There would be no additional cumulative impacts to wetlands within the project area in relation to vegetative management because wetlands and springs would not be disturbed within the WIZ buffer. Three sites near wetlands or springs are proposed for either new system road or temporary road construction. If the WCPs and BMPs are not followed in these areas and they are used in the future, there is a potential for the loss of wetland vegetation.

**Alternative D**

**Direct and Indirect Effects**
Alternative D proposes the least amount of activities near wetlands and springs. Only nine stands (Table 3-54) are proposed for commercial or non-commercial activities near wetlands. Twenty-six stands would have proposed activities near springs (Table 3-55). AWCPs and BMPs would be followed in stands that have wetlands and springs within them to maintain compliance with E.O. 11990 and the CWA, as described under Alternative B. The effects described under Alternative B would be similar to Alternative D, but with a lower magnitude of effect due to the decreased level of activity. Alternative D is the least impactful action alternative in regards to wetlands and springs.

**Cumulative Effects**
There would be no additional cumulative impacts to wetlands within the project area in relation to vegetative management because wetlands and springs would not be disturbed within the WIZ buffer. Three sites near wetlands or springs are proposed for either new system road or temporary road construction. If the WCPs and BMPs are not followed in these areas and they are used in the future, there is a potential for the loss of wetland vegetation.

**Floodplains**

**Alternative A (No Action)**

**Direct and Indirect Effects**
Three FEMA-designated floodplains are located within the project area (Boxelder Creek, Estes Creek, and Little Elk Creek). Alternative A would have no new proposed activities within the Steamboat project area. Roads that are currently affecting floodplains (via CDAs) would continue to do so. It is expected that floodplains would stay generally at existing conditions.

**Cumulative Effects**
There would be no additional cumulative impacts to floodplains within the project area with this alternative because no new activities would occur.
Alternative B (Proposed Action)

Direct and Indirect Effects
Alternative B proposes 10 new road-stream crossings. None of the proposed crossings are on perennial streams. Six of these crossings are proposed on intermittent streams and four are proposed on ephemeral streams. None of the road-stream crossings are within FEMA-designated floodplains. All new road-stream crossings would be installed to sustain bank-full dimensions and be consistent with the WCPs and BMPs. By following these guidelines, impacts to floodplains would be minimal to none.

Effects on floodplains are expected to be minimal from harvest activities since activities would not occur within 100 feet of intermittent and perennial streams. The sensitive areas (Table 3-48) are sensitive areas for floodplains also. Some activities would occur within floodplains, such as meadow or hardwood enhancement. Where floodplains need to be accessed, WCPs and BMPs would be implemented. Some roads currently located in floodplains would be maintained or reconstructed. This would generally improve the condition of floodplains in the planning area by reducing flow concentration along roads and soil compaction and displacement. Improvement to road-stream crossings that are currently a CDA or are impassible to fish could also improve the access of the stream to the floodplains during high flow.

Cumulative Effects
Currently, 39 road-stream crossings exist in the floodplains of perennial or intermittent streams. These crossings, combined with 10 new road-stream crossings, would increase the overall amount of road-stream crossings within the Steamboat project area to 49. In addition, seven crossings exist on routes that would be either converted to new system road or used as a temporary road. However, the total number of CDAs would be reduced through road maintenance activities in Alternative. Therefore, there would be only minor additional cumulative impacts to floodplains within the project area from new road-stream crossings within floodplains.

None of the proposed road-stream crossings are within an area designated as a FEMA floodplain. The three sensitive crossings (Table 3-48) would be a concern, but cumulative impacts should not result provided that the WCPs and BMPs are implemented.

Alternative C

Direct and Indirect Effects
Alternative C proposes 20 new road-stream crossings. None of the proposed crossings occur on perennial streams. Eight new crossings are proposed on ephemeral streams and 12 are proposed on intermittent streams. None of the proposed road-stream crossings are within FEMA-designated floodplains.

Effects would be similar to those described under Alternative B, but at a higher magnitude due to the increased number of road-stream crossings and timber harvest activities. This alternative proposes 600 acres of commercial activities within the WIZ, the highest acreage of any action alternative. It also has two more intermittent road-stream crossings than in Alternative B. However, this alternative would also repair the highest number of CDAs throughout the project area.
Overall, Alternative C would have the most potential for negative impacts on floodplains compared to the other action alternatives.

**Cumulative Effects**
Currently, 42 road-stream crossings exist in the floodplains of perennial or intermittent streams. These crossing, combined with 20 new road-stream crossings, would increase the overall amount of road-stream crossings within the Steamboat project area to 62. In addition, seven crossings exist on routes that would be either converted to new system road or used as a temporary road. However, the total number of CDAs would be reduced through road maintenance activities in Alternative. Therefore, there would be only minor additional cumulative impacts to floodplains within the project area from new road-stream crossings within floodplains.

None of the proposed road-stream crossings are within an area designated as a FEMA floodplain. The three sensitive crossings (Table 3-48) would be a concern, but cumulative impacts should not result provided that the WCPs and BMPs are implemented.

**Alternative D**

**Direct and Indirect Effects**
Alternative D proposes six new road-stream crossings. None of the proposed crossings are on perennial streams. Five are proposed on intermittent streams and one is proposed on an ephemeral stream. None of the proposed road-stream crossings are within FEMA-designated floodplains.

Effects would be similar to, but at lower magnitude, than those described under Alternative B because Alternative D has one less proposed road-stream crossing. In addition, fewer crossings are proposed near sensitive areas. Alternative D is the least impactful of the three action alternatives to floodplains.

**Cumulative Effects**
Currently, 38 road-stream crossings exist in the floodplains of perennial or intermittent streams. These crossing, combined with 6 new road-stream crossings, would increase the overall amount of road-stream crossings within the Steamboat project area to 44. In addition, seven crossings exist on routes that would be either converted to new system road or used as a temporary road. However, the total number of CDAs would be reduced through road maintenance activities in Alternative. Therefore, there would be only minor additional cumulative impacts to floodplains within the project area from new road-stream crossings within floodplains.

None of the proposed road-stream crossings are within an area designated as a FEMA floodplain. The three sensitive crossings (Table 3-48) would be a concern, but cumulative impacts should not result provided that the WCPs and BMPs are implemented.
Soil Erosion

Alternative A (No Action)

Direct and Indirect Effects
Under Alternative A, no new activities would occur on erosive soils. Existing activities would continue under this alternative and include timber sales, post-harvest (KV) activities, road maintenance, fuel reduction, mining, and grazing. Existing soil erosion concerns associated with the use of roads would be expected to persist and possibly increase over time if roads are not effectively close. Rills, gullies, and areas of standing water would continue to exist and possibly worsen. Routine grid maintenance occurs every five to ten years on NFS roads within the Black Hills National Forest. Roads in the Steamboat project area are scheduled for grid maintenance in 2012 and 2013.

The risk of high-intensity, stand-replacing fire events would generally be expected to increase over time. Since 2000, extensive areas of soil erosion have occurred in areas of high-intensity fire. After the Jasper Fire, soil removed via erosion occurred at a rate 13 times greater in areas of high intensity fire than in areas of low or moderate intensity fire (Keyser et al. 2006). This movement is attributed to an increase in runoff and sediment yields, which is caused by soil water repellency, removal of surface cover, and the sealing of pores by sediment particles (Larsen et al. 2009). Since fuels would continue to accumulate under Alternative A, a high intensity fire would be more likely under this alternative than under the action alternatives. As a result, a high intensity fire leading to increased soil erosion and a loss in site productivity would be more likely under this alternative (Robichaud et al. 2000).

This alternative has the highest potential for soil erosion compared to Alternatives B, C, and D if a wildfire were to occur. In addition, existing roads would contribute more sediment through erosion under this alternative because none of the existing erosive issues would be immediately addressed and may not be addressed at all through routine grid maintenance. Conversely, erosion related to timber harvest activities would not occur under Alternative A, which would be a positive effect.

Cumulative Effects
Alternative A does not propose any new activities so no cumulative effects are expected.

Alternative B (Proposed Action)

Direct and Indirect Effects
Alternative B proposes commercial, non-commercial, prescribed burning, and road related activities that may result in varying amounts of erosion depending upon site conditions and the extent of the activity. Generally, the harvesting of timber is not a source of soil disturbance (USDA-Forest Service 1997). Although, the level of soil erosion experienced in harvest units is determined by site characteristics, logging systems, seasonal timing of activities and unit design. These factors cause the soil surface cover to be altered, and the extent of alteration determines how much erosion would occur.

Soil disturbance assessments conducted in the project area in 2008 and 2009 showed that 94 percent of the transects had less than 15 percent of the sites showing any sign of erosion (0 to 4 sites per transect). Two transects had more than 15 percent of the sites showing signs of erosion. One transect in SMU 193F...
was located in a previously harvested area and most signs of erosion were due to skid trails. The second transect was located in SMU RnG and signs of erosion were present after burning.

Erosion to the level that long-term soil or site productivity may be impaired (i.e., detrimental erosion) is possible with timber harvest activities. The removal of timber causes an increase in runoff due to the decrease of evapotranspiration. This can cause the soil to hold more water. The increase in the weight of the soil can cause mass movement to occur. The transect located in SMU 193F had erosion greater than 15 percent and is located in the Windy timber sale (unit 14), which was harvested in 2004. The other transect located in SMU RnG with greater than 15 percent erosion was not located within a previous timber sale unit, but showed signs of recent burning. It is not known if full implementation of design criteria occurred at these sites. In Alternative B, no activities are proposed in the location of these transects.

Nine SMUs are rated as either ‘severe’ or ‘very severe’ for ‘hazard of off-road or off-trail erosion’ and comprise approximately 41 percent of the project area. These SMUs are 149G (Pactola-Rock Outcrop Complex), 161F (Rockoa-Rock Outcrop complex), 190E and 193F (Vanocker-Citadel Complex), 202G and VoG (Vanocker-Sawdust-Rock Outcrop Complex), 219G (Grizzly-Rubbleland-Rock Outcrop), HtG (Hopdraw-Sawdust-Rock Outcrop Complex), and RnG (Rock Outcrop-Sawdust Complex). Both transects that showed erosion on more than 15 percent were located on SMUs with ‘severe’ or ‘very severe’ ratings. The establishment of vegetation and the use of erosion control measures (e.g. waterbars and logging slash) would minimize erosion. Direct effects may occur immediately after harvest activities and before rehabilitation occurs. After rehabilitation, erosion is expected to return to background levels and effects are expected to be minimal. It is anticipated that full implementation of design criteria and WCPs would limit the amount of soil erosion to below 15 percent on any given unit.

There are approximately 8,085 acres of vegetation treatment and 5,199 acres of prescribed burning (some areas of treatment and burning overlap) on SMUs 149G, 161F, 193F, 202G, 219G, HtG, RnG, VaE, and VoG. Timber harvest activities remove the biomass and increase runoff. Activity on these SMUs should occur during the dry months to minimize erosion. Smaller landings would also help minimize erosion after slash piles on the landings are burned. More erosion occurs as more bare ground is created. Burning these landings during the fall would allow more time for vegetation to become established before spring runoff and precipitation. It is anticipated that full implementation of design criteria outlined in Appendix C would limit the amount of soil erosion to below 15 percent on any given unit.

New and temporary road construction, reconstruction of existing roads, and conversion of non-system roads into system roads would occur under Alternative B and would be expected to contribute by varying degrees to erosion. Erosion occurs on the surface of the road, the ditch paralleling the road, and on the cut and fill slopes. Levels of erosion are affected by road surfacing, cross-drainage off of the road surface, and the soil material of the road and cut and fill slopes (USDA-Forest Service 1996). Different soil types have varying degrees of erosion due to roads. Approximately 92 percent of the soils in the Steamboat project area are rated as ‘severe’ for ‘hazard of erosion on roads and trails’. Approximately 20 miles of new NFS system roads and 10 miles of temporary roads would be installed under Alternative B. In addition, 74 miles of existing roads would be reconstructed and 6 miles of non-system roads would be converted under this alternative. It is estimated that one-third to one-half of all road erosion occurs during the first year after construction. Within two to three years, erosion returns to background levels.
if continued use is not allowed. If roads continue to be used, erosion would continue and sediment would be produced, especially if use occurs during wet weather (USDA-Forest Service 1996). Engineering road design specifications and guidelines should be followed to protect highly erodible soils and road surface material. These include placement of aggregate on the roadbed, installation of culverts, water diversion structures (especially for grades steeper than 10 percent), and seeding of cut and fill slopes as soon as possible after construction. Construction and maintenance of roads should occur during the late summer when precipitation events are not as frequent. These guidelines parallel those guidelines outlined in the BMPs. Following these guidelines would keep erosion to a minimum on new and existing roads within the Steamboat project area.

The hazard of high intensity wildfires would be expected to be lower compared to Alternative A because Alternative B includes efforts to reduce the fire hazard across the project area. Associated soil erosion from wildfires may still occur under Alternative B. Fuel reduction treatments should generally contribute to lower fire intensity and; therefore, lower the severity of effects on soils. Any wildfires that occur following implementation of the action alternatives would be expected to have less potential to cause erosion and subsequently produce negative effects on soils and site productivity.

Negative impacts related to soil erosion would be less under this alternative than Alternative A because erosion issues associated with roads would be addressed and the potential for high intensity wildfires would be lower. Due to the level of treatment proposed under Alternative B compared to Alternatives C and D, the effect of erosion would be less than Alternative C and more than Alternative D.

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Construction</td>
<td>16 miles</td>
<td>34.2 miles</td>
<td>0 miles</td>
</tr>
<tr>
<td>Road Conversion</td>
<td>4.1 miles</td>
<td>8.2 miles</td>
<td>2.7 miles</td>
</tr>
<tr>
<td>Temporary Road</td>
<td>6.9 miles</td>
<td>10.1 miles</td>
<td>5.5 miles</td>
</tr>
</tbody>
</table>

Areas designated as part of the permanent transportation network are no longer managed as a soil resource and were not analyzed in this report for soil erosion, but are addressed in the water quality section above.

**Cumulative Effects**

Proposed activities may result in additional limited, site-specific soil erosion and soil displacement. Soil would be moved during road construction under the action alternative. Proposed road reconstruction and decommissioning have the potential to result in short-term increases in erosion, but design is targeted at reducing existing limited erosion in some locations by stabilizing currently disturbed areas and targeting the establishment of vegetation that would be expected to prevent or limit erosion in the long term. Soil health assessments that were conducted in the Steamboat project area in 2008 and 2009 overlapped the Cavern, Rochford, and Windy timber sales. These soil health assessments did not show a site that had greater than 15 percent erosion. Most of the erosion identified at this site occurred on or near roads, landings, or skid trails. Ongoing and future projects that could affect soil erosion levels in the project area are also expected to incorporate design criteria to prevent erosion from becoming detrimental. Implementation of the Forest-wide travel management plan is expected to reduce the amount of off-road and off-trail travel, which is anticipated to reduce the amount of soil displacement and erosion that are associated with these activities. Through application of site-specific design criteria...
intended to prevent or minimize soil erosion on soils that would be expected to be more susceptible to
detrimental erosion, WCPs, and other measures, it could be expected that any erosion that occurs
would be minimal and within the limits of Forest Plan standard 1103.

**Alternative C**

**Direct and Indirect Effects**
The direct and indirect effects of Alternative C would be similar to Alternative B but at a higher
magnitude due to the increased level of vegetation treatment and road construction.

Approximately 11,285 acres of vegetation treatment and 5,199 acres of prescribed burning (some areas
of treatment and burning would overlap) would occur in SMUs that are rated as ‘severe’ or ‘very severe’
for off-road erosion. Approximately 40 miles of new road construction, 13 miles of temporary road
construction, 10 miles of non-system road conversion, and 81 miles of reconstruction are proposed
under Alternative C. Therefore, the erosion effects due to new road construction and maintenance
would be greater under Alternative C than Alternative B.

Because the number of acres proposed for vegetation treatment is higher under Alternative C, the
hazard for high intensity fire is lower. Therefore, the potential for wildfires to cause erosion and produce
negative effects on soils and site productivity would be less under Alternative C than Alternatives A, B or
D.

Implementation of design criteria and WCP direction would occur in accordance with Forest Plan
standards 1109 and 1110 and would maintain erosion below 15 percent of affected units.
Negative impacts from erosion associated with road construction would be highest under this
alternative, but impacts of erosion related to high intensity wildfire are expected to be lowest compared
to the other alternatives.

**Cumulative Effects**
Alternative C proposes commercial harvest on more acres than the other action alternatives. As a
result, there would be more landings, temporary roads, and skid trails under this alternative. The risk is
greater for activities to reach the 15 percent threshold, especially on sites where past treatment was
recently completed. However, timber sales are usually implemented over a range of years and not all
sales are in operational at the same time. If all of the timber sales were implemented during the same
time, the chance for soil erosion to reach threshold levels would be higher. Because that does not
happen, the effects of soil erosion are mitigated over time. Therefore, cumulative impacts should be
minor and below the 15 percent threshold on any given unit.

**Alternative D**

**Direct and Indirect Effects**
The direct and indirect effects of Alternative D would be similar to Alternative B but at a lower
magnitude due to the decreased level of vegetation treatment and the absence of new road
construction.
Approximately 6,075 acres of vegetation treatment and 5,199 acres of prescribed burning (some areas of treatment and burning overlap) would occur in SMUs that are rated as ‘severe’ or ‘very severe’ for off-road erosion. No new system road construction is proposed under this alternative. Approximately 8 miles of temporary road construction, 70 miles of reconstruction of existing roads, and 4 miles of non-system road conversion is proposed under Alternative D. Implementation of design criteria and would minimize erosion from temporary road construction and conversion and maintenance of existing roads.

The overall miles of road construction and maintenance and acres proposed for treatment are fewest under this alternative. Consequently, the hazard for a high intensity fire is greater because more fuels would be allowed to accumulate. The potential for a wildfire to cause erosion and produce negative effects on soils and site productivity would be higher under Alternative D than Alternatives B or C, but lower than Alternative A.

Implementation of design criteria and WCP direction would occur in accordance with Forest Plan standards 1109 and 1110 and would maintain erosion below 15 percent of affected units. Negative impacts of erosion related to road construction would be lowest under Alternative D when compared to the other two action alternatives, but the potential impacts of erosion related to high intensity wildfire would be highest compared to Alternatives B and C. With the implementation of design criteria during road maintenance activities, existing erosive areas would be repaired, providing a beneficial impact compared to Alternative A.

**Cumulative Effects**

Alternative D proposes only eight miles of temporary roads and four miles of road conversion. In addition, Alternative D has the lowest level of commercial timber activity compared to the other action alternatives. As a result, the potential for soil erosion would be lower. The cumulative effects would be similar to Alternative B, but would likely occur at a lower level.

**Soil Compaction**

**Alternative A (No Action)**

**Direct and Indirect Effects**

Under Alternative A, no new activities are proposed on erosive or compactable soils. Existing activities would continue under this alternative and include timber sales, post-harvest (KV) activities, road maintenance, fuel reduction, mining, and grazing. With the absence of new activities, existing levels of bulk density are expected to decrease over time through various natural processes including root development, freeze/thaw cycles, and wildlife activity (especially gopher excavation). This alternative would result in the least amount of soil compaction because no activities are proposed that would increase compaction levels and current compaction levels would decrease over time.

**Cumulative Effects**

Alternative A does not propose any new activities. Current soil compaction levels would stay the same except where there are ongoing activities. Some compaction could occur from existing projects, but would be minimal and would not accumulate with any actions related to the Steamboat Project.
**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

Alternative B proposes commercial and non-commercial timber harvest, prescribed burning and road management activities that would result in varying amounts of soil compaction depending upon site conditions, the extent of the activity, and the weight of vehicles and equipment on the ground. Soil health surveys conducted in 2008 and 2009 examined soil compaction. Eight transects showed compaction on more than 15 percent of the sites. These sites are located on SMUs 24C (Citadel-Vanocker Complex), 193F and VaE (Vanocker-Citadel Complex), 199C (Vanocker-Paunsaugunt Complex), McB (Marshbrook-Cordeston Loams), and RnG (Rock Outcrop-Sawdust Complex). All but one of the sites showing compaction above 15 percent were located in previous timber sales units: Windy Units 6 and 14 harvested in 2004 and Cavern Units 14 and 18 harvested in 1999. Under Alternative B, 271 acres are proposed for treatment within these SMUs.

Thirteen SMUs in the Steamboat project area are susceptible to compaction based on their low strength and high water capacity properties. Approximately 6,131 acres of vegetation treatment and 5,892 acres of prescribed burning (some areas of treatment and burning overlap) are to occur on these SMUs. It is expected that activities proposed under this alternative may result in varying levels of soil compaction, but increases in bulk densities would not be expected to exceed the regional soil quality standards if activities were to occur during times when the soil was dry, frozen, or covered with at least one foot of packed snow. The installment of dozer lines is the main cause of soil compaction during prescribed burning. Recent monitoring studies within the Black Hills National Forest have concluded that the use of existing roads as fire lines would minimize the amount of compaction resulting from prescribed burning (USDA-Forest Service 2010a). Based on the expectation that WCPs and design criteria specified above would be implemented, soil compaction levels should not reach the detrimental level of 15 percent in any single unit (USDA-Forest Service 2005c).

New system and temporary road construction, reconstruction of existing roads, and non-system road conversion would occur under Alternative B and would be expected to contribute to compaction. Compaction occurs primarily during construction of the road, the ditch paralleling the road, and the cut and fill slopes. Compaction as a result of road construction would repair itself over time as activity along the roads would only occur once and vegetation would be established within one year. Approximately 20 miles of new system road, 10 miles of temporary roads, 74 miles of reconstruction, and 6 miles of non-system road conversion are proposed under Alternative B. Restriction of use on these roads after harvesting activities would eliminate any further compaction as a result of vehicle activity. Reclamation and revegetation of temporary constructed routes would occur in accordance with Forest Plan standards 1109 and 1110. Once drainages are in place and vegetation becomes established on road surfaces, compaction from these roads would be expected to return to background levels as roots penetrate and break up compacted soil.

Under Alternative B, detrimental compaction would occur on temporary haul roads and skid trails, especially on SMUs 18C, 24C, 27B, 40B, 43C, 82C, 88B, 92C, 205D, CtE, McB, So, and TaB. Best management practices monitoring would occur after timber sales are closed to assess the amount of compaction and maintain this amount below 15 percent of each unit. The level of soil compaction occurring under Alternative B is expected to be less than Alternative C and greater than Alternatives A or D.
Cumulative Effects
Soil health assessments were conducted within the Steamboat project area in 2008 and 2009 at locations that overlapped the Cavern, Rochford, and Windy timber sales as well as some adjacent undisturbed sites. Evidence of compaction was found along skid trails and landings at all sites that were surveyed within a timber sale unit. Based on Forest-level monitoring (USDA-Forest Service 2010a), total soil compaction would be expected to be below 15 percent in all activity areas, and any increase in levels would be expected to decrease over time depending on various site and climatic conditions. Ongoing and future projects, such as post-sale activities, that could compact soil in the project area would be expected to incorporate and implement design criteria to avoid detrimental compaction. The recently implemented Forest-wide travel management plan is expected to reduce the amount of off-road and off-trail travel, which is anticipated to reduce the amount of soil compaction associated with these activities. Because these various activities would take place over time, and Forest-level monitoring has documented bulk densities to remain below or return to levels below those defined by Regional soil quality standards as detrimentally compacted, cumulative soil compaction would be minimal and within the acceptable limits set by Forest Plan standard 1103.

Alternative C
Direct and Indirect Effects
The direct and indirect effects of Alternative C would be similar to Alternative B but at a higher magnitude due to the increased level of vegetation treatment and road construction.

Approximately 9,692 acres of vegetation treatment and 5,892 acres of prescribed burning (some areas of treatment and burning overlap) would occur on the SMUs classified as low strength and high water capacity under Alternative C. Approximately 40 miles of system road construction, 13 miles of temporary road construction, 81 miles of reconstruction, and 10 miles of non-system road conversion are proposed under Alternative C, which is more than Alternative B. Thus the amount of compaction due to the construction and maintenance of roads is greater in this alternative than Alternative B. More acres are proposed for treatment, creating more skid trails and temporary haul roads, which could cause compaction. This alternative would have the most negative impacts relating to soil compaction compared to any other alternative.

Cumulative Effects
Alternative C would have the greatest potential for soil compaction levels to reach the 15 percent threshold as compared to the other action alternatives due to the higher road mileage and greater acreage of lands proposed for commercial harvest. Landings, temporary roads, and skid trails are the most common areas of compaction within a timber sale. Because there are more lands proposed under Alternative C, the potential effects would be greater under this alternative than under Alternative B. However, because timber sales are spread out over time, the effects of compaction would also be spread out, allowing areas to naturally recover from past and ongoing treatments and minimizing the potential for negative cumulative effects.
Alternative D

Direct and Indirect Effects
The direct and indirect effects of Alternative D would be similar to Alternative B but at a lower magnitude due to the decreased level of vegetation treatment and the absence of new road construction.

Approximately 4,715 acres of vegetation treatment and 5,892 acres of prescribed burning (some areas of treatment and burning overlap) would occur on the SMUs classified as low strength and high water capacity under Alternative D. No road construction is proposed, but approximately 8 miles of temporary road construction, 70 miles of reconstruction, and 4 miles of conversion is would occur. The level of proposed vegetation treatment and road management activities is less than Alternatives B and C and more than Alternative A. Therefore, the potential for negative impacts relating to soil compaction would be less than Alternatives B or C and greater than Alternative A.

Cumulative Effects
Alternative D proposes no road construction, less road conversion, and less commercial harvest than the other action alternatives. Less compaction is expected from the proposed activities and, when considered along with past and ongoing activities, should not reach the 15 percent threshold. No detrimental cumulative effects related to soil compaction are expected under Alternative D.

Soil Nutrients

Alternative A (No Action)

Direct and Indirect Effects
Under Alternative A, nutrient levels may increase over time as biomass is allowed to accumulate. Soil nutrients could be impacted in the event of a high intensity wildfire. Such a wildfire could occur under any alternative, but soil nutrients would be most impacted under this alternative because the risk and severity of a fire is expected to be greater due to lack of management. Monitoring and rehabilitation would be implemented as needed to access the effects on soil nutrients after a wildfire. This alternative is the most beneficial to soil nutrients unless a high intensity wildfire occurs.

Cumulative Effects
Existing activities such as timber harvest, post-harvest (KV) activities, mining, and grazing would continue under this alternative. A risk for a stand-replacing wildfire exists under all alternatives, but has the highest risk under Alternative A. Cumulative effects on soil nutrients are not expected from the past activities on the Forest and past and potential activities on private lands.

Alternative B (Proposed Action)

Direct and Indirect Effects
Under Alternative B, 12,336 acres are proposed for vegetation treatment and 10,608 acres are proposed for prescribed burning (some acres overlap between these treatments). The loss of organic matter and nutrients would generally be expected to occur in those timber harvest areas where whole-tree yarding is used (Rafferty and Gies 2011). This method is estimated to remove 75 to 85 percent of the slash
generated from harvest activities in the stand and place it in mechanical harvester piles. Whole-tree
yarding is desirable in areas where fuel reduction is necessary to target the reduction of high intensity
wildfires that result in severe effects to soil nutrients. In addition, prescribed burning targets removal of
fuels and reduces the potential of a high intensity wildfire. Prescribed fires are burned at a moderate
intensity, which removes the duff layer and consumes organic matter within the surface layer. In soils
with low organic matter, prescribed burns should occur at low intensity to help retain some organic
matter. Within the Steamboat project area, two SMUs have organic matter content less than two
percent: HtG (Hopdraw-Sawdust-Rock Outcrop Complex) and RnG (Rock Outcrop-Sawdust Complex).
Three stands composed of these SMUs have proposed activities (Table 3-57). Proposed design criteria
must be applied to these stands to meet Forest Plan standard 1102. The Steamboat project area has
four SMUs that contain a rooting depth of 6 to 20 inches: RnG, 116E and PaE (Paunsaugunt-Rock
Outcrop Complex), and 124C (Paunsaugunt-Citadel Complex). A total of 146 stands have at least one of
these SMUs of varying acreage. Stands that have more than 50 percent of lands with SMUs with a low
rooting depth are listed in Table 3-58. Alternative B proposes 986 acres of vegetation treatment and
942 acres of prescribed burning on SMUs with low organic matter content and a shallow rooting depth.
Whole-tree yarding activities on these SMUs may contradict Forest Plan guideline 1102a.
Implementation of design criteria as outlined in Appendix C would ensure compliance with the Forest
Plan.

Stand 081709-44 has soils with low organic matter and low rooting depth. This stand has the highest
potential to lose its soil nutrients during implementation of the proposed action. Whole tree yarding for
this stand is not an option for meeting Forest Plan standard 1102. Because the soils are low in nutrients,
lop and scatter should is the only option for this stand. Winter logging would also benefit this stand
because there is a higher potential for fine slash to be left within the stand instead of being scattered
post-harvest.

Direct and indirect effects may occur, but with the implementation of the design criteria and the
retention of slash on the ground where harvest units overlap the above listed SMUs, the effects should
be minimal. Also, if whole tree yarding is used as the harvest method, winter logging would be more
beneficial in retaining nutrients on site; more fine slash is retained on the ground during winter logging
due to the increased brittleness of tree limbs.

<table>
<thead>
<tr>
<th>Stand ID</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>081708-74</td>
<td>No treatment</td>
<td>Overstory Removal</td>
<td>No Treatment</td>
</tr>
<tr>
<td>081708-75</td>
<td>No treatment</td>
<td>Commercial thin</td>
<td>No Treatment</td>
</tr>
<tr>
<td>081709-44</td>
<td>Commercial thin</td>
<td>Commercial thin</td>
<td>Commercial thin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stand ID</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>081506-27</td>
<td>Products other than logs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>081506-29</td>
<td>Products other than logs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>081506-31</td>
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<tr>
<td>081506-32</td>
<td>Products other than logs</td>
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</tr>
<tr>
<td>081506-64</td>
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<td>081506-68</td>
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<td></td>
</tr>
<tr>
<td>081506-77</td>
<td>Products other than logs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cumulative Effects

Timber harvest and fuels treatments are proposed to occur on soils with an effective rooting depth of less than 15 inches. These sites inherently have limited nutrient availability and water-holding capacity, which is generally visible in the growth of ponderosa pine at those locations or evident in site indices. Application of design criteria would retain or return residual slash material in the stands with shallow soils (i.e., effective rooting depths of 15 inches or less), with the expectation that soil nutrient levels would generally be maintained or potentially improve. Ongoing and future projects that could affect soil nutrients in the project area would also be expected to incorporate and fully implement design criteria targeted at retaining on-site material with the expectation that soil nutrient levels would be retained.
There is the potential for cumulative effects to occur on stand 081709-44 in relation to soil nutrients. The soil map units under this stand have both low organic matter and low rooting depth. If whole tree yarding is implemented, the potential exists for the soil nutrient levels to stay low through the year 2021. However, if whole tree yarding is not implemented in this stand, the potential for a cumulative effect decreases until it is almost negligible.

Alternative C

Direct and Indirect Effects
Under Alternative C, approximately 1,551 acres of vegetation treatment and 942 acres of prescribed burning (some acres overlap between these two treatments) would occur. Stands that are proposed for treatment and would require design criteria to meet Forest Plan standard 1102 are listed in Tables 3-57 and 3-58.

The proposed activity under Alternative C is similar to that of Alternative B, although more stands have treatment proposed. This alternative would have the highest negative effect on soils in regards to soil nutrients as compared to all alternatives. This is based on the greater amount of activity proposed on soils with shallow rooting depth and low organic matter. Plus, some of these stands also include planting after thinning, which shows that there could be less opportunity to leave fine slash within the stands.

Cumulative Effects
Alternative C proposes more lands, as compared to Alternative B, for treatment that have soil map units that do not have the ability to hold soil nutrients. If the design criteria are implemented, no cumulative effects to soil nutrients would occur in these stands because the direct and indirect effects related to the Steamboat Project would be eliminated. Effects would be similar to Alternative B, but with more potential for effect due to a higher level of treatment.

As with Alternative B, stand 081709-44 has the potential for a cumulative impact of loss of soil nutrients if whole-tree yarding is implemented. Effects would the same for this stand under Alternative C as under Alternative B. Also, stand 089903-31 could have a net loss of soil nutrients because this stand has mass movement potential and was rated as unstable from field surveys. Implementation of the overstory removal with a wet winter could cause this hillside to be more unstable and soils move further downhill. This could result in future loss of soil nutrients.

Alternative D

Direct and Indirect Effects
Under Alternative D, approximately 722 acres of vegetation treatment and 942 acres of prescribed burning (some acres overlap between these two treatments) would occur. Stands that are proposed for treatment and would require design criteria to meet Forest Plan standard 1102 are listed in Tables 3-57 and 3-58.

The proposed activity under Alternative D is similar to that of Alternatives B and C, although fewer stands have treatment proposed. This alternative has higher potential for high intensity wildfire than
Alternatives B and C and, consequently, the potential for effects to soil nutrients as a result of wildfire would be greater. Effects to soil nutrients as a result of harvest activities would be the least under this alternative compared to Alternatives B and C, but would be higher than Alternative A.

**Cumulative Effects**

Alternative D proposes fewer acres for treatment with soil map units with low soil nutrients as compared to the other action alternatives. Cumulative effects would be the least negative under this alternative as compared to Alternatives B and C. More stands would not be harvested, so there would not be a loss of future nutrients in these stands and soil map units. Alternative D would have effects similar to what is described under Alternative B, but with a lower potential for negative impacts.

Cumulative effects for stand 081709-44 would the same as described under Alternative B as under Alternative D because the same action is proposed.

**Soil Heating**

**Alternative A (No Action)**

**Direct and Indirect Effects**

Under Alternative A, limited soil heating effects caused by prescribed burning would not occur. Severe soil heating effects, such as complete consumption of ground cover vegetation, litter, and duff, development of water repellency, extensive soil erosion, decreased soil biological activity, and disturbance of the soil nitrogen pool, could occur in the event of a stand-replacing fire. These effects could occur under any alternative, though the potential for large, stand-replacing fires would be the greatest under Alternative A. Altered soil conditions resulting from intense fire may affect long-term productivity of sites (USDA-Forest Service 2005a).

**Cumulative Effects**

All current activities would continue under this alternative, which includes timber harvest, post-harvest (KV) activities, grazing, and mining. High-intensity, stand-replacing wildfires could occur under any alternative, but the risk is expected to the highest under Alternative A. Cumulative effects from a potential wildfire are expected to be the greatest under Alternative A due to the highest fire risk.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

Severe soil heating effects, as described above, could also occur under Alternative B. However, the potential for large, stand-replacing fires would be lower under Alternative B.

Alternative B proposes 10,608 acres of prescribed burning. It is estimated that approximately 1,000 to acres a year for up to 10 years would actually be completed. No burning is proposed on soils with high potential for impacts from fires of moderate intensity. Fires of this intensity provide the heat necessary to remove the duff layer and consume organic matter in the surface layer. A mosaic of burning conditions would be expected within the project area during a prescribed burn due to differences in factors such as vegetation type, wind speed, soil moisture, and relative humidity. Prescribed burning would be expected to contribute to a reduction in the potential for high intensity wildfires while
contributing to very limited hydrophobicity (i.e., water repellency) and soil erosion. Hydrophobic soil would be expected to break down enough to no longer affect hydrologic processes within five years (USDA-Forest Service 1996) and ground cover vegetation would be expected to recover within three to five years, even in the case of a wildfire (Driscoll et al. 2004, Keyser et al. 2006). In the event that a prescribed burn was to exceed the intensity of the prescription, a site evaluation may be necessary to assess the effects and determine if any rehabilitation is required. Additionally, prescribed burns of low intensity would be expected to consume some of the fuels, releasing some of the associated nutrients to the soil.

To keep soil heating effects to a minimum, prescribed burning proposed under the action alternatives would be conducted to minimize the residence time on the soil while meeting burn objectives in accordance with the WCPs.

**Cumulative Effects**
Prescribed burning is proposed to reduce fuels and contribute to the goal of reducing the extent of crown fire and difficulty of suppression. Burns are expected to be conducted in accordance with the WCPs to limit the fire residence time at the soil surface. This measure is expected to prevent soil heating to the point that soil could become severely burned. Prescribed burning in the area would generally be expected to have beneficial long-term effect by potentially limiting the extent or intensity of future crown fires that may occur within the project area, thereby limiting soil heating that can be associated with high-intensity wildfires.

**Alternative C**

**Direct and Indirect Effects**
Alternative C would reduce the fire hazard to a greater extent than Alternative B, reducing the potential impact of soil heating from a high intensity wildfire.

Alternative C proposes the same amount of acreage for prescribed burning as Alternative B. Therefore, the effects are expected to be similar to what is described under Alternative B.

**Cumulative Effects**
Prescribed burning is proposed in the same areas under all three action alternatives. Therefore, the effects that are described under Alternative B would also apply to Alternative C.

**Alternative D**

**Direct and Indirect Effects**
Alternative D would reduce the fire hazard across the project area, but to less extent than either Alternative B or C. Therefore, the potential for negative impacts from soil heating would be higher under Alternative D as compared to the other action alternatives but would be lower than Alternative A.

Alternative D proposes the same amount of acreage for prescribed burning as Alternative B. Therefore, the effects are expected to be similar to what is described under Alternative B.
Cumulative Effects
Prescribed burning is proposed in the same areas under all three action alternatives. Therefore, the effects that are described under Alternative B would also apply to Alternative D.

Regeneration Hazard

Alternative A (No Action)

Direct and Indirect Effects
Under the no action alternative, no new activities would occur that would affect regeneration on forested sites.

Cumulative Effects
Alternative A does not propose any new activities. Regeneration is expected to be similar to that which is typical for soils in the area. Therefore, adverse cumulative effects are not expected.

Alternative B (Proposed Action)

Direct and Indirect Effects
Ponderosa pine regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors. Activities proposed under Alternative B would take place on SMUs classified as having low or moderate potential for seedling mortality for the majority of the stands within the project area. Only four stands have a proposed commercial activity that would occur in an SMU with 10% of the unit having a high rating for seeding mortality. Based on that classification and the silviculture report (Haas 2011), which states that pine regeneration has occurred and is occurring in the project area, seedling mortality is not expected to generally be of concern under Alternative B.

Five stands (081509-01, 081510-18, 089902-01, 089904-12, and 089904-29) with proposed activities have identified meadows as a part of the stand. Thinning of these stands would be beneficial in maintaining the meadows by removing encroaching pine. Seedling mortality should not be an issue within the meadows because pine trees are generally undesirable within meadows.

<table>
<thead>
<tr>
<th>Stand Location</th>
<th>Stand Id</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>081509</td>
<td>10</td>
<td>Commercial meadow enhancement/ Non-commercial thinning, Prescribed burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>081510</td>
<td>13</td>
<td>Commercial thin/ Non-commercial thin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>081510</td>
<td>17</td>
<td>No treatment</td>
<td>Overstory removal</td>
<td>No treatment</td>
</tr>
<tr>
<td>081510</td>
<td>18</td>
<td>Individual tree selection/ Non-commercial thin/ Prescribed burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>081510</td>
<td>73</td>
<td>No treatment</td>
<td>Overstory removal/Planting</td>
<td>No treatment</td>
</tr>
<tr>
<td>081706</td>
<td>24</td>
<td>No treatment</td>
<td>Commercial thin/ Non-commercial thin</td>
<td>No treatment</td>
</tr>
<tr>
<td>081708</td>
<td>4</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>089902</td>
<td>1</td>
<td>Individual tree selection</td>
<td>Individual tree selection</td>
<td>No treatment</td>
</tr>
<tr>
<td>089904</td>
<td>9</td>
<td>Commercial thin/ Non-commercial thin</td>
<td>Commercial thin/ Non-commercial thin</td>
<td>No treatment</td>
</tr>
<tr>
<td>089904</td>
<td>12</td>
<td>Meadow enhancement/ Prescribed burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>089904</td>
<td>13</td>
<td>Prescribed burning</td>
<td>Shelterwood Cut/ Non-commercial</td>
<td>Prescribed</td>
</tr>
</tbody>
</table>
Cumulative Effects

Soils within the project area are rated as having low potential for seedling mortality. Problems obtaining sufficient regeneration have not been encountered in the project area (Haas 2011). Because this is generally an inherent characteristic of sites, Alternative B would generally not be expected to influence soil characteristics to the point of altering regeneration of ponderosa pine and cumulative effects would not be expected to occur.

Alternative C

Direct and Indirect Effects

Alternative C proposes activities within twelve different stands that have regeneration hazards (Table 3-59) and in five stands with identified meadows. As discussed above, treatments within these stands would improve the meadow health with the removal of pines. Again, based on the silvicultural report (Haas 2011) and past experience, regeneration is generally not expected to be a problem in harvest units.

The one stand with a potential regeneration problem would be stand 08150-73 (Table 3-59). This stand is composed of SMUs 124C, 190E, and 193F. SMU 124C is identified as having a high rating for seedling mortality and the other two have a moderate rating of seedling mortality. Due to the SMUs under the stand, implementation of the overstory removal could negatively impair future seedling growth. This stand is also identified for subsequent planting to ensure that the stand would meet Culmination of Mean Annual Increment (CMAI) as defined in the Forest Plan (USDA-Forest Service 2005c). Due to the SMUs within the stand, the planting may not be successful. The potential exists for this stand to not meet CMAI even if planting occurs.

Cumulative Effects

Alternative C proposes treatment in more stands with soil map units with a seedling mortality rating of ‘high’ as compared to the other action alternatives. The cumulative effects would be similar to what is described under Alternative B, but to a greater degree.

Alternative D

Direct and Indirect Effects

Alternative D proposes activities within seven stands that are identified with SMUs with high seedling mortality for more than 10% of the stand (Table 3-59). Only two stands are proposed for a commercial thinning activity. The silviculture report (Haas 2011) does not identify regeneration as a problem within the Steamboat project area. Therefore, it is expected that the two stands with commercial activities should adequately regenerate.

Alternative D proposes activities within four of the stands with identified meadows within the Steamboat project area. Only stand 089902-01 does not have a proposed activity within Alternative D.
This stand is directly below Dalton Lake Dam and has mild pine encroachment within the meadow; however, the pine is the only source of shade for Little Elk Creek. Not implementing a commercial activity within stand 089902-01 should not have a long-term negative effect on this meadow.

**Cumulative Effects**

Alternative D has the fewest stands with a proposed activity on soil map units that have a ‘high’ rating for seedling mortality. The potential for a negative cumulative impact to regeneration is the least for this alternative as compared to the other action alternatives.

**Geological Hazards**

**Alternative A (No Action)**

**Direct and Indirect Effects**

Under the no action alternative, no new activities are planned on slopes with characteristics indicative of mass movement potential. Soil mass movement is expected to continue at existing levels or may increase if a high intensity fire occurs and results in extensive tree mortality on these soils.

**Cumulative Effects**

Potential for mass movement events would be expected to be limited to rates typical of the geology in the area. Therefore, adverse cumulative effects are not expected.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

Alternative B proposes timber harvest on SMUs that are identified in the Forest Plan as being susceptible to mass movement. Slope stability surveys were conducted for the Steamboat project area between 2008 and 2010 on soils and slopes that have been identified as susceptible to mass movement per Forest Plan guideline 1108. These surveys identified 44 sites as stable, 24 sites as cautionary or having signs of instability, and 9 sites as unstable. Proposed treatments in some of these areas have been dropped from the proposed action. Other stands were retained for treatment because the total acreage of soils with stability issues within the stand was low.

Overall, a total of 43 proposed treatment stands overlap one of the areas where the surveys showed unstable slopes (Table 3-60). In each case, the entire stand is not considered unstable but some part of the stand (greater than 1 acre in size) was rated as unstable. Twenty of these stands have a proposed commercial activity.

There is potential for increased soil erosion as a result of the commercial harvest activities within the stands that are rated as unstable. Removal of the basal area would reduce the amount of soil-water that is being used by trees. The removal of trees could increase the amount of water in storage in soils, soils could become over-saturated and trigger some kind of mass movement (e.g. landslide, soil creep, or slump). Due to this, it is recommended to maintain basal areas above 60 to reduce the mass movement potential.
Three stands within the Steamboat project area (081510-08, 081510-35 and 081708-90) are proposed for commercial activities that would reduce the basal area below 60 and could remove enough timber to trigger future mass movement. Implementation of the proposed activities within these stands could cause the non-compliance with Forest Plan guideline 1108. Existing roads are located near three stands (089903-95, 081510-8, and 081510-35) with proposed commercial activity that could reduce the basal area of stands. The roads near the thinned stands could increase the potential for future mass movement. Eight stands with unstable soils are proposed for non-commercial treatments under Alternative B. Non-commercial activities should not cause any further destabilization of the hillsides because they would not greatly reduce the basal area of the stand.

Prescribed burning would not significantly reduce the basal area in stands as burns would be of low intensity, largely removing ground fuels and small trees in some areas. The concern with prescribed burning would be where dozer lines are constructed in areas that are rated as unstable. The recommendation is to use existing roads or trails as much as possible. If not possible, construction of hand lines is preferable to dozer lines. This would minimize the new disturbance within the unstable areas.

<table>
<thead>
<tr>
<th>Stand</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
<th>Site Specific Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>081509-05</td>
<td>Understory thin</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails. Keep higher density of trees upon the unstable hillslope (20 acres)</td>
</tr>
<tr>
<td>081509-11</td>
<td>Commercial thin</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads. Keep a higher density of trees along the eastern side of the stand (8 acres).</td>
</tr>
<tr>
<td>081509-15</td>
<td>Prescribed burning</td>
<td>Overstory Removal/Prescribed burning</td>
<td>Prescribed burning</td>
<td>Minimize disturbance from skid trails and temporary roads. Keep a higher density of trees within the middle of stand. Alternative C only. (34 acres).</td>
</tr>
<tr>
<td>081509-24</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
<td>None (17 acres)</td>
</tr>
<tr>
<td>081510-03</td>
<td>No treatment</td>
<td>Overstory Removal/Planting</td>
<td>No treatment</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-04</td>
<td>Prescribed burning</td>
<td>Shelterwood cut/Prescribed burning</td>
<td>Prescribed burning</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-08</td>
<td>Commercial thin/Prescribed burning</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-09</td>
<td>Commercial thin</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads and retain more trees along the eastern side of the of the stand boundary (total of 2 acres).</td>
</tr>
<tr>
<td>081510-27</td>
<td>Prescribed burning</td>
<td>Commercial thin/Prescribed burning</td>
<td>Prescribed burning</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-33</td>
<td>NT</td>
<td>Shelterwood Cut/Prescribed burning</td>
<td>NT</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-35</td>
<td>Shelterwood Cut/Prescribed burning</td>
<td></td>
<td></td>
<td>Avoid seeps. Minimize disturbance from skid trails and temporary roads. (entire stand)</td>
</tr>
<tr>
<td>081510-36</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
<td>None (entire stand)</td>
</tr>
<tr>
<td>081510-42</td>
<td>No Treatment</td>
<td>Overstory</td>
<td>No</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>Stand</td>
<td>Alternative B</td>
<td>Alternative C</td>
<td>Alternative D</td>
<td>Site Specific Design Criteria</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>081510-54</td>
<td>Prescribed burning</td>
<td>Commercial thin/Prescribed burning</td>
<td>Prescribed burning</td>
<td>Minimize disturbance from skid trails and temporary roads and retain more trees along the eastern side of the of the stand boundary. Alternative C only. (2 acres)</td>
</tr>
<tr>
<td>081510-57</td>
<td>NT</td>
<td>Commercial thin</td>
<td>NT</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-58</td>
<td>Non-commercial thin/Prescribed burning</td>
<td>Commercial thin/Prescribed burning</td>
<td>Non-commercial thin/Prescribed burning</td>
<td>Avoid seeps (all alternatives). Minimize disturbance from skid trails and temporary roads within stand for Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-60</td>
<td>NT</td>
<td>Overstory Removal/planting</td>
<td>NT</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081510-74</td>
<td>Prescribed Burning</td>
<td></td>
<td></td>
<td>None (entire stand).</td>
</tr>
<tr>
<td>081510-75</td>
<td>Commercial thin</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads. (6 acres)</td>
</tr>
<tr>
<td>081708-20</td>
<td>No Treatment</td>
<td>Overstory removal</td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads along the southern boundary. Alternative C only. (1 acre)</td>
</tr>
<tr>
<td>081708-21</td>
<td>No Treatment</td>
<td>Shelterwood Cut</td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads along the southern half of the stand. Alternative C only. (34 acres)</td>
</tr>
<tr>
<td>081708-42</td>
<td>Shelterwood Cut</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads along the western boundary of the stand (6 acres).</td>
</tr>
<tr>
<td>081708-43</td>
<td>No Treatment</td>
<td>Shelterwood Cut</td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads along western boundary. Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081708-44</td>
<td>No Treatment</td>
<td>Overstory Removal/Planting</td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads (entire stand). Alternative C only. (entire stand)</td>
</tr>
<tr>
<td>081708-62</td>
<td>Commercial thin/Prescribed burning</td>
<td></td>
<td>Prescribed burning</td>
<td>Minimize disturbance from skid trails and temporary roads. Alternatives B and C.(46 acres)</td>
</tr>
<tr>
<td>081708-64</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
<td>None (4 acres)</td>
</tr>
<tr>
<td>081708-87</td>
<td>Commercial thin</td>
<td></td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads along western boundary (1 acre).</td>
</tr>
<tr>
<td>081708-88</td>
<td>No Treatment</td>
<td>Overstory Removal</td>
<td>No Treatment</td>
<td>Minimize disturbance from skid trails and temporary roads along northern and eastern half of the stand (37 acres). Alternative C only.</td>
</tr>
<tr>
<td>081708-90</td>
<td>Commercial thin/Prescribed burning</td>
<td></td>
<td></td>
<td>Minimize disturbance from skid trails and temporary roads (entire stand).</td>
</tr>
<tr>
<td>089902-20</td>
<td>Commercial Meadow Enhancement/Prescribed burning</td>
<td></td>
<td></td>
<td>Minimize skid trails and temporary roads along the eastern and middle part of stand (4 acres).</td>
</tr>
<tr>
<td>089902-23</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
<td>None (2 acres)</td>
</tr>
<tr>
<td>089902-46</td>
<td>Prescribed burning</td>
<td></td>
<td></td>
<td>None (8 acres)</td>
</tr>
<tr>
<td>089902-49</td>
<td>Commercial thin</td>
<td></td>
<td></td>
<td>Minimize skid trails and temporary roads (27 acres).</td>
</tr>
<tr>
<td>089902-66</td>
<td>Individual tree selection</td>
<td></td>
<td></td>
<td>Minimize skid trails and temporary roads (21 acres).</td>
</tr>
<tr>
<td>089902-73</td>
<td>Non-commercial thin</td>
<td></td>
<td></td>
<td>Move new road construction outside of the instable areas. (6 acres).</td>
</tr>
<tr>
<td>089903-04</td>
<td>Products other than logs</td>
<td></td>
<td></td>
<td>Avoid or leave a higher density of trees in the northern section of stand (17 acres).</td>
</tr>
<tr>
<td>089903-11</td>
<td>Commercial thin/Prescribed burning</td>
<td></td>
<td></td>
<td>Minimize skid trails and temporary roads within the unstable areas. Avoid or leave a higher density of trees in the northern bend and western half of stand</td>
</tr>
</tbody>
</table>
Alternative B proposes approximately 0.9 miles of new construction, road conversion, or temporary road in areas that were rated as unstable. The highest concern is approximate 0.7 miles of new road construction that is within an area that was rated as unstable in T3N, R5E, Section 12 and T3N, R6E, Sections 7 and 18. Most of this road is at the top of the hill and should not be problem. However, a portion of the road drops into the hillslope that has been identified as unstable. This roadcut could be a catalyst in the future for debris flow under high saturated conditions. The larger concern would be the conversion of non-system road U140124 into a NFS road because this could cause some cutting into the hillslope. This route is at the base of the hill near an ephemeral tributary to Stagebarn Canyon. This route could intersect sub-surface water flow resulting in areas where slumping or other type of debris flow could form. Undercutting a hillslope for road building is one of the most common triggers for mass movement (Ritter 2006).

The other concern is a temporary road proposed in T3N, R6E, Sections 6 and 7. This temporary road is only 0.1 miles but within an area that is rated as unstable and cuts midslope along the Little Elk Creek canyon walls. If cutslopes are created by the construction of this temporary road, it could destabilize the hillside.
Two new roads are proposed within the southern part of the project area within T2N, R6E, Sections 7 and 8. Both of these roads are on the ridge and should not cause any increased instability by road building. Any time the roads or any spur roads cut midslope, the potential for instability increases.

Road reconstruction or maintenance is proposed on several NFS roads that cross areas of known unstable slopes. Reconstruction activities should be done with care and during dry times of the year within these sections to avoid triggering further movement. Unstable sites vary in size and are most common on mid-slope roads. During reconstruction activities, these roads could be examined to increase the water drainage off of the road if necessary. Table 3-63 shows the NFS roads that cross areas with unstable slopes and are proposed for reconstruction or maintenance.

<table>
<thead>
<tr>
<th>FSR Road</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
</tr>
</thead>
<tbody>
<tr>
<td>135.1I</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>135.1M</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>144</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>144.1G</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>144.2B</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>144.2E</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>149.2A</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>224.1A</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>226.1C</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>704.1C</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Cumulative Effects**

As described in the Direct and Indirect Effects section, design criteria for activities proposed on Citadel, Lakoa, and Rockoa soils with slopes greater than 30 percent would minimize the risk of mass movement. Small areas of existing unstable slopes are usually excluded during implementation unless there are mitigation measures in place. The application of Forest Plan guideline 1108 would minimize the potential for mass movement events (USDA-Forest Service 2005c). Provided that mass movement is avoided, cumulative effects would not occur.

**Alternative C**

**Direct and Indirect Effects**

Overall, a total of 55 proposed treatment stands include one of the areas where the surveys showed unstable hillslopes. In each case, the entire stand is not considered unstable but some part of the stand (greater than 1 acre in size) was rated as unstable. Forty-two of these stands have a proposed commercial activity that would remove basal area (Table 3-60).

Effects would be similar to those described under Alternative B with a greater potential for future slope instability due to the increased acres proposed for thinning. Four stands (081708-44, 0815010-3, 42, and 60) would have the highest potential because they would require either reserve trees or planting after the completion of commercial activities. Thinning these stands could cause future instability.

Thirteen stands are proposed for commercial timber activities under Alternative C where the entire stand has been surveyed as unstable in the past. Implementation of these commercial activities could
Contribute to future instability to the hillslopes. Four stands have either roads within or near them located along unstable hillsides (089903-095, 081510-08, 081510-35, and 081510-57). These stands are more at risk of increased soil erosion from potential future mass movement. Only one stand is proposed for prescribed burning (089903-30) and not commercial activity. Prescribed burning on this stand should not trigger any future mass movement.

Alternative C proposes more new roads on unstable hillslopes than Alternative B. One non-system route (U140174) is proposed for conversion to a NFS road. This route is located at T3N, R6E, Section 8. The other two routes are proposed as temporary roads also located at T3N, R6E, Section 8. Existing roads are proposed for reconstruction in areas that have unstable soils. As described above, road maintenance should be done carefully, especially when cleaning up the cut slope and roadside ditches.

Overall, Alternative C has a greater risk to trigger future mass movement as compared to Alternative B. This is due to the increased level of commercial timber harvest and road management activities on unstable hillslopes. There is potential to be in violation of Forest Plan guideline 1108 with the implementation of Alternative C because there is a good potential for resource damage to roads and hillsides from implementation.

**Cumulative Effects**

Alternative C proposes more activities on hillslopes, as compared to Alternative B, that were rated as unstable from field surveys. Overall, 14 stands (Table 3-60) are proposed for timber harvest that would reduce the basal area below the recommendation included in design criteria. The potential for mass movement within these stands would be greater than in the other stands listed in Table 3-60. Collectively, 42 stands with an unstable rating and 159 stands with a caution rating have a proposed activity under Alternative C. There is a greater potential for a future mass movement event from implementation of Alternative C as compared to all action alternatives due to the greater disturbance proposed on unstable hillslopes. Even if design criteria are in place, reduction of the basal area on these stands would place them at risk of mass movement if future harvest or road construction activities were to take place in the same stands. Implementation of Alternative C could violate Forest Plan guideline 1108 if mass movement events occur. These mass movement events would represent resource damage that could be avoided if trees were not removed from these hillsides.

**Alternative D**

**Direct and Indirect Effects**

Overall, a total of 40 stands intersect one of the areas where surveys showed unstable hillslopes and Alternative D proposes a treatment. In each case, the entire stand is not considered unstable but some part of the stand (greater than 1 acre in size) was rated as unstable. Seventeen of these stands have a proposed commercial activity that would remove basal area.

Effects would be similar to, but at less intensity, than what is described under Alternative B because Alternative D proposes fewer acres of treatment, no new road construction and fewer miles of road conversion or maintenance. The same three stands are proposed for commercial activities as under Alternative B. The effects of harvest activities described under Alternative B would the same as Alternative D. Two stands (081510-08 and 081510-35) are near roads and also have a proposed commercial activity. These stands would potentially have more future instability if the commercial
activities are implemented. Only five stands where the entire stand was surveyed as unstable are proposed for non-commercial activities. Again, there should not be any potential future mass movement from these proposed activities.

Under Alternative D, existing non-system route U140124 would be converted to a system road. There would also be a proposed temporary route located within T3N, R6E, Sections 6 and 7. Again, the effects that are described under Alternative B for these two routes would be the same under Alternative D. Also, the same system roads proposed for reconstruction or maintenance under Alternative B are included in Alternative D. The effects of road reconstruction or maintenance would be the same under Alternative D as described under Alternative B.

Overall, Alternative D would have the lowest potential for future debris flows as compared to the other two action alternatives. This is because fewer hillslopes are proposed for commercial activities. However, Alternative D would be more impactful than Alternative A for the protection of the hillslopes from future mass movement because some hillslopes with soil concerns are proposed for commercial harvest and road management activities.

**Cumulative Effects**

Alternative D proposes the least amount of timber activities on hillsides that were rated as unstable from field surveys. The three stands (081510-08, 081510-35, and 081708-90) identified under Alternative B would have the same cumulative effect potential under Alternative D as under Alternative B. This is because these stands have the same proposed activities under both alternatives. Overall, 40 stands with an unstable rating and 134 stands with a caution rating have a proposed activity under Alternative D.

Implementation of Alternative D does have the potential for violation of Forest Plan guideline 1108 because of the potential for resource damage from a future mass movement event. However, the potential for a future mass movement event is the lowest under Alternative D as compared to the other action alternatives.

Alternative D proposes the least amount of road conversion and temporary road construction along unstable hillslopes. The potential still exists for a future mass movement event from the construction of these three routes; however, it is the lowest as compared to the other two action alternatives.

Alternative D is the action alternative that is most compliant with Forest Plan guideline 1108.

### 3.9 Transportation Network

#### 3.9.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for the transportation network. It summarizes the Steamboat Project Transportation Report (Allard 2011), which is located in the Steamboat project file.
3.9.2 Existing Conditions

The existing transportation network was inventoried and reviewed in 2010. Approximately 134 miles of road exist on National Forest System (NFS) land in the Steamboat project area. This includes 94 miles of NFS road, 28 miles of non-NFS road, 7 miles of private road and 6 miles of county road. NFS roads are those routes that are included in the NFS and under federal jurisdiction. Private roads occur on private in-holdings and are maintained by the landowner, except in cases where rights-of-way are established between the landowner and the federal government. Non-NFS roads are routes that exist on the ground through NFS land but are not on the NFS (i.e., are not maintained by the Forest Service). Some of these routes are old logging roads that were decommissioned in the past. Also included are user-created routes (i.e., unofficial routes across public land).

The Forest-wide travel management plan decision was signed and went into effect in 2010. The plan established a Motorized Vehicle Use Map (MVUM), which specifies the routes that are open to motorized travel and the type of vehicle (i.e., motorcycle, ATV, etc.) that is permitted to use certain routes. The MVUM limits motorized use to designated routes and eliminates open, cross-country travel (i.e., closed unless designated open). This represents a paradigm shift from the previous direction, which allowed for motorized travel anywhere that it wasn’t specifically restricted (i.e., open unless designated closed).

The Forest Service does not yet have rights of way for some private roads that would be necessary to access proposed harvest units. If the proposed action is selected and rights of way cannot be obtained, then those harvest units would be dropped.

3.9.3 Environmental Consequences

The geographic area considered for cumulative effects analysis for the transportation network is the Steamboat project area. The analysis is bounded by the time period of 10 years prior to 10 years into the future to account for the effects of recent past actions and the effects of this project and other foreseeable future actions.

Alternative A (No Action)

Direct and Indirect Effects
Alternative A would have no direct effect because no new roads would be constructed or converted and no existing roads would be reconstructed. Existing roads that have Best Management Practice (BMP) violations would be addressed during specified maintenance as funding becomes available. General road maintenance activities would continue as funding is available.

Indirect effects are possible on routes where degraded road conditions already exist. While general road maintenance would continue under the no action alternative, that maintenance is most often conducted on high-use roads. Other, lesser used routes in the project area would not be reconstructed under the no action alternative and would degrade further, decrease the safety of the route to motorized travelers and ultimately lead to increased repair costs in the future.
Cumulative Effects

The indirect effects described above would be exacerbated into the future under Alternative A, resulting in the cumulative effect of increasing degraded road conditions.

Alternative B (Proposed Action)

Direct and Indirect Effects

Improvements that can be done only under reconstruction include installing drainage structures, clearing and grubbing, and adding aggregate to harden the roadbed or drainage structures. Realignment of the road may also be done only under reconstruction. For the Steamboat Project, it is estimated that less than one percent of the total reconstruction miles would require realignment.

Changing road conditions make it difficult to predict how much work would be needed at the time timber harvest activities begin. Since both pre-use maintenance and reconstruction would likely involve disturbance of the surface, for the purposes of analysis there is no differentiation between reconstruction and pre-use maintenance in order to allow unforeseen problems to be corrected. The final determination of the amount of road work that is needed would be made based on input from the District specialists and by a route verification at the time the timber sale road package is completed.

Access to the timber harvest units proposed under Alternative B would require 20 miles of new construction, 5 miles of conversion (non-system to system), and 75 miles of maintenance to existing roads. All newly constructed system roads would be closed following harvest unless designated as open for motorized travel in the MVUM. Closure methods would be determined by District specialists on a site by site basis.

Improvement and maintenance of the existing road network would provide better, safer vehicle access to the area. But, the addition of system roads would increase maintenance costs and road density and could temporarily lead to an increase in erosion because of removal of roadside vegetation. The roadway would be reseeded following disturbance and sediment basins would be constructed where necessary to catch run-off. Erosion may be decreased through the addition of aggregate surfacing or by placing rock in rolling dips.

Additional measures to minimize impacts would be implemented using “Engineering Design Guidelines” and BMP.

Cumulative Effects

The accumulation of past, present and reasonably foreseeable impacts could have both beneficial and negative effects in the Steamboat project area. Maintenance of existing roads that would occur under Alternative B would decrease the overall negative impacts (e.g. sedimentation, erosion, safety hazards) to which these roads contribute. However, the addition of 25 miles of new roads (new construction and conversion combined) would increase maintenance costs in the long term. For an analysis of the effects of the proposed road construction activities on a specific resource (e.g. wildlife, botany, hydrology/soils), refer to that specific resource section within this document.
Alternative C

**Direct, Indirect and Cumulative Effects**

Overall, the effects of Alternative C would be the same as those described for Alternative B, except Alternative C includes 41 miles of new construction, 10 miles of new conversion and 81 miles of maintenance to existing roads. This increase in road mileage would subsequently result in an increased cost of construction and maintenance, both in the short-term and long-term.

Alternative D

**Direct, Indirect and Cumulative Effects**

The effects of Alternative D would be similar to Alternative B, but would occur on a smaller scale. Alternative D does not include any new road construction; it proposes four miles of road conversion and 70 miles of maintenance to existing roads. The costs of road construction would be eliminated entirely in the short-term and the cost of road maintenance in the long-term would be reduced compared to the other two action alternatives.

3.10 Lands/Minerals/Special Uses

3.10.1 Introduction

This section discusses the existing conditions and environmental consequences for lands, minerals and special uses as a result of the alternatives considered for the Steamboat Project. It summarizes the Steamboat Project Lands and Minerals Resource Report (Jackson 2011), which is located in its entirety in the Steamboat project file.

3.10.2 Existing Conditions

**Lands and Special Uses**

Of the more than 1.5 million acres within the Black Hills National Forest boundary, approximately 289,000 acres are in private, state, or other federal ownership. This creates a complex landownership pattern. Complications and inefficiencies resulting from this ownership pattern include the need to: 1) acquire private property or convey NFS lands out of federal ownership for private property by land exchanges or Small Tracts Act cases; and 2) acquire, grant and manage rights-of-way and other special use permits across both public and private lands for roads, trails, and overhead and underground utility lines. This ownership pattern has provided an opportunity for the Forest Service to acquire easements and to grant rights-of-ways to individuals and local and state agencies.

Many private parcels of land are located within the Steamboat project area totaling 2,713 acres. These private parcels are most often long continuous irregular-shaped parcels of open pasture land that was settled as homesteads. Some parcels are still being actively ranced, but more and more parcels are being subdivided for housing developments or for single family residences. Access to private parcels is provided through system or non-system forest roads, state highways or county roads, for which the
State or County holds easements. The remainder of the project area consists of federal land administered by the Forest Service.

Easements
A number of private and public road easements have been granted in the project area for access across the NFS lands. Currently two Federal Land Policy and Management Act (FLPMA) easements and one pending authorization are located within the project area. There is currently one National Forest Roads and Trails Act (FRTA) easement to Meade County within the project area. Conversely, the Forest Service has obtained six easements from private land owners in order to cross private land. The project file contains information related to these easements.

Recreation Residences
Six special use permits issued to recreation residence holders are located within the project area boundary. The Waite Gulch recreation residence tract has five cabins located approximately one mile northeast of Nemo. One additional cabin is located within the project area in T4N, R3E, Section 34. All cabins are privately owned structures located on NFS land under special use permit. Earlier in Forest Service history, people were encouraged to build recreation cabins on NFS land. This is no longer the practice, but existing cabins are allowed to remain under special use permits.

Special Uses
The Steamboat project area contains approximately 20 miles of distribution and transmission overhead power utility lines under special use permits to Black Hills Power, Black Hills Electric Cooperative and Qwest, Inc.

Many of the roads within and adjacent to the Steamboat project area are utilized throughout the year to access special use permitted areas such as utility lines right-of-ways, recreation residences, public water systems, electronic tower installations, subdivisions and private property.

A special use permit is issued on NFS land for the Nemo cemetery located ¼ mile southwest of Nemo.

The South Dakota National Guard (SDNG) holds their annual training on the Forest each year during the second week of June. Coordination between the USFS and SDNG will ensure that the training activities and any proposed activities under any of the action alternatives are compatible.

Minerals and Geology
The three main land types underlying the project area are North Gently Dipping Plateau Lands, Limestone Canyon Lands, and Crystalline Hills and Ridges. The dominant type, making up over half of the project area is North Gently Dipping Plateau Lands, associated with broad and narrow ridges and valley bottom, moderately sloping side slopes and rock outcrops. The rocky outcrops associated with these plateaus are sandstone and limestone. Limestone Canyon Lands comprise approximately ¼ of the project area. Crystalline Hills and Ridges make up the rest of the project area; this land type is associated with narrow ridges, moderately steep to steep side slopes, narrow valley bottoms and rock outcrops. These rock crops are mainly slate and schist.
The Steamboat project area is primarily composed of Proterozoic rocks containing iron deposits, hematite and magnetite. Mineral deposits are strata bound in Proterozoic metamorphosed conglomerate and shale of the Boxelder Creek Formation; these include potential for uranium, thorium, gold, and detritus minerals. The Boxelder Formation unconformably overlies the Nemo Iron-formation. The mineral potential of the Black Hills National Forest was evaluated by the US Geological Survey (Dewitt et al. 1985) and the US Bureau of Mines (Gersic et al. 1990).

Mining played a large part in the development of this area, as evidenced by numerous historic prospect pits, adits, shafts, and abandoned mine workings. The project area contains numerous geological and mineralogical resources including areas of current mineral production, prospecting, and exploration, and areas of known mineral potential. As used in this report, the term “minerals” is used very broadly to include metals, industrial rocks and minerals, oil, gas, coal, and common variety rocks such as sand and gravel.

Numerous unpatented placer and unpatented lode claims are located in the project area. None of the claimants have surface rights; therefore, management activities and access within these claim boundaries generally are not a concern. The placer claims along creeks are used primarily for recreational hand panning and sluicing. A few abandoned opened portals and small open pits are in the project area. Communication with claimants on these working claims is imperative during all phases of the project. Numerous inactive claims are located in the project area.

The abandoned mines present in the Steamboat project area present physical hazards. Most of these abandoned mines are unidentified but field visits have located several sites. The probability of unevaluated cave resources is also high within the Steamboat project area.

Current mineral production consists primarily of sand, gravel and landscape rocks such as quartz and slate. Favorable mineral potential has been identified within the Steamboat project area for gold, iron, high-calcium limestone, sand and gravel, and crushed stone. There are currently 29 mining claims, a small open-pit iron mine (mostly operated on private property) and several reclaimed historic mines within the Steamboat project area. Both public gravel pits and in-service pits are located in the project area. Most notable are Vanocker Quarry located in T4N, R5E, Section 29 and Benchmark Quarry located in T3N, R4E, Section 22.

The extent of paleontological (i.e., fossil) resources within the project area is currently unknown. The Pahasapa Limestone and the Minnelusa Formation have the potential to contain fossils. Caves within the project area have the potential to contain more recent vertebrate fossils from animals that lived in the caves or fell into vertical shafts at cave entrances.

### 3.10.3 Environmental Consequences

#### Alternative A (No Action)

**Direct, Indirect and Cumulative Effects**

**Lands and Special Uses**
Alternative A would not cause either beneficial or adverse effects to lands and special use resources in the project area. Special uses and recreation would be expected to continue. Fire hazard and risk of epidemic mountain pine beetle infestation would be expected to increase over time. A stand-replacing fire could affect special uses by threatening improvements. Damage to utility systems could disrupt service and cost thousands of dollars to repair. In the absence of these events, the no action Alternative would not be expected to affect lands or special uses.

Minerals and Geology
Alternative A would not cause either beneficial or adverse effects to mineral resources in the project area. Existing roads provide adequate access to the active mines as well as access to many of the abandoned mines and mineral claims.

Alternative B (Proposed Action)

Direct, Indirect and Cumulative Effects

Lands and Special Uses
Road system changes would have potential adverse effects if access to permitted areas, facilities and private property is not accommodated. Certain access roads, private road easements and public road easements must be provided for maintenance and management activities.

Unclassified roads that are currently being used for private road easements need to remain unclassified and maintained by the easement holder. If these roads are changed to system roads there would be increased road maintenance costs and increased time needed to convert private road easements to public road easements.

The action alternatives propose management activities around power lines within the project boundary. These lines should be shown as protected improvements on the timber sale maps. Timber harvest activities associated with the any of the action alternatives might provide an opportunity to remove hazard trees from the power line corridors and reduce fire risk adjacent to utility lines. Timber removal activities could include timber within the power line right of way for line maintenance. A number of electrical distribution lines and telephone lines exist within the Steamboat area. These lines are smaller in nature but should also be shown on the timber sale maps as protected improvements.

Minerals and Geology

Unpatented Mining Claims
The action alternatives propose some road closures that might affect some mineral claims, but if they do, the roads can be reopened as needed. Access to mines and mineral claims would still be available.
and the potential to respond to future access needs would be maintained. This requirement for road access is documented under 36 CFR 228.1 subpart A and United States Mining Laws 30 U.S.C. 21-54, which confers a statutory right to enter upon public lands to search for minerals. If road access becomes a necessity, then the category of road use and maintenance level of the road would be determined. Bureau of Land Management (BLM) index to mining claims LR 2000 lists numerous claims within the Steamboat project area. While not active, there is always the possibility that they may become so during the life of the project. Proposed activities could temporarily affect the owners of these claims if their need for access to their area of operation is inhibited. Several active claims exist in the project area and communication with claimants on these working claims is imperative during all phases of the project. There should be no negative direct, indirect, or cumulative effects to the mineral resources or to mining claimants from any of the alternatives.

Caves
The Forest Plan mandates a study of the significance of caves, a process that has not yet been accomplished. Caves that are determined to be significant or that have not been evaluated for significance must be managed to protect their biological, cultural, ecological, hydrological, and physical characteristics. Mitigation measures that are already in place should protect cave resources. Standard 1504 of the Forest Plan calls for special precautions for mine operating plans in karst (cave) areas such as in the Minnelusa Formation and the Pahasapa Limestone. Standard 1401 includes specific management practices for significant caves or caves that have not been evaluated for significance. The practices include maintaining a 500 foot buffer around the caves and taking measures to prevent changing the cave ecosystem, water, sediment, nutrient, chemical, airflow, or temperature regimes. With these mitigation measures in place, there should be no negative direct, indirect, or cumulative effects to caves from any of the alternatives.

Alternative C

Direct, Indirect and Cumulative Effects

Lands and Minerals
Policy and direction for acquiring rights-of-way is to secure access as needed to ensure the sound long-term stewardship of NFS lands. The first priority is to acquire permanent and unrestricted access to NFS lands; second priority is to acquire permanent access for administrative purposes only (not for public use). Lowest priority and desire is to acquire temporary access as a last resort when a temporary right-of-way can be secured with minimal effort and expense.

This policy recognizes that there are situations where a temporary and limited right-of-way may be appropriate. There are, however, serious drawbacks in acquiring nothing more than permission to cross a landowner’s parcel for a short period of time. In particular, temporary rights-of-way are not an encumbrance on the land that transfers with changes in ownership. This can be particularly problematic when a change in ownership occurs prior to completion of management activities and temporary rights-of-way are often inadequate in meeting any long term management objective.

In the case of the Steamboat Project, acquiring three to four temporary rights-of-way through multiple landowners could provide for an additional estimated 225 treated acres. Acquisition of these rights-of-way was not pursued. The reasoning for this action was that doing so would delay the project decision
and implementation, coordination with dozens of landowners has historically not provided any success, and the volume of timber or acreage to be treated was not high enough to offset the effort and cost of acquiring the right-of-way.

Minerals and Geology
The effects of Alternative C would be identical to those described under Alternative B above.

Alternative D

Direct, Indirect and Cumulative Effects

Lands and Special Uses
The effects of Alternative D would be identical to those described for Alternative B above.

Minerals and Geology
The effects of Alternative D would be identical to those described under Alternative C above.

3.11 Recreation and Travel Management

3.11.1 Introduction

This section discusses the existing conditions and environmental consequences for recreation and travel management as a result of the alternatives considered for the Steamboat Project. It summarizes the Steamboat Project Recreation and Travel Management Report (Jones 2011), which is located in its entirety in the Steamboat project file.

3.11.2 Existing Conditions

Developed Recreation

Campgrounds
Steamboat Rock recreation area is primarily a picnic ground but tent camping is also allowed. It is located near the southwest boundary of the project area 2½ miles south of Nemo on Nemo Road. This recreation facility is managed by Forest Recreation Management (FRM) from the weekend before Memorial Day through the weekend after Labor Day. This facility is currently open year round but receives no maintenance during the winter and early spring. This recreation area is dominated by ponderosa pine and Boxelder Creek flows along the north edge of the facility.

Dalton Lake campground is located in the north central part of the Steamboat project area. This campground has 11 camping units, three day use picnic tables, a day use parking area and a small lake with an accessible trail circling approximately 1/3 of the lake. Dredging of the lake and improvements to the accessible path will likely take place in the fall of 2011. This recreation facility is also managed by FRM from the weekend before Memorial Day through the weekend after Labor Day and is closed during the winter. This recreation area is dominated by ponderosa pine with Little Elk Creek flowing along the north edge of the facility.
Privately-owned Facilities
The Nemo Guest Ranch and Big Mama’s are private facilities in or near the town of Nemo that offer camping and cabin rentals. They are located on the west edge of the project boundary. Stagebarn Caverns are located on the east side of the project but are not currently open for public tours.

Trails
The Centennial trail is 111 miles long in total with approximately nine miles traversing north and south through the Steamboat project area. The Centennial trail is open for motorized vehicles less than 62” in width from Dalton Lake to Pilot Knob. It is open to non-motorized traffic on the remainder of the trail. Within the project area, trailheads are located at Dalton Lake and the town of Nemo. The Centennial trail is open year round for public use. Its high season of use is from mid-June through September with a lesser use during the late fall. It is currently a very popular with the motorized community and up until March 22, 2010 (i.e., Travel Management Record of Decision) it was the only official motorized trail on the Northern Hills Ranger District. The area around the trail is dominated by ponderosa pine with intermixed pockets of white spruce, aspen and birch.

Since the Black Hills National Forest recently completed its travel management analysis, there are now approximately 51 miles of motorized trails within the Steamboat project area. These trails are south of Dalton Lake and north of Steamboat Rock. Seventeen of these trails are open to vehicles less than 62” wide and eight are trails open to all vehicles, which includes one rock crawling route. These trails pass through a variety of landscapes including ponderosa pine, aspen, birch, rocky canyons and cliff tops. Many of these trails were roads at one time and were converted to trails with the travel management decision. These trails vary in difficulty depending on the skill of the rider with the easiest being the roads converted to trails and the most difficult being trail 8284 (Iceman) which is designed for specialized rock crawling vehicles.

No snowmobile trails are located within the project boundary.

Travel Management
Travel management consists of all modes of motorized or non-motorized transportation and all types of travel surfaces. Travel management is a function of all the resource areas involved in managing the National Forest and involves defining where travel is acceptable or not based on resource concerns.

All recreation activities rely on a transportation system of some type, if for no other reason than to provide access to an area. Many of the Forest Plan goals and objectives cannot be met without a transportation system. It is the function of travel management to combine all of the issues and concerns of the resources, the public, and the management emphasis into a comprehensive plan that meets these needs in a responsible manner.

The Travel Management Record of Decision was signed on March 22, 2010 defining what types of vehicles and the locations they are allowed to travel within the Black Hills National Forest. This decision went into effect in December of 2010 and a motor vehicle use map (MVUM) was published displaying the road/trail system open to motorized vehicles. Visitors are expected to comply with the new ruling. Summer 2011 will begin the education phase of this new rule; it may take a while for visitors to adjust to traveling on designated routes.
Some roads in the current system were transformed to trails based on this decision. The new system includes a mix of trails open to all (e.g. rock crawler and 4x4) and dirt bike trails within the project that are considered new system routes even though these routes have existed on the ground and have been used for many years by the public.

**Dispersed Recreation**

The total volume of dispersed recreation is difficult to quantify, but is thought to be high for the Steamboat area and in particular east of Nemo toward Piedmont. Dispersed recreation activities that are known to occur in the area include driving for pleasure, ATV, UTV and motorcycle riding. This is a popular area for ATV, dirt bike and four wheel drive vehicles because of its proximity to Nemo.

The other popular dispersed recreation area in the Steamboat project area is little Elk Creek from Dalton Lake to Piedmont. Although no system trail exists along this route, an old road bed that was washed out by flooding in the 1970s parallels the creek. This route is extremely popular by day use hikers, horseback riders and geology field camps looking at the rock formations. Although this is a non-system route, it likely gets more use then several of the NFS trails due to its proximity to the population base along I-90 travel corridor.

Other dispersed recreation activities that occur in this project are horseback riding, mountain biking, hiking, hunting, wildlife viewing, Christmas tree cutting and firewood gathering. The project area is also popular for big game and turkey hunting and the roads receive heavy hunter traffic in the spring and fall. Recreational use of the area continues to increase, as do conflicts between motorized and non-motorized users.

**Recreation Special Uses**

One defined outfitter and guide area exists for hunting in the Steamboat Project. This area currently does not have anyone with a special use permit for guided hunting.

An undetermined number of colleges and universities use the Little Elk Creek route for geology field camps for day use trips to study the rock formations.

One guide is permitted for horseback riding on the Centennial trail from Nemo to Dalton Lake and the cliff area above Nemo. This guide has a defined set of trails that they are allowed to ride on with their customers.

One guide is permitted to lead adventure tours. These tours primarily use the Centennial trail in the Steamboat project area.

An ATV/UTV/dirt bike poker run is permitted and occurs in June on portions of the Centennial Trail and other motorized routes as defined by their permits and the motor vehicle use map.

Four 4x4 recreation events use routes in this project area including trail 8284. These events occur in June, July, August and September.
One recreation event is permitted to use the Centennial trail for an ultramarathon during the last weekend in June. Recreation event permits are also granted for a bicycle race and a volksmarch using the non-system route in Little Elk Creek.

### 3.11.3 Environmental Consequences

#### Alternative A (No Action)

Although Alternative A would not change current management or propose any new activities, changes would still occur through human use of the area. Visitors would continue to recreate on the Forest, access to private land would be requested, and wildfires would have the potential to impact recreational opportunities or experiences in the area. This alternative is responsive to those who do not want any changes made in the Steamboat project area. It also serves as a reference point from which to compare the action alternatives.

**Direct and Indirect Effects**

No changes would be made to developed recreation, dispersed recreation or travel management under Alternative A. The same recreation activities currently available in the Steamboat project area would continue under this alternative.

In the absence of other events, conifer forest in the project area would continue to crowd out other vegetation types. The loss of large areas of timber to a severe wildfire could reduce the quantity and quality of recreation opportunities. A severe wildfire could also potentially concentrate dispersed recreation use into a smaller area as users avoid burned areas in favor of green ones.

The number of pine trees infested and killed by mountain pine beetles is likely to continue to increase while climatic conditions and population dynamics are favorable. This would lead to increasingly unsafe conditions in dispersed recreation areas because of increased potential for falling trees and short-term increased fire hazard in beetle-killed stands.

**Cumulative Effects**

The cumulative effects analysis area for the Steamboat project is the project area plus a two-mile buffer around the project area. This extent is chosen because recreational uses in the project area are connected to adjacent areas (trails extend beyond the project area boundary), and events within the project area may displace use to adjacent but reasonably nearby areas. Boxelder Forks, Wonderland Cave, Nemo Guest Ranch, Big Mama’s, and Stagebarn Caverns are all either Forest Service or privately owned facilities adjacent to the project area. The time period considered is 20 years.

Cumulative effects from activities within the project area could conceivably impact these facilities. Under Alternative A, no thinning of ponderosa pine would occur, allowing likelihood of mountain pine beetle infestation to continue to increase. Beetle-killed trees are less aesthetically pleasing than healthy trees because they display red needles the year after mortality. The presence of mountain pine beetle in the Steamboat project area would also increase the risk of infestation of trees outside the area, including trees around and within the listed campground. Loss of trees immediately adjacent to or within the campground would decrease its attractiveness to users.
The lack of any treatment activities in Alternative A would also leave the project area, and the adjacent private campground, at risk of high-intensity wildfires. A blackened landscape is less appealing to most campers than an area with live trees. Although the campground itself may survive a fire, the surrounding landscape would be at risk and the loss of those areas to a high-intensity fire would negatively impact the camping experience. If large areas of forest in the Steamboat project area remain untreated and are lost to a high-intensity wildfire, the loss of recreational opportunities could negatively affect local communities. Hunting is a fairly common dispersed recreation activity that occurs in both the spring and fall in the project area. Users of the project area help support the local economy through the purchase of food, accommodations, recreation equipment, souvenirs, gasoline, and other items. If a wildfire were to change the landscape of the project area, the negative impacts could continue to be felt for decades in the nearby communities such as Nemo and Piedmont.

As the local population increases, use of forest roads and trails would probably continue to increase. This increased use may result in increased dust, ruts, damage and vandalism if the roads and trails are not maintained at adequate levels. No improvements or closures would take place under Alternative A, compounding the effects of increased use.

**Direct, Indirect and Cumulative Effects Common to All Action Alternatives**

Timber sale activity to promote healthy forests would benefit developed recreation sites. Healthier forests are safer and provide a visually more appealing appearance for the visitor to enjoy. Timber sales and fuels reduction projects would provide added benefit to the facilities by reducing the chance of high severity wildfires.

Since many of the roads in the southern portion of the Steamboat project area were converted to trails for motorized traffic they would be affected by all action alternatives. These newly converted routes would have logging and administrative traffic using them concurrently with the recreationists. Prior to the Travel Management Decision, this was the case in this area and both types of traffic coexisted. Forest Service recreation administrators will work closely with sale administrators and fire personnel to sign the routes for safety and post any administrative closings if they are needed. These management activities would provide the same benefits for trails as listed above for the developed sites: healthier forests and reduced fire danger.

The Centennial trail would be minimally affected by any of the alternatives. Several proposed timber sale activities are located adjacent to the trail. The recreation staff would work with other Forest Service administrators to provide for safety near the trail. These activities would provide the same benefits as listed above for the developed sites.

Any effects to dispersed recreation would be temporary in nature. As the name implies, dispersed recreation can occur anywhere throughout the project area. Campers, hunters, people gathering forest products or driving for pleasure for example can choose to recreate in another location if management activities are currently taking place in the area they like to frequent.

Under all alternatives, the Forest Service would continue to repair and maintain NFS roads and trails under its jurisdiction. New and existing user-created routes that are causing resource damage would be rehabilitated or removed as funding allows.

Emergency restrictions would continue to be implemented as needed, such as temporarily closing roads during wet conditions to prevent rutting and erosion, or closing an area to off-road motorized use.
during periods of extreme fire danger. The Forest Service would continue to patrol and enforce regulations to protect road and trail surface resources, vegetation, and other resources. None of the alternatives would affect State, County, or private management.

No changes in special use permits for outfitter/guides are anticipated under any alternative.

Alternative B (Proposed Action)

**Direct and Indirect Effects**

Trail 8294 (FSR 144.2D) will benefit as it needs work done to it before it could be added to the MVUM. Use of this road for logging traffic would recondition the route so it can be added to the MVUM when the work is done. This road should be left open as a trail when the work is done.

FSR 224.1A south of Dalton Lake, is proposed to be reconditioned. The road is washing out where it intersects with FSR 224, Dalton Lake Road, and reconditioning would be a benefit to both the road and the Centennial trail.

Trails 8089, 8144, 8275, 8277, 8279, 8280, 8281, 8282, 8283, 8284, 8286, 8287, 8288, 8289, 8290, 8291, 8292, 8293, 8294, 8295, and 8296 are proposed to be reconditioned. These routes are all roads that are managed as trails. Some visitors would perceive this as a benefit to the trails to have them reconditioned and soil erosion would likely be reduced. Other visitors would perceive this as negative because they enjoy the challenge of rough routes.

Along Trail 89 (Centennial) is one proposed new construction road that crosses the non-motorized portion of the trail. Newly constructed roads are proposed to be closed after treatments are complete so this disruption to the trail should be temporary. Safety precautions would be put in place during construction and use of the road where it crosses the trail.

Twenty miles of new road construction are proposed under Alternative B. The newly constructed roads could be either a benefit to travel management or cause issues depending on how one looks at it. The negative is an increased amount of roads would likely increase the incidence of visitors driving on them even though they are supposed to be closed when management activities are complete. This could increase the need for law enforcement presence. The positive could possibly be use of these routes to complete loops for the OHV trail system. This project does not propose any new loops to the OHV trail system but the road templates on the ground could provide future possibilities.

Trail 8089 on the motorized portion of the Centennial also has a proposed new construction road that crosses the trail in two places. Newly constructed roads are proposed to be closed after treatments are complete so this disruption to the trail should be temporary. Safety precautions should be put in place during construction and use of the road where is crossed the trail.

There should be no direct effects to campgrounds, trailheads or dispersed recreation other than those listed as common to all alternatives.

**Cumulative Effects**

See the description of effects common to all action alternatives above.
Alternative C

Direct and Indirect Effects
Effects from Alternative C would be the same as described under Alternative B except that the magnitude of impacts from new road construction would be higher as Alternative C includes 41 miles of construction, compared to 20 under Alternative B.

Alternative D

Direct and Indirect Effects
Effects of Alternative D would be similar to Alternatives B and C except that Alternative D does not include any new road construction, so those associated effects would not occur.

3.12 Scenery

3.12.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for scenic resources. It summarizes the Steamboat Project Scenery Report (Keegan 2011), which is located in the Steamboat project file.

3.12.2 Existing Conditions

Value Landscape Character Unit Development

Landscape character gives a geographic area its visual and cultural image, and consists of the combination of physical, biological and cultural attributes that make each landscape identifiable or unique. Existing landscape character may range from predominantly natural landscapes to those that are heavily culturally influenced. The landscape character units are derived from an ecological framework utilizing ecological land descriptions and existing landscape uses. Ecological units are the mapped landscape analysis units used for ecosystem planning and management. The visual image created by the physical, biological, and cultural factors in the ecological land unit description helps define the landscape character for scenery management.

Scenic Class

Scenic class measures the relative importance of, or value, of discrete landscape areas having similar characteristics of scenic attractiveness and landscape visibility. Scenic class is used to compare the value of scenery with the value of other resources. The components of scenic class are scenic attractiveness (which is based upon human perceptions of the intrinsic beauty of landform, water characteristics, vegetative pattern, and cultural land use) and landscape visibility (which is based upon the distance zones from the observer and the concern level for scenery).
The higher the scenic class, the more important it is to maintain the highest scenic value. The inventoried scenic class values on the BHNF are: 1 (Highest), 2, 3, and 4 (Lowest). The scenic class values demonstrate the importance of the views in different areas. Within the Steamboat project area, approximately 19 percent of the NFS acres are Class 1, 39 percent are Class 2, 17 percent are Class 3, and less than 25 percent are Class 4.

**Inherent Scenic Attractiveness**

Inherent scenic attractiveness is obtained by classifying the landscape into different degrees of variety. This determines which landscapes are most important and those that are of lesser value from the standpoint of scenic quality. The classification is based on the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic value. The combination of valued landscape elements such as landform, water characteristics, vegetation, and cultural features are used in determining the measure of scenic attractiveness.

Scenic attractiveness classifications are: A - Distinctive, B - Typical and C - Indistinctive. ‘Distinctive’ refers to those areas where landform, vegetative patterns, water characteristics and cultural features combine to provide unusual, unique or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, order, harmony, uniqueness, pattern and balance. ‘Typical’ refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use combine to provide ordinary or common scenic quality. ‘Indistinctive’ refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use have low scenic quality. Often water and rock form of any consequence are missing in Class C landscapes. Within the Steamboat project area, approximately 22 percent of the NFS acres are classified as ‘distinctive’, 36 percent are ‘typical’, and 42 percent are ‘indistinctive’.

**Landscape Visibility**

Landscape visibility is the portion of landscapes visible from travel ways and use areas important to constituents for their scenic quality, aesthetic values, and landscape merits. Travel ways and use areas are identified and classified during the Forest-wide planning process in order to determine which observer locations, and their importance, to use in the landscape visibility analysis. Sensitivity Level 1 travel ways that lead to important scenic features, residential areas, resorts, recreation areas, unique natural phenomena, wilderness trailheads, national parks, state and county parks, attract higher percentage of users having high concern for scenic quality, thus increasing the importance of those travel ways.
From Sensitivity Level 1 corridors (i.e., communities, state and federal highways) approximately 40 percent of the planning area is visible. This includes U.S. Interstate 90, the community of Nemo, and the Centennial Trail. The majority of these seen areas are along the northeastern and southwestern edges of the planning area and in the northern portion of the area along the Centennial Trail.

From the Sensitivity Level 2 corridors (i.e., county roads and major NFS roads) approximately 45 percent of the planning area is visible. This includes Nemo Road (NFSR 414), Forest Highway 26 (Vanocker Canyon), and NFSRs 224 (White Gates) and 137 (Wonderland Cave). The most visible areas are in the northwest quarter of the planning area.

**Scenic Integrity Objectives**

Scenic integrity objectives (SIO) are management objectives that were adopted from the scenic class values. Scenic integrity is a measure of the degree to which a landscape is visually perceived to be complete. The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal.

- **Very High**: A scenic integrity level that generally provides for ecological change only.
- **High**: A scenic integrity level meaning human activities are not visually evident. In high scenic integrity areas, activities may only repeat attributes of form, line, color and texture found in the existing landscape character.
- **Moderate**: A scenic integrity level that refers to landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low**: A scenic integrity level that refers to landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, effect, and pattern of natural opening, vegetative type changes or architectural styles within or outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
- **Very Low**: A scenic integrity level that refers to landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.
- **Unacceptable Low**: A scenic integrity level that refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any line, form, color, texture, pattern or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used as a management objective.
Within the Steamboat project area, approximately 19 percent of the NFS acres have a high SIO, 38 percent have a moderate SIO, and 44 percent have a low SIO.

Existing scenic integrity represents the current status of a landscape. It is determined on the basis of visual changes that detract from the scenic quality of the area. Direct human alterations may be included if they have become accepted over time as positive landscape character values. Existing scenic integrity is the current visual state, which is measured in degrees of deviation from the natural appearance of the landscape character type. These ratings give an indication of the present level of visual quality and visual evidence of management activities. The frame of reference for measuring achievement of scenic integrity levels is the valued attributes of the existing landscape character unit being viewed. In natural or natural appearing character, this is limited to natural or natural appearing vegetative patterns, features of water and rock, and landforms.

The area is noted for conifer stands in gently rolling terrain, meadows that follow streams and intermittent streams, and pockets of aspen and other hardwood trees. Forested areas are predominantly populated by ponderosa pine communities, but scattered white spruce communities populate most streams, wet areas, and north and east facing aspects. Water features are limited to narrow, quiet, low-flow streams. Apparent human alterations in the form of roads have generally been accepted over time as part of the positive cultural landscape character attributes when they do not dominate the landscape in appearance or quantity and are limited around non-motorized areas or recreation facilities. The northwest two-thirds of the planning area is primarily forested with scattered meadow and past management vegetation alterations in the form of fuel treatments, non-commercial thinning, commercial thinning, shelterwood cuts, and overstory removals. Many of these managed areas are still heavily populated with trees. In the remaining southeastern third of the planning area, past vegetation management dominates the land, as it has been heavily managed through commercial and non-commercial treatments. In the eastern portion of the planning area, the vegetation on approximately 4,000 acres was heavily impacted by the Little Elk fire (663 acres in 2002) and Ricco fire (3,959 acres in 2005); in these locations pioneer species are slowly revegetating the intensely burned areas.

Mountain pine beetle activity is evident in this area in the form of red-needle trees that were recently killed; however, these generally occur in small isolated individual trees or pockets. Trees that are under attack display globs of pitch on the trunk when viewed up close and the color of the needles is a lighter green hue than normal, which is generally not apparent from a distance. Unless an individual walks through the forest looking at each tree, the scope of the pine beetle activity is often not apparent.

As a result of wildfire and vegetation management, the southeast third of the planning area has a heavily managed appearance while the remainder of the planning area has a moderately managed appearance resulting in a moderate to low SIO condition overall for the planning area.
3.12.3 Environmental Consequences

Analysis Methods

Scenery assessment illustrates how the features of the landscape can be inventoried and analyzed so managers can compare and evaluate vegetation management treatments based on an understanding of how people value their environment.

Four primary steps were followed in the scenery assessment of the Steamboat project area: 1) Identify the landscape character; 2) Identify the key scenic features (identified in scenic class and scenic attractiveness Forest GIS layers), and landscape visibility of the area; 3) Compare the existing scenic integrity with the Forest Plan SIO assigned to this area; and 4) Evaluate the expected level of scenic integrity resulting from the alternatives. Where necessary, design criteria were created for specific stands to meet SIO. Design criteria are listed in Appendix C.

Effects Analysis

Alternative A (No Action)

Direct and Indirect Effects

Existing conditions and natural processes of trees growing and regenerating would continue. The quantity of trees within the forest would increase. In the northwestern two-thirds of the planning area, conditions are primed for normal ecological processes in the form of wildland fire, insects and disease, to take place. In dense forested areas, these ecological processes are not easily controlled and may affect natural resources in a manner that is undesirable or move the landscape vegetation away from the desired future condition in areas that are valued for their scenic beauty. In less dense stands, fire would play a key role in maintaining the ecological balance and insect activity would likely be at low levels.

Fire is an essential ecological process in this ecosystem. Wildfires during the summer would continue to be extinguished as quickly as possible. The natural role of fire in the landscape would be limited to prescribed fires in the spring and fall. Currently, the quantity of prescribed fire acres is not equal to the tree growth rate, resulting in areas of dense tree growth, thus reducing visible open space. Views into the forest would become more limited as the trees continue to grow, reducing visual diversity, including wildflowers, shrubs, hardwoods, and open meadows. Should wildfires burn into stands of densely packed growing trees, smaller trees could act as ladder fuels, allowing fire to move up into the crowns of the trees, resulting in groups of fire killed trees.

Efforts are made to keep wildfires small. These efforts would likely continue to limit visual evidence of the effects of wildfires within the landscape. Should fires spread beyond initial containment, such as in drought or high wind conditions, and spread into hillsides of densely packed trees, large patches of fire killed trees are expected. As these trees fall, these areas would be more visible in the landscape as large openings. During periods when the ground is snow covered, these areas would be highly visible in the landscape. Burned areas may or may not be similar in shape and size to meadows and other existing natural open areas in the landscape. Eventually, seeds carried by the wind from surrounding trees
would initiate the process of regrowth in these open areas. As in previous fire areas, we may see the burned area become populated by aspen or other hardwoods.

Currently, a large outbreak of mountain pine beetle is occurring in the forest. In areas similar to the Steamboat project area, with a basal area of 90 or greater, pine beetles have killed the majority of trees. Limited evidence exists of extensive pine beetle activity within the project area. Under the no action alternative, the potential exists for pine beetles to move into the project area and expand rapidly in the densely stocked forest stands that currently exist. Trees that are valued for their scenic beauty would likely be killed. When trees are removed during commercial operations, the remaining tops and limbs are treated and reduced or eliminated, resulting in a clean forest floor that mimics the effects of periodic wildfires that historically burned through the landscape. Such an appearance is generally desired by the public. In the event of a widespread mountain pine beetle infestation, that would not occur. The resulting decay and falling of these trees would create a ‘jack-straw’ of down trees, a very undesirable scenic condition.

In areas where trees are killed on a limited basis, in areas of one to ten acres, a mosaic of tree sizes and openings would be maintained that would move toward the desired future condition. Should fires occur or insect activity levels increase beyond natural levels, killing large areas of trees, the forested landscape would move away from the desired future condition. In some areas where the insect attacks or crown fires dominate the landscape, large open areas (exceeding the size of openings normally found in this area) could be created, dramatically changing the appearance of the forest as viewed from private land interspersed through out the planning area. In these areas a large amount of downed trees, a greater amount than natural levels, would dominate the landscape.

Small openings interspersed with forested areas provide an opportunity to see into the forest, which in turn increases the potential to view wildlife, wildflowers, flowering shrubs, and provides an ever changing kaleidoscope of light and shadow. Openings in the overstory vegetation can contribute to fostering a variety of sizes of vegetation, creating an interesting and diverse visual landscape.

In areas where no disturbance occurs, the vegetation would grow into a thick dense forest in competition for light, water, and nutrients. In some areas, the dense conifers are out-competing the hardwoods for these necessary components for plant growth. This dense vegetation provides the greatest potential for disturbance (e.g. fire or insect) that could greatly change the visual appearance of the vegetation across the landscape. The dense vegetation may shade out visually desirable elements such as shrubs, wildflowers and other low growing plants, thereby reducing visual diversity.

**Cumulative Effects**

No cumulative effects would occur as a result of Alternative A. No large-scale changes from the existing condition would occur. The scenic integrity would stay the same, although incremental changes may be evident due to individual tree mortality, until a natural large-scale change occurs, such as insect, disease, or wildfire.
Effects Common to All Action Alternatives

Direct Effects

Vegetative treatments result in the removal of trees within a stand. How well these treatments blend into the characteristic landscape, and meet SI0, is based upon the slope, aspect, and vegetation remaining on the site. Thinning trees to an even spacing can result in a managed, unnatural appearance. Reducing soil disturbance, uneven spacing of the trees remaining in the landscape, and cleaning up the slash to natural levels can result in an appearance that is in harmony with the landscape character, often resulting in a higher SI0 being achieved. Those treatments where more large trees remain (i.e. 60 basal area or more) can generally blend in to the characteristic landscape the best or maintain the most desired vegetative characteristics. Those treatments that leave the least large trees (i.e., 20 to 45 basal area) can be the most visible. This project maintains a large tree component across the majority of the planning area, with only a few units removing the entire overstory. In time, this could result in a multi-storied forest, although with a reduced density of trees. This lower population of trees should reduce the susceptibility to mortality from wildfire and mountain pine beetles and a forested appearance in the long term. By treating these areas through the action alternatives before the pine beetle activity moves into this planning area, the visually desirable large tree characteristics have a greater potential to remain as a feature in the planning area than under the Alternative A. In addition, the treatments would enhance the large tree component, when present, by reducing competition for nutrients around them. A variety of vegetation structure would be maintained; both large and small trees and an increase in hardwoods, grasses and shrubs should result. Overall, the variety of vegetation that would be enhanced at the stand level should be a very positive feature from a scenery standpoint.

Prescriptions range from ‘more naturally appearing’ to ‘less natural appearing’ treatments (British Columbia Ministry of Forests and Range 2010). Note: restoration type treatments will appear heavily managed (i.e., less naturally appearing) initially and will take time to move toward a more natural appearing condition:

Generally more naturally appearing after treatment
- Individual Tree Selection
- Commercial Thin
- Patch Clearcut
- Group Selection
- Aspen/Birch Enhancement (restoration treatment)
- Products Other than Logs
- Shelterwood Cut
- Overstory Removal
- Meadow Enhancement (restoration treatment)

Generally less naturally appearing after treatment

Meeting Scenic Integrity Levels

In general a specific integrity level can be achieved by decreasing the visual contrast of the deviation being viewed. Several approaches may meet integrity levels:
1. Usually the most effective way is to repeat form, line, color, texture, pattern and scale common to the valued landscape character being viewed. For example, in natural or natural appearing landscapes such deviations as created openings can sometimes be added by repeating size, shape, edge effect, surface color and pattern from natural openings common to the landscape character. If repetition is accurate and well designed the deviation may blend so well the change is not evident (High SIO). It may only borrow well enough to be noticeable but visually subordinate (Moderate SIO).

2. Another approach is to borrow form, line, color, texture, pattern and scale from similar but different valued landscapes outside that being viewed. For example, it may be possible to borrow the size, shape, edge effect, surface color, and pattern of natural openings and repeat them in continuous textured landscapes where they do not presently exist. Because these are introduced elements from landscape character outside the one being viewed, these are usually evident (Moderate SIO) if not dominant (Low SIO).

Commercial Vegetative Treatments
Commercial treatment prescriptions result in the removal of overstory trees (nine inches and greater DBH) within a stand.

*Commercial Thin* treatment methods generally meet a moderate to high SIO. Commercial thinning can result in a uniform appearance of the remaining forest stand, both in size and spacing. The vertical lines of the remaining tree boles would be more evident. Thinning the understory would further increase the emphasis and visibility of the larger diameter trees in the landscape. Understory grasses and shrubs would be more evident offering seasonal variety of light and color when spring flowers are evident. The visibility of larger diameter trees would add variety of color, light and texture. When higher numbers of larger trees remain on the landscape, the evidence of this thinning is reduced, and can have a natural appearance. In the foreground and middleground, textural differences would be the most evident; in the background, textural changes may be evident but form, lighting and color differences can be the most evident. Commercial thin treatments with a remaining basal area of 60-80, generally meet a moderate to high SIO. Those with a basal area of 40-60 generally meet a low to moderate SIO. In stands with a mixture of tree sizes, including the understory, random spacing, and groups of remaining trees can help maintain an appearance in character with the surrounding landscape and improve the SIO rating.

*Shelterwood Cut* methods result in an open hillside with scattered larger trees (approximately 30 commercial-sized trees per acre) with a basal area of 30, with few to no understory trees. Due to the wide spacing and no understory, this treatment results in a heavily managed appearance. A low SIO can be met if there are a variety of tree sizes remaining throughout the treatment unit.

*Individual Tree Selection* methods result in at least three distinct age classes. These treatments are designed to maintain and foster a variety of tree ages and sizes with an overall goal of moving toward a less managed and more natural appearance. We have limited experience with this treatment in the Black Hills National Forest. However, based on field samples (i.e., trees marked with ribbons to get a visual image of what the remaining stand would look like after treatment) the stand would be more open, with a variety of tree sizes, spacing and clumping. This treatment could potentially meet a moderate or high SIO, depending upon the quantity of overstory trees remaining after treatment.
Overstory Removal methods result in an open area with seedlings scattered across the opening. In areas of high visibility, 5-10 overstory trees would be left in clumps to mimic natural patterns in the landscape and reduce the visual impact of large open expanses. There may be a few other overstory trees in locations where minimal seedlings are present. In the foreground, the opening in the forest canopy and the seedlings across the forest floor would be the most evident. In the middleground and background, the form, or shape, of the unit would be most evident in the winter months when snow is present on the ground, creating a strong contrast from the darker surrounding forest. These units have the greatest potential to appear out of scale and character with natural vegetative patterns. Overstory removal treatments generally meet a low SIO, depending on how closely they appear in shape and size to mimic the natural openings in the characteristic landscape and the size of the remaining seedlings. A moderate SIO can be achieved if the size of the unit does not exceed the natural openings by more than 10 percent, otherwise it would likely meet a low SIO. If the units do not borrow from the shape and size of the natural openings, a SIO higher than very low is not expected.

Patch Clearcut methods result in scattered openings that do not exceed 10 acres in size. The size of the openings would vary depending upon the stand. The shapes of the openings would be designed to mimic natural openings. The resulting matrix of forested areas and open areas should result in a natural appearing condition. A moderate to high SIO should be achieved.

Group Selection method results in scattered openings that do not exceed two acres in size. The remainder of the unit would be thinned. Currently, only one or two age classes may exist, but over time this treatment would result in a multi-story stand of five age classes, with each age class occupying approximately 20 percent of the site. The result would be a natural appearing forest with a variety of tree sizes. A moderate to high SIO should be achieved.

Product-other-than-log methods remove trees five to nine inches in diameter. Conditions where this treatment would be used include: a) where the existing stand is essentially the same height resulting in a less dense even-aged forest; or b) in a stand where only the understory is treated and the overstory is untreated, also resulting in a multi-storied forest. When this thinning occurs, screening would be reduced and views into the forest would be increased. This reduction in the understory would further increase the emphasis and visibility of the larger diameter trees in the landscape, specifically the vertical line of the tree boles as well as the texture of the branching structure. Understory grasses and shrubs would also be more evident, offering seasonal variety of light and color when spring flowers are evident. Initially, this treatment leaves a moderate level of vegetation debris on the forest floor, reducing grasses and shrubs and dominating foreground views. Once the slash is cleaned up, this treatment should meet a moderate SIO in the foreground. In the middleground and background, large diameter trees should be more dominant in the landscape; in these distance zones this treatment should meet a moderate to high SIO.

Aspen/Birch Enhancement and Meadow Enhancement treatments are both restoration treatments to remove encroaching conifers, either from hardwood stands or meadows. In pine cover-typed stands, these treatments remove pine trees similar to a commercial thin, with 40 or 60 BA remaining depending upon the structural stage. In aspen or birch cover-typed stands all pine would be removed. It will take time for new shoots to sprout and take advantage of the reduced competition for nutrients. These remaining trees create a transition zone between open meadows and the surrounding forest. These treatments would restore meadows and hardwood stands, ecological goals identified in the Forest Plan.
If all the slash is treated or removed, these treatments should meet a moderate to high SIO when they are completed.

*Non-commercial Thin* results in the removal of understory trees (less than nine inches DBH) within a stand. Those treatments that leave an uneven spacing between remaining trees and a variety of tree sizes have the greatest potential to maintain a natural appearance and, depending upon the density of the remaining trees and the surrounding vegetation, blend into the characteristic landscape.

Non-commercial thinning can result in a uniform appearance of the remaining forest stand (both in size and spacing). When non-commercial thinning occurs, screening would be reduced and views into the forest would be increased. This reduction in the understory would further increase the emphasis and visibility of the larger diameter trees in the landscape. Understory grasses and shrubs would be more evident, offering seasonal variety of light and color when spring flowers are evident.

How well non-commercial treatments blend into the characteristic landscape and meet the SIO is based upon the slope, aspect, soil disturbance, residual tree spacing, and slash clean-up. Often, reducing soil disturbance, uneven spacing of the remaining trees, and reducing the quantity of slash to natural levels will result in a higher SIO being achieved. Evidence of vegetation management would generally be more visible when these landscapes are snow covered, so the shape of the treatment unit should not follow a geometric pattern (e.g. square, rectangular, or angular shapes). As most of the planning area is covered with treatments units, non-commercial treatments would extend over most of the area in a combination of treatments.

When activities are completed, non-commercial thin treatment methods generally meet a moderate SIO. A high SIO can be achieved if the remaining trees vary both in spacing (including clumps) and height.

*Understory Thin* results in the removal of understory trees (less than nine inches DBH) within a stand to maintain or enhance wildlife habitat. Although similar to non-commercial thinning, tree densities and spacing would be more irregular. A more natural appearing condition results, and a high SIO is usually achieved.

*By-products of vegetation removal* including slash (i.e., tops and branches not utilized for commercial products or fuel that are left on the ground, or piled, throughout the area of the vegetation removal) and stumps would likely be evident throughout the treatment areas. As a result of the treatment, slash is in quantities usually well above natural levels creating strong contrasts in color and texture. On steep slopes, stumps can be highly evident as they too will reflect light; on flat terrain grasses can grow up and hide them. With both by-products, it is the quantity present that determines how natural the forest will appear after treatment. Additional slash treatments such as piling and burning, crushing, or moving to a large landing for treatment can all greatly reduce the visual impact from the slash.

*Burning Slash* - When slash is piled, it is usually burned within one or two years. Burning of slash is dependent upon weather conditions that aid in containing the fire to the immediate area. Generally, these conditions occur within two years of the time the slash is placed on the ground. Once the dried slash is burned, circular burn marks are clearly evident on the ground. Normally, these burn marks are no longer visible once new grasses and other vegetation grow up the following spring. Piling and
burning can meet a range from high to low SIO. A low scenic integrity is usually only achieved when large burn bays are used and the soil is sterilized; even with seeding it can take a number of years to re-establish the vegetation.

However, due to the wetter snow conditions found within this planning in the winter (when burning of piles occurs), the slash often is not fully consumed, leaving piles of blackened slash, which is a visually negative element due to the concentration of material. This residual material is visually evident in the landscape for years. Where burn piles are placed within the foreground of visually sensitive roads, and the piles are not completely consumed, only a low SIO would be achieved.

Should the fire from any of these piles spread into the surrounding area a low intensity fire would likely occur. Black scorch marks may be evident on the boles of the trees, from less than one foot to three feet in height. These marks would fade over time; at three years they should blend with the bark on trees. Often shrubs are stimulated and begin to grow in these areas, depending upon the amount of tree cover. Areas that have received a low intensity fire often meet a high SIO within one or two growing seasons. An underburn, if burned in a cool manner (i.e., a slow-moving backing fire) would usually have the same effects.

Fuel Reduction removes vegetation in the understory in WUI areas, to reduce the amount of fuel available for wildland fires. This results in an open, park-like stand with scattered overhead trees. A moderate to high SIO should be achieved.

Prescribed Burning involves sending fire across the landscape within a designated boundary and controlled in a manner to keep the fire from getting into the tree tops. Prescribed fire is beneficial to the scenic resource by removing dead plant material and slash and stimulating plants, shrubs and hardwoods that increase visual diversity and fall color in the landscape. Once the area is burned, ash and blackened tree bark are clearly evident across the landscape. Normally, these burn marks are no longer visible once new grasses and other vegetation grow up the following spring. Prescribed burning can meet a range from high to low SIO, depending upon burn intensity. Most burns conducted on this Forest meet a high SIO within one year after the burn is completed.

Logging systems - skidding logs on, or across, steep slopes can remove vegetation and displace soil, leaving trails that can be quite visible and creating lines or unusual color contrasts in the landscape. These skid trails would be evident until clean up activities (i.e., slash is removed and seeded areas germinate) are completed. On gently rolling terrain, disturbance is generally kept to a minimum; however, it is dependent upon the quantity of logs moved along the skid trails.

Log landings are locations where logs are brought, piled, and then loaded onto trucks and removed from the site. The size of these landings and amount of disturbance (i.e., vegetation removed and often soil displaced) will vary by location, depending upon the type of logging system employed and the volume of logs being brought to the landing. Once logging is completed, these landing sites are cleared of debris and reseeded. The length of time before the site appears as a natural opening is generally one to four years, depending upon the level of disturbance, any remaining debris, and how quickly grasses take over the site.
**Indirect Effects**

Skidding logs on, or across, steep slopes can remove vegetation and displace soil, creating opportunities for noxious weeds to become established in treated areas. These weeds often have shapes that are not common in the natural landscape, drawing attention to them. Noxious weeds are generally recognized as non-natives and out-of-place in the landscape by the general public. As the quantity of these weeds increase in the landscape they out-compete native plants, resulting in a decrease in visual quality. Efforts are made to minimize this potential, so it is difficult to predict where and how wide spread this effect will be on the scenery.

Thinning and reducing the overall density of ponderosa pine vegetation can lead to the amount of grasses, forbs, shrubs, and hardwoods increasing in the landscape. This could increase the variety of colors evident now, and in the future, across the landscape. Thinning trees to an even spacing can result in a managed, unnatural appearance.

There is the potential for hardwoods to increase, creating a greater amount of fall color across the landscape as a result of the removal of conifers in fuel breaks that traverse hardwood stands; however, it would be limited to these corridors.

**Alternative B (Proposed Action)**

**Direct and Indirect Effects**

This alternative treats approximately 56 percent of the planning area through commercial (approximately 10,048 acres) and non-commercial (approximately 2,288 acres) vegetation treatments. Of the commercial treatments, overstory removals are the most evident by creating large open areas and have the greatest potential to negatively affect the scenery within the project area. These treatments would make up four percent of the planning area. The majority of these areas proposed for final overstory removals are heavily managed, have been thinned in the past, and have an understory of trees coming up. These units would be the most visible in the foreground distance zone along Forest Highway 26 and in the foreground and middleground distance zones of the Centennial Trail. Visually sensitive overstory removal units that need to have 10 overstory trees per acre retained in a clumpy arrangement include:

- High SIO: 081706-52
- Moderate SIO: 081508-6, 081508-70, 081508-22, 071508-7, 081706-1 (below the 5,160 ft. contour), 081509-43, 081507-41

The dissected nature of the terrain in this planning area limits views to the foreground and near middleground. This alternative creates a variety of treatments. This is particularly evident when overstory removal units are clumped together to create single contiguous large units, such as: a) units 081509-34, 081509-61, 081509-63, 081509-64 combined together for approximately 123 acres that are visible, b) 081508-6, 081508-70, 081509-7 combined for approximately 98 acres that are highly visible, and c) units 089901-6, 089901-32, 089901-33 combined for approximately 225 acres that are visible. With the addition of leaving clumps of trees in overstory removal treatments in visually sensitive areas, as noted above, these treatments should meet the moderate SIO.
The majority of the planning area would be treated to reduce the density of the tree stems within the forest at all levels from sapling to mature trees. This would create a more open natural appearing forest with all sizes of trees present. Follow up prescribed burning on approximately 1,000 acres a year for a maximum of 10,608 acres would help to maintain this open forest condition.

Road construction creates a road template with a cut and fill slope in the landscape. On steep slopes this road template can be highly visible; on flat slopes the road template is not readily evident unless the viewer is in a superior position. Of the 20 miles of proposed new road construction, approximately five miles would be readily apparent in the landscape. Any new road construction along the edge of private land has the potential to be highly visible.

Given the variety of treatments and the juxtaposition across the rest of the landscape, the remaining treatments should meet their assigned SIO. The mix of treatments should create a variety of vegetation sizes and spacing within the natural range of vegetative patterns. Given the past vegetation treatments and the proposed treatments in this alternative, the majority of this planning area would be in a more open condition. This open condition should reduce the potential for wildfires and insect attack that quickly (i.e., in less than 10 years) change the character of the landscape from forest to grassland, while maintaining the appearance of a ponderosa pine ecosystem where fire has repeatedly thinned the forest.

The reduction in tree stems across the landscape would increase the potential visibility of desirable fall and spring colors in the landscape.

**Cumulative Effects**

Understanding past, present and reasonably foreseeable actions, is necessary in order to evaluate potential cumulative effects of the various alternatives.

Methodology includes:

1) Review activities that are known to have occurred, or planned, within the planning area.
2) Review aerial photos of the area to compare areas where activities have occurred with areas that activities are not known to have occurred.
3) Review past activities in the field and determine their effect on scenery.
4) Review planned activities and determine the potential cumulative effects.

The boundary on the ground for analyzing cumulative effects is primarily that of the planning area. This identified area is the landscape that is evident in the foreground and middle ground from the main travel routes, approximately 40-45% of the planning area. The time boundary for this analysis extends from 1949 to 2040.

Fire suppression over the past century has played a role in the increased density of the vegetation on the forest. Likewise, much of the forest was non-commercially thinned by the Civilian Conservation Corp (CCC) in the 1930s and 1940s, but we do not know if that effort included any or all of this planning area. Northern Hills Ranger District records (FACTS Database) list vegetation treatments that extend back as early as 1960. Past vegetation treatments include: commercial thins (approximately 11,320 acres), non-commercial thinning (approximately 8,550 acres), and less than a thousand acres of each of
the following treatments: individual tree release, overstory removals, patch clearcuts, shelterwood cuts, group selection cuts, seed tree cuts, and sanitation harvest.

The effects of past vegetation treatments are most visible in the southeastern portion of the planning area. However, the rolling terrain limits viewing opportunities from main roads and trails of this heavier level of vegetation manipulation. When one visits these areas, large yellow-bark ponderosa pine trees are very limited. In general, the vegetation is scattered. The area is generally open with patches of densely grouped trees. The form of the land dominates the view, particularly during periods when the ground is covered with snow. Approximately 10 percent of the planning area is in an open vegetative condition due to past treatments.

The remaining northern and western portions of the planning area are a matrix of open, lightly treated, and heavily treated vegetation across the landscape. The variety of tree spacing density and tree size creates a slightly modified appearance. Locations where vegetation management boundaries go straight up a landform, perpendicular to the landform contours, create an unnatural vegetative pattern in the landscape. This is particularly evident along the county boundaries.

Evidence of past wildfires are evident on the eastern portion of the planning area including Big Elk (1949 – 4,940 acres), Little Elk (2002 – 663 acres), and Ricco (2005 – 3,959 acres). Each of these fires occurred on steep, generally east facing slopes, and occurred on both private and NFS lands. These fires burned intensely either from the bottom of the slope to the top or were wind driven across, and down, the slopes, killing almost all the trees. Of the recent fires in the last decade, the burn patterns are still highly evident from Interstate 90, as the fires killed the majority of the trees. This large open area covers approximately 80 percent of the visible area from Interstate 90, and approximately 10 percent of the planning area.

The 62 years since the Big Elk fire have seen vegetation grow up in the landscape. The only difference that is visually evident from the surrounding forested area is a reduced density of trees, particularly on the south facing (i.e., drier) slopes. This forest-grass matrix is still in character with the characteristic vegetative patterns of the Black Hills.

The Boxelder fire (2006 – 225 acres) occurred along Nemo Road. This fire backed down steep slopes in the foreground of Nemo Road. This less intense backing fire killed only a small portion of the trees visible from the road. As a result, evidence of the fire is limited today. Most people would not realize a wildfire had occurred in this area. Fires prescribed to reduce fuels and competing vegetation are conducted in the fall and spring seasons. They are conducted in a manner to limit mortality of overstory trees; as a result, they also normally blend into the landscape within one or two years.

Under the action alternatives, trees of all sizes would be removed. The removal of 12-inch diameter trees would take approximately 120 years to replace (Cook pers. comm. 2006). In addition, it takes approximately 20 years for a ponderosa pine tree to grow, from germination, to approximately 20 feet in height.

When trees are cut, the resulting appearance of vegetation treatments would change little for the first 10 years after the treatments are completed. Once trees become established, vegetation colors in the landscape would slowly change from the greens and browns of the grasses (depending on season) to
green of the ponderosa pine trees. The forms of cutting units can still be dominant during this time, and
texture is limited. The next 20 years would see a slow change until the trees reach a height of 20 feet,
when they have enough visual mass to change the open appearance of the landscape. During this time,
approximately 30 years, the texture of the vegetation would change from smooth to coarse as the trees
gain height and crown girth.

This alternative treats approximately 46 percent of the planning area through commercial vegetation
treatments and approximately 11 percent through non-commercial vegetation treatments. Prescribed
burning would occur on 10,608 of these same acres over time.

Of the commercial treatments in this alternative, overstory removals would result in a more open
condition on approximately 8,746 acres, or four percent of the planning area. These treatments would
be visible from Vanocker Canyon, Nemo Road, the Centennial Trail, and other main travel routes within
the planning area. The retention of groups of overstory trees would maintain a vegetative pattern of
vegetation that is in character for the Black Hills area. Panoramic views are generally limited to
Interstate 90, Nemo Road, and the Centennial Trail within this planning area. As a result, most
treatments are viewed in a foreground or middleground view. Roads are generally not evident in the
landscape except in the immediate foreground view.

The remaining commercial and non-commercial treatments should be in keeping with the characteristic
landscape vegetative patterns as if fires had played their natural role in this landscape. The level of
treatments would result in areas of dense and less dense vegetative patterns across the entire planning
area.

With the reduction in vegetation density, beetle-killed pockets of dead trees may stay small and
scattered. A less dense, but forested, landscape may be maintained across the landscape where large
trees would be fewer but more visually evident and dominant in the landscape. A forested backdrop
adjacent to private land is expected to meet a moderate level of scenic Integrity. Roads and other
activities that change the natural contours may be more evident with the thinning of the vegetation on
the landscape.

Summary
Alternative B would modify the vegetation across the landscape so that management activities would be
more evident. The variety of treatments would also create a variety of textural patterns and improve
opportunities to view hardwoods and wildlife. Overstory removal treatments generally do not meet the
high or moderate SIO; however, the retention of groups of trees on each acre and the rolling nature of
the topography would limit the negative elements of these treatments. The combination of wildfires
over the past decade, planned overstory removals in this alternative, and past treatments would result
in approximately 24 percent of the planning area in an open vegetative condition. Other treatments to
increase hardwoods and decrease potential for pine beetle activity should meet the assigned SIO. In
addition, prescribed fire, pile burning and other fuel reduction treatments should meet a moderate to
high scenic integrity within one year after completion.
Alternative C

Direct and Indirect Effects

The direct effects of Alternative C are similar in scope to Alternative B but on a wider scale. This alternative treats approximately 82 percent within the planning area through commercial (approximately 16,588 acres) and non-commercial (approximately 1,461 acres) vegetation treatments, an increase in commercial treatments and a decrease in non-commercial treatments compared to Alternative B. Of the commercial treatments, overstory removals are the most evident and have the greatest potential to negatively affect the scenery within the project area; these treatments would cover 17 percent of the planning area. The majority of these areas proposed for final overstory removals are heavily managed, have been thinned in the past, and have an understory of trees established. These units would be the most visible in the foreground distance zone along Hwy. 26, in the foreground and middleground distance zones of the Centennial Trail and the middleground of Interstate 90. To reduce the visual effects of the overstory removal treatments, 10 overstory trees per acre would be retained in a grouped ‘clumpy’ arrangement. This would include the following units:

- Moderate SIO: 081507-26, 081508-6, 081508-70, 081508-22, 071508-7, 081706-1 (below the 5160 ft. contour), 081509-43, 081507-41, 081509-16, 081509-52, 081509-22.
- Moderate SIO that will be highly visible from Interstate 90: 081510-3, 089903-36, 089903-31, 089903-106, 089903-131, 089903-108, 089903-19, 089903-120 (western 7 acres).

The dissected nature of the terrain in this planning area limits views to the foreground and near middleground. This alternative includes a variety of treatments, sometimes treating entire landforms. This is particularly evident when overstory removal units are clumped together to create single contiguous large units, such as: a) units 081509-34, 081509-61, 081509-63, 081509-64 combined for approximately 123 acres that are visible, b) 081508-6, 081508-70, 081509-7 combined for approximately 98 acres that are highly visible, c) units 089901-6, 089901-14, 089901-32, 089901-33, 081707-45 combined for approximately 318 acres that are visible, and d) units 081509-21, 981509-15 combined for approximately 176 acres that are highly visible. With the addition of leaving clumps of trees in overstory removal treatments in visually sensitive areas, as noted above, these treatments should meet the moderate SIO.

The majority of the planning area would be treated to reduce the density of the tree stems within the forest, at all levels from sapling to mature trees. This would create a more open natural appearing forest with all sizes of trees present. Follow up prescribed burning on approximately 1,000 acres a year for a maximum of 10,608 acres would help to maintain this open forest condition.

Road construction creates a road template with a cut and fill slope in the landscape. On steep slopes, this road template can be highly visible; on flat slopes the road template is not readily evident unless the viewer is in a superior position. Of the 41 miles of proposed new road construction, approximately 10 miles would be readily apparent in the landscape, including the west side of Steamboat Rock. Any new road construction along the edge of private land has the potential to be highly visible.
The larger percentage of overstory removal treatments compared to Alternatives B and D would dominate the landscape. Given the past vegetation treatments and the proposed treatments in this alternative, the majority of this planning area would be in a very open condition. This open condition should reduce the potential for wildfires and insect attack that quickly (i.e., in less than 10 years) change the character of the landscape from forest to grassland, while maintaining the appearance of a ponderosa pine ecosystem where fire has repeatedly thinned the forest. The planning area would have a very open, heavily-managed, appearance with a low level of scenic integrity.

The reduction in tree stems across the landscape would increase the potential visibility of desirable fall and spring colors in the landscape.

**Cumulative Effects**
Cumulative effects for this alternative would be similar to Alternative B with the following exceptions: this alternative treats approximately three-quarters of the planning area through vegetation treatments, of which nearly one-fifth of the planning area would be moved from a forested condition to an open condition.

Of the commercial treatments in this alternative, overstory removals would result in a more open condition on approximately 3,740 acres, or 17 percent of the planning area. These treatments would be visible from Vanocker Canyon, Nemo Road, the Centennial Trail, and other main travel routes within the planning area. The retention of groups of trees would maintain a vegetative pattern that is in character for the Black Hills area. Panoramic views are generally limited to Interstate 90, Nemo Road, and the Centennial Trail within this planning area. As a result, most treatments are viewed in a foreground or middleground views. Roads and the lines they visually create in the landscape would be more visible in all viewing distances.

The remaining commercial and non-commercial treatments should be in keeping with the characteristic landscape vegetative patterns as if fires had played their natural role in this landscape. The increased level of treatments would result in a less dense overall vegetative appearance across the entire planning area.

With a greater reduction in vegetative density, beetle-killed pockets of dead trees should be less evident than Alternative B. A less dense, but forested, landscape may be maintained across the landscape where scattered clumps of large trees would be fewer, but more visually evident and dominant in the landscape. The scattered forest backdrop adjacent to private land is expected to meet a moderate level of scenic integrity. Roads and other activities that change the natural contours may be more evident in the landscape than Alternative B.

**Summary**
Alternative C would modify the vegetation across the landscape so that management activities would be more evident. The variety of treatments would also create a variety of textural patterns and improve opportunities to view hardwoods and wildlife. With the greater quantity of overstory removal treatments (with the retention of groups of trees on each acre) the more open forest-grass texture would be highly evident in the landscape. The grouping of remaining overstory trees would reduce the negative visual color and texture contrast that is normally created by this treatment in a forested landscape. The combination of wildfires over the past decade, planned overstory removals in this
alternative, and past treatments, would result in approximately 37 percent of the planning area in an open vegetative condition. Other treatments to increase hardwoods and decrease potential for pine beetle activity should meet the assigned SIO. The visual effects of prescribed fire and fuel treatments would be the same as Alternative B.

**Alternative D**

**Direct Effects**
The direct effects are similar in scope but on a slightly smaller scale than Alternative B. This alternative treats approximately 53 percent of the planning area through commercial (approximately 9,394 acres) and non-commercial (approximately 2,288 acres) vegetation treatments. This is approximately 650 acres fewer commercial treatments, while maintaining the same number of non-commercial acres as Alternative B. Of the commercial treatments, overstory removals would be the most evident but are reduced to 775 acres in Alternative D. Ten overstory trees per acre would be retained in a group to reduce negative visual effects. This would include the following units:

- Moderate SIO: 081507-41, 081508-6, 081508-70, 081508-22, 071508-7, 081706-1.

The dissected nature of the terrain in this planning area limits views to the foreground and near middleground. This alternative includes a variety of treatments, sometimes treating entire landforms. This is particularly evident when overstory removal units are clumped together to create single contiguous large units, such as stands 081508-6, 081508-70, and 081509-7 combined for approximately 98 acres that are highly visible. With the addition of leaving clumps of trees in overstory removal treatments in visually sensitive areas, as noted above, these treatments should meet the moderate SIO.

Less than half of the planning area would be treated to reduce the density of the tree stems within the forest. This would create a more open natural appearing forest with all sizes of trees present. Follow up prescribed burning effects would be the same as Alternatives B and C.

No new roads would be constructed in this alternative, maintaining the existing landform topography.

The lower percentage of overstory removal treatments would have a greater potential to blend with the vegetative patterns in the landscape. Given the past vegetation treatments and the proposed treatments in this alternative, the majority of this planning area would be in a forested condition. The planning area would have a less-managed appearance than Alternatives B or C with a moderate to high level of scenic integrity.

**Indirect Effects**
The reduction in tree stems across the landscape would increase the potential visibility of desirable fall and spring colors in the landscape.

**Cumulative Effects**
Cumulative effects for this alternative would be similar to Alternative B with the exception that this alternative treats less than half of the planning area through commercial and vegetation treatments, of which nearly one-tenth of the planning area would be moved from a forested condition to an open condition.
Of the commercial treatments in this alternative, overstory removals would result in a more open condition on approximately 775 acres, or 3 percent of the planning area. These treatments would be visible from Vanocker Canyon, Nemo Road, the Centennial Trail and other main travel routes within the planning area. The retention of groups of trees would maintain a vegetative pattern that is in character for the Black Hills area. Panoramic views are generally limited to Interstate 90, Nemo Road, and the Centennial Trail within this planning area. As a result, most treatments are viewed in a foreground or middleground view. Roads, and the lines they visually create in the landscape, would be more visible in all viewing distances.

The remaining commercial and pre-commercial treatments should be in keeping with the characteristic landscape vegetative patterns as if fire had played its natural role in the landscape. The increased level of treatments would result in a less dense overall vegetative appearance across the entire planning area.

With a greater number of overstory trees remaining, beetle-killed pockets of dead trees may be more evident than in Alternative B or C. A more dense forested landscape may be maintained across the landscape. The dense forest backdrop adjacent to private land is expected to meet a moderate to high level of scenic integrity. No new lines in the landscape from road construction would be evident in this alternative.

**Summary**

Alternative D would modify the vegetation across the landscape, both scattered and concentrated in areas, to create a variety of vegetative patterns. The variety of treatments would also create a variety of textural patterns and improve opportunities to view hardwoods and wildlife. With the reduced quantity of overstory removal treatments, the planning area would maintain a more forested character across the landscape. The grouping of remaining overstory trees would reduce the negative visual color and texture contrast that is normally created by this treatment in a forested landscape. The combination of wildfires over the past decade, planned overstory removals in this alternative, and past treatments would result in approximately 23 percent of the planning area having an open vegetative condition.

Other treatments to increase hardwoods and decrease potential for pine beetle activity should meet the assigned SIO. The visual effects of prescribed fire and fuel treatments would be the same as Alternatives B and C.

### 3.13 Heritage Resources

#### 3.13.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for heritage resources. It summarizes the Steamboat Project Heritage Report (Karchut 2011), which is located in the Steamboat project file.

#### 3.13.2 Existing Conditions

The Steamboat project area contains numerous cultural resource sites that relate to the prehistoric and historic time periods representing various aspects of occupation and utilization of resources in the northwest Black Hills. Cultural resource sites that are associated with the historic period outnumber
those that have been previously documented as relating to the prehistoric period. The geology of this area appears to have been a focal point of people during prehistoric times for chert material quarrying activities. These local material types were favored for stone tool manufacture. Based on a limited amount of water conveniences in this area, natural springs typically display evidence of prehistoric occupational use. Historic period use also displays a distribution of habitations at source water locations, mainly springs. The highest percentage of sites in this analysis area relate to historic period transportation systems, homestead, farmstead, and cabin dwellings, and depression era water development projects. Historic period industrial exploitations appear to be limited to timber harvest and water diversion to areas outside the project area for hard rock mine activities.

Specific areas of concerns for heritage resources include the protection of National Register of Historic Places (NRHP) eligible and unevaluated cultural resource sites, consultation with local American Indian groups, and the protection of culturally significant areas, traditional cultural properties (TCP), recent and historic graves. Currently there are no known TCP in the Steamboat project area.

Of the total land administered by the Forest Service under analysis for this project, all 24,596 acres, including private land areas (2,713 acres) not included in potential treatment planning, have been previously inventoried for heritage resources to current Level III standards. These projects were primarily Black Hills National Forest timber and range projects. The Level III projects inventories cover a large portion of the project area to current standards.

Heritage resource effects were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during commercial and non-commercial timber harvest, fuels reduction activity, prescribed fire, and travel management activities.

The Level I files review indicates 72 cultural surveys identifying 73 cultural resources properties that have been evaluated as “eligible or potentially eligible/unevaluated” for nomination to the NRHP within the Steamboat project area perimeter. An additional 87 properties located inside the Steamboat project area one mile perimeter have been evaluated.

### 3.13.3 Environmental Consequences

#### Past Effects

Past effects to heritage resources are from road building, reconstruction and decommissioning, fire suppression, timber harvest, residential development, livestock grazing, wildlife habitat restoration and recreation use. Earlier ground disturbance in the project area includes road construction and building of water bars and other types of erosion control.

Along with current timber sales, other ongoing activities include firewood cutting, livestock grazing, mining activity, road and utility construction/maintenance, fuels management and fire suppression. The principal recreation uses include snowmobiling, hiking, hunting, all terrain vehicle/motorcycle use of trails and roads, and recreational driving. All of these actions cause a potential risk to negatively impact both known and presently undiscovered heritage resources.
Future Actions

Reasonably foreseeable future actions include a continuation of activities identified under the current actions. Other reasonably foreseeable actions that would affect heritage resources include local population growth and increasing numbers of visitors to the Forest, which could create additional direct and indirect effects from recreationists. As the number of visitors increases, so would the need to inform and involve Forest users in resource management. Risk to heritage resources would also increase in areas where tree or vegetation densities and fuel loads remain at unnatural levels. These conditions provide for higher intensity burns associated with wildland fires.

Adverse cumulative effects to heritage resources on and around the Forest result from the advances of time (such as weathering), destruction through development, and inadequate or inappropriate maintenance. As a result, the research value of heritage resources can disappear. Sites themselves can become so affected that they no longer have potential as interpretive sites, and in general cease to be a source of enhancement for present and future generations.

Effects Analysis

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

In considering the no action alternative, current Forest Service budgets are such that much of the heritage site survey and documentation work is done as part of other management undertakings, and are paid for by other resources areas such as timber, fuels, range, lands, and recreation. The level of heritage work would be significantly reduced under Alternative A, thus creating the most reductions in heritage management activities. This decrease in heritage site management can intensify cumulative effects in the form of increased soil erosion from weathering, vandalism, and intense wildland fires from neglected fuels loading.

Action Alternatives (Alternatives B, C and D)

Direct, Indirect and Cumulative Effects

Effects on Heritage Resources from Timber Harvest

Timber management would result in various degrees of soil disturbance. Timber harvesting, skid trails, temporary road use, landings, yarding of equipment, and piling and disposal of slash piles can adversely affect heritage resources. In comparing the alternatives, Alternative C would disturb the greatest number of acres, followed by Alternative B and Alternative D. As the amount of potential ground disturbance increases the potential for disturbance and adverse effect to heritage resources also increases.

Under Alternatives B, C and D, disturbance to heritage resources would be minimized through identification and avoidance or design criteria. The Forest would be in compliance with Section 106 of the National Historic Preservation Act (NHPA) under each alternative, provided the design criteria outlined for the known significant historic properties are implemented.
Effects on Heritage Resources from Fuel Reduction

Fire management treatments would result in various degrees of soil disturbance. Effects to heritage resources occur with low, moderate and high intensity burn activities. This includes the construction of both hand and mechanical fire lines and breaks. All three action alternatives include identical amounts of prescribed fire and fuel reduction activities, so would have the same potential to affect heritage resources.

Under Alternatives B, C and D, disturbance to heritage resources would be minimized through identification and avoidance or design criteria. The Forest would be in compliance with Section 106 of the NHPA under each alternative, provided the design criteria outlined for the known significant historic properties are implemented.

Effects on Heritage Resources from Roads

Heritage resources can be adversely affected by road construction and reconstruction activities. Adverse effects also occur under certain conditions through use of temporary roads, road maintenance, closures, and road decommissioning activities. Effects to heritage resources are of particular concern where two-track roads are subject to maintenance and use as temporary roads. In most cases, mitigation measures that use barrier cloth and additional material fill can reduce damage to heritage resources.

In a review of the alternatives considered, Alternative C would result in the greatest number of miles of road construction and maintenance and would therefore have the greatest potential to affect heritage resources, followed by Alternative B. Alternative D does not include new road construction and would rely on existing roads, largely eliminating the potential impact of road construction on heritage resources, although maintenance and conversion activities would still occur.

Alternatives B and C contain areas planned for road construction and reconstruction activities that have the potential to adversely affect significant historic properties. Specific design criteria to prevent degradation of heritage resources are identified in Appendix C. The Forest would be in compliance with Section 106 of the NHPA under each action alternative, provided the appropriate design criteria are implemented.

Summary of Effects

There would be no effect to heritage resources within this analysis area provided that all eligible and potentially eligible properties, TCP, and culturally significant areas are avoided or have mitigation measures developed in consultation with the state historic preservation office (SHPO), tribal historic preservation offices (THPO) and other interested parties. Twenty-six known significant cultural resource sites have been identified and would require appropriate mitigation measures are in place prior to project implementation.

Under the Steamboat Project alternatives, all eligible, potentially eligible properties, TCP, and culturally significant areas would be avoided or mitigated. In addition, the site-specific mitigation measures outlined for known significant historic properties provided in the “Mitigation” section of this report must be followed prior to project implementation. As a result, it is expected that no potential direct, indirect,
or cumulative impacts to cultural resources would occur during implementation of the action alternatives.

3.14 Socio-Economics

3.14.1 Introduction

This section discusses the existing conditions and environmental consequences in the Steamboat project area for socio-economics. It summarizes the Steamboat Project Socio-Economic Report (Stores 2011), which is located in the Steamboat project file.

Forest resources provide economic components of community sustainability by providing for a wide variety of uses, values, products, and services. The resources within the Black Hills National Forest have provided an economic array of benefits to the residents of the Black Hills area. These resources range from sustenance for American Indian tribes, logs used to construct early mining camps, towns and mines, ties used for railroad construction, and the lumber harvested by the timber industry, which remains active today.

The Black Hills National Forest is annually one of the top timber-producing forests in the National Forest System. The Black Hills have exhibited an extraordinary ability to produce ponderosa pine through natural regeneration (i.e., without tree planting), which allows sustainable timber harvest to continue at a relatively high rate. Consequently, many of the communities in and around the Black Hills are at least partially dependent on jobs and revenue generated by the local timber industry.

3.14.2 Existing Conditions

All data presented in this section was obtained from the U.S. Census Bureau website at www.census.gov.

**Population**

The Steamboat project area is located in Lawrence, Meade and Pennington Counties in western South Dakota. All three counties are primarily rural, although Pennington County includes Rapid City, which is the second largest metropolitan area in South Dakota. The 2010 Census found that 67,956 (67%) of Pennington County’s residents lived in Rapid City. Other population centers near the project area are Spearfish, Lead and Deadwood in Lawrence County and Sturgis in Meade County.

Table 3-62 displays the population of Lawrence, Meade and Pennington Counties using data from the 2010 Census and the estimated 2008 population of each county.
Table 3-62. Area Population (Based on 2010 Census data)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawrence County</td>
<td>24,097</td>
<td>21,802</td>
<td>+2,295</td>
<td>+10.5%</td>
</tr>
<tr>
<td>Meade County</td>
<td>25,434</td>
<td>24,253</td>
<td>+1,181</td>
<td>+4.9%</td>
</tr>
<tr>
<td>Pennington County</td>
<td>100,948</td>
<td>88,565</td>
<td>+12,383</td>
<td>+14%</td>
</tr>
<tr>
<td>South Dakota</td>
<td>814,180</td>
<td>754,837</td>
<td>+59,343</td>
<td>+7.9%</td>
</tr>
</tbody>
</table>

Based on the 2010 Census data, the population of Lawrence and Pennington counties is growing at a faster rate than the state of South Dakota’s total population. Meade County’s population also grew, but at a lower rate than the other two counties or the state as a whole.

Table 3-63 displays the ethnic background of the counties in the project area as compared to South Dakota as a whole. Updated ethnicity data from the 2010 Census is not yet available for South Dakota; the data shown here is the most recent available from the U.S. Census Bureau.

Table 3-63. Population by Ethnicity (Based on 2006-2008 3-year estimates)

<table>
<thead>
<tr>
<th>Origin or Race</th>
<th>Lawrence County</th>
<th>Meade County</th>
<th>Pennington County</th>
<th>South Dakota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>95.1%</td>
<td>91.3%</td>
<td>84.8%</td>
<td>87.1%</td>
</tr>
<tr>
<td>African American</td>
<td>0%</td>
<td>0.8%</td>
<td>1.3%</td>
<td>1%</td>
</tr>
<tr>
<td>Native American</td>
<td>1.9%</td>
<td>2%</td>
<td>8%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2.2%</td>
<td>3.5%</td>
<td>3.9%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Asian</td>
<td>0.4%</td>
<td>1.2%</td>
<td>1.2%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>0.4%</td>
<td>1.6%</td>
<td>0.7%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Pennington County closely mirrors the state of South Dakota’s ethnic breakdown, with Lawrence and Meade Counties mirroring each other and each having a higher proportion of Caucasian residents than Pennington County or South Dakota as a whole.

Widespread settlement of the Black Hills by Euro-American settlers began in the 1870s after gold was confirmed in the Black Hills by the Custer Expedition. Initially, settlement of the Black Hills was illegal as the area had been set aside for the indigenous Sioux tribes. However, the draw of gold lured prospectors into the area and eventually led to the development of communities within the Black Hills. Following the initial gold rush, logging and ranching became the primary building blocks of the local economy in the early 20th century. Today, the economy is much more diversified and recreation and tourism have emerged as large factors in drawing people into the area. Sub-development of private land within the Black Hills has led to an increasing population dispersed across the area rather than localized around the established population centers.

**Economic Well Being**

Personal income, unemployment rate and poverty level are useful measures of economic well being, or how well individuals and families are able to meet their basic needs for housing and subsistence as well as higher-level needs such as long-term financial stability and the ability to procure and enjoy luxury items. Economic ties to forest resources are integral to the economic well being of many residents in
the Black Hills. Some are engaged in the performance of vegetation management activities, such as
timber harvest or grazing as a source of income. Others benefit economically from the recreation
activities that occur on the forest as visitors to the area purchase gas, groceries, or recreational
equipment from local retailers. Forest management proposals have the potential to impact economic
prospects for these groups in varying ways. Table 3-64 displays per capita income, unemployment rate,
and poverty level for the three counties in the project area and South Dakota. As with ethnicity data,
the economic data displayed below is based on the most recent data available and does not reflect the
2010 Census.

Table 3-64. Economic Well Being (Based on 2006-2008 3-year estimates)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Lawrence County</th>
<th>Meade County</th>
<th>Pennington County</th>
<th>South Dakota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Capita Income (in 2008 dollars)</td>
<td>$23,658</td>
<td>$22,234</td>
<td>$25,036</td>
<td>$23,798</td>
</tr>
<tr>
<td>Unemployment</td>
<td>3.1%</td>
<td>5%</td>
<td>5.2%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Individuals Below Poverty Level</td>
<td>14.6%</td>
<td>9.5%</td>
<td>14.4%</td>
<td>13.2%</td>
</tr>
</tbody>
</table>

Per capita income is relatively similar across all three counties and South Dakota as a whole, while
unemployment is lowest in Lawrence County and the poverty level is lowest in Meade County. Based on
the 2006-2008 3-year estimates, the national per capita income was slightly higher ($27,466), the
unemployment rate was higher (6.4%) and the poverty level was within the range of the three counties
and identical to South Dakota’s (13.2%).

Timber harvest has contributed greatly to the area’s economy. Early settlers used timber harvested
from the Black Hills to construct buildings, railroads, and mining facilities. The very first timber sale on a
national forest took place in 1898 near Nemo, South Dakota, which is now part of the Northern Hills
Ranger District. A portion of this sale, called Case 1, is within the Steamboat Project Area. Today, the
Black Hills National Forest is one of the top timber-producing forests in the National Forest System. This
timber supply is a significant component of the support of local and regional communities, as well as
contributing to the area’s supply of goods and services. Overall, the Black Hills National Forest’s
practices have had a positive influence on the economy of the Black Hills area.

Three communities in the Black Hills region, Spearfish and Hill City, South Dakota and Hulett, Wyoming,
are home to large lumber mills, all operated by a single company, that provide a significant number of
jobs and are an important component of the local economy. Several smaller independent milling
operations are scattered throughout the area. These mills rely on timber from the Black Hills National
Forest to continue operations.

Environmental Justice

Executive Order (EO) 12898 (February 11, 1994) directs Federal agencies to focus attention on the
human health and environmental conditions in minority and low-income communities. The purpose of
EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health
or environmental effects on minority and low-income populations. The Council on Environmental
Quality (CEQ) defines a minority as “Individuals who are members of the following population groups:
American Indian or Alaska native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.”

CEQ further directs:

“Minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis...a minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above stated thresholds (CEQ 1997).”

Table 3-63 displays a breakdown of the analysis area population by ethnicity. The minority population as a percentage of the analysis area (i.e. Lawrence, Meade and Pennington Counties) is not meaningfully different than that of the state of South Dakota and is in fact lower for Lawrence and Meade Counties. Therefore, a minority population as defined by EO 12898 does not exist in the analysis area.

CEQ defines “low-income population” as:

“Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census’ Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions or environmental exposure or effect (CEQ 1997).”

Table 3-64 displays the estimated poverty levels within each county in the analysis area between 2006 and 2008 (the most recent data available from the Census Bureau). Poverty levels are not significantly different in these counties from the state as a whole with the exception of Meade County, which has a poverty level that is lower than the state level.

Because no minority or low-income populations as defined by EO 12898 were identified in the analysis area, no further analysis of environmental justice was conducted.

Social Concerns

Several social concerns were raised during scoping:

- There was some concern about the risk of wildfire to private property as well as the risk of an escaped prescribed burn to private property.
- There were concerns about the impacts of both closing and opening roads, with some favoring fewer roads to allow for non-motorized recreation and others favoring more open roads for motorized recreation and access to the area for fire suppression resources.
- Concern was expressed that the proposed management actions may affect the scenic integrity of the project area.
- Concerns were raised regarding the level of timber harvest, with some commenters favoring less active management and some favoring more management.
There were several commenters who expressed concern regarding the spread of noxious weeds as the result of management activities.

3.14.3 Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects
Under this alternative there would be no reduction to current insect or fire hazards or changes to the road network relative to implementing any actions in the Steamboat project area.

The mountain pine beetle epidemic is rapidly expanding in areas adjacent to the Steamboat Project Area. This epidemic is killing large numbers of mature pine trees and changing vegetation structure on a landscape scale. As trees are killed they fall to the ground, adding dead, dry fuels within an area already rated as having high fire hazard. The rate of infestation is increasing and the epidemic is likely to spread over a large area over the next three to five years.

A great deal of attention has been focused on the increasing size and severity of wildfires occurring on forested lands, particularly pine forests of the west. Recent wildfires on the Black Hills National Forest have demonstrated that these fires are larger, hotter and more lethal to vegetation and soils than historic fires in ponderosa pine ecosystems. Additionally, these wildfires are more dangerous or damaging to human settlements, property and values because of settlement patterns of humans within these environments.

If a large, high intensity wildfire were to occur, aesthetics, privacy, and economic property values in the burned area would likely be considerably diminished in the short-term. As vegetation grows back and burned dead timber falls and deteriorates, the long-term (beyond 10-15 years) effects of the wildfire on property values would be lessened. Sense of loss of amenities and property values gradually fades. People become accustomed over time to changes in scenery and other impacts like loss or damage to structures. Large amounts of smoke could affect local communities during a fire event. Smoke from such a wildfire would present health problems to elderly and persons with respiratory problems.

There would be no effect to access and travel beyond current impacts, as management activities would not change. If there were a large fire, an area closure may be placed on National Forest System lands for safety reasons from falling dead trees along roads and to allow time to repair damaged roads and rehabilitate the area. Also, temporary closure to off-road motorized use could be implemented to protect sensitive soils and reduce weed infestations. Travel management restrictions in the project area are governed by the Forest-wide travel management plan.
**Cumulative Effects**

The geographic area used for the analysis of cumulative social effects is the land area within the Steamboat project area boundary. The analysis examines effects over a 15 year period, the maximum amount of time it is expected for activities resulting from the proposed action to be completed.

Under Alternative A, no direct effects would occur, so accumulation of effects would only result from the associated indirect effects described above. For those concerned about the threat of wildfire to private property, the no action alternative has the potential to increase this threat cumulatively. Fire hazard ratings are currently high for much of the project area and the additional effect of not taking action to reduce those ratings would increase or maintain the threat to private property.

There would be no accumulation of effects concerning the size of the road network since no new roads would be added to the system under Alternative A. Roads that are currently in need of repair could continue to degrade under the no action alternative due to lack of management. Regardless of the decision rendered as a result of the Steamboat analysis, travel management would be governed by the Forest-wide plan.

The cumulative effect of not conducting timber harvest in the area would be increased risk to forest stands from mountain pine beetles (and wildfires, as discussed above). Forest stands that are already dense would become more so under Alternative A, increasing their risk of pine beetle infestation. Large pockets of pine beetle activity, resulting in large areas of red-needled or needleless trees, would have a negative effect on forest aesthetics and economic values in the project area.

No accumulation of effects concerning noxious weeds is expected under the no action alternative. Existing weed infestations would remain but would also be treated to some degree as a result of ongoing management. Since no management actions would be taken as a result of the Steamboat Project, it is not expected that any new infestations of noxious weeds would become established.

**Alternative B (Proposed Action)**

**Direct and IndirectEffects**

Under Alternative B, forest vegetation would be treated on a broad landscape scale to alter structural diversity and to reduce the risk of mountain pine beetle infestation and high severity wildfire within the Steamboat project area.

Prescribed burning would occur under Alternative B. The potential social effects from prescribed burning include the risk of fire escape, smoke impacts to health and safety, and associated costs. These risks are minimized by design criteria such as construction of fire lines, the presence of suppression engines and crews, and adherence to prescribed burn plans.

The reduced fire hazard in the treatment areas would reduce the potential for high intensity wildfire and would increase the likelihood that firefighters would be suppressing, from defensible positions, low to moderate intensity fires.
Reduction in mountain pine beetle risk would not eliminate infestations from the project area, but would minimize the potential for infestations to reach epidemic levels. Smaller scale infestations have a lesser impact on scenic values, habitat for certain wildlife, economic values of timber and overall forest health.

Alternative B would close newly constructed roads. Reconstruction and pre-use maintenance of existing routes would improve road conditions, making them safer for travel and less impactful to hydrological resources. Allowable uses of routes currently existing on the ground would be displayed in the MVUM.

**Cumulative Effects**
The geographic and temporal scale used for cumulative effects is described under Alternative A above.

Treatments conducted under the Steamboat Project would act cumulatively with past treatments to reduce the fire hazard and risk of pine beetle infestation on a larger scale within the project area. This could have differing impacts on social concerns. One positive impact is that reduction of fire hazard would help alleviate concerns of those who live within the project area. Reducing pine beetle risk would also help maintain scenic integrity in some stands, which would be desirable to forest visitors. On the other hand, those who prefer the forest to maintain an unmanaged appearance would be negatively impacted in areas where treatments are more aggressive (i.e., shelterwood cuts and overstory removals). Also, non-motorized recreation enthusiasts could be impacted, at least in the short term, by the addition of new roads to the system and the potential for increased motorized access. Implementation of the Forest-wide travel management plan would help to minimize this impact by defining areas where motorized travel is and is not allowed.

Jobs and income supported by Alternative B would coincide with employment and income contributions from other projects occurring on the Black Hills National Forest. While estimates of employment and income impacts from these projects are not available, they would accrue alongside potential employment and income impacts from the proposed action.

The Black Hills area economy was dominated by mining, timber harvest, and agriculture for many years. The region’s economy is now well-diversified. The proposed action and other action alternatives would contribute to the local economy by producing forest products and employment and through procurement of services and products associated with project implementation.

**Alternative C**

**Direct, Indirect and Cumulative Effects**
Direct, indirect and cumulative effects for Alternative C would be similar to those described for Alternative B above. In comparison to Alternatives B and D, the impacts of Alternative C on mountain pine beetle risk and fire hazard would be greater, as described in other sections of this EIS. Also, Alternative C contains a greater number of acres treated through commercial timber harvest so would have a slightly higher economic impact on the area.
Alternative D

Direct, Indirect and Cumulative Effects
Direct, indirect and cumulative effects for Alternative D would be similar to those described for Alternative B above. In comparison to Alternatives B and C, the impacts of Alternative D on mountain pine beetle risk and fire hazard would be less, as described in other sections of this EIS. Alternative D includes the fewest acres of commercial timber harvest and would have a slightly lower economic impact.

3.14.4 Economic Analysis

The following is a summary of the analysis used to calculate a variety of financial measures describing the alternatives in this EIS. The Quick Silver program was used to perform the analysis (QS Version 6.00.0001, USDA-Forest Service, Tessa Systems, July 2008).

The objective of the analysis is to provide a relative comparison of the costs and revenues associated with implementing the four alternatives being analyzed. This economic analysis is for comparison purposes only and is not the key factor in choosing an alternative. The decision maker will use this information while also weighing the non-monetary costs and benefits (e.g. positive and negative effects to natural resources) associated with the project. There are costs and benefits associated with activities occurring in the Steamboat project area that are not included in this analysis (e.g. recreation management, Christmas tree cutting, fuel wood gathering, special use permits). This analysis does not include these activities because they occur across the District and Forest and they are not directly related to the proposed action. The alternatives presented in this EIS would not significantly change these other activities.

This EIS discusses a no action alternative and three action alternatives for managing the Steamboat project area for the next ten to fifteen years. The financial analysis includes those actions connected to the vegetation treatments for fire and fuels reduction needs and related actions that are planned over this management timeframe. The only benefits included in the analysis were the revenues generated from the volume of timber harvested per alternative. This analysis does not include revenues generated in the local and regional economies related to wages, equipment and supplies purchased, and taxes paid. No values are presented for Alternative A because no actions are proposed, so no monetary costs or benefits related to this project would be generated.

The action alternatives described in this EIS are consistent with national initiatives and policy such as the National Forest Management Act, National Fire Plan and direction provided by the Forest Plan and associated economic assumptions. Any future project proposals will receive a separate environmental analysis, including an economic analysis, as appropriate. Table 3-67 displays the financial measures summarized by alternative.

The only benefit calculated for the alternatives was the sale of softwood timber. Costs include road construction, prescribed burning, sale prep and administration, non-commercial thinning, and post-sale activities. A complete list of the costs and benefits for each alternative and the value associated with each is located in the Steamboat project file.
Costs

Sale preparation/administration costs are based upon a 3-year average of costs for the Forest. Normally, all of the administration portions of costs are spread out over the contract period. Rather than trying to develop specific assumptions on what costs occur in what year, all the costs are lumped in year 1. This assumption results in a lower economic value than if the costs were spread out. Road costs are based upon the estimated costs given the amount of work that needs to be done. Costs for Non-commercial thinning, fuels treatments, and weed control are all based on the recent planning costs used in recent timber sales. The costs include district administration and overhead.

Benefits

The stumpage values are the average experienced on the forest as documented by the Regional Office. The revenues are assumed to occur all at once. This assumption simplifies the situation that would normally occur with the revenues occurring throughout the life of the sale. This assumption by itself would tend to raise the economic value of the project, but it is consistent with the assumption on sale administration costs, which tend to lower the economic value of the project.

The results of the Quick Silver analysis are displayed in Table 3-65 below. The values shown are intended to show relative efficiency of each alternative and serve as a means of comparing alternatives. The values will fluctuate with changes in costs and stumpage values and do not reflect actual costs and revenues.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Net Value</td>
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<td>-$11,735,509</td>
<td>-$14,516,920</td>
<td>-$11,652,839</td>
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<tr>
<td>Benefit/Cost Ratio</td>
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<td>0.03</td>
<td>0.04</td>
<td>0.02</td>
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<tr>
<td>Benefits</td>
<td>0</td>
<td>$419,209</td>
<td>$629,230</td>
<td>$296,831</td>
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<tr>
<td>Costs</td>
<td>0</td>
<td>-$12,154,718</td>
<td>-$15,146,150</td>
<td>-$11,949,670</td>
</tr>
</tbody>
</table>

Alternative A (No Action)

Although costs associated with Alternative A are not integrated into this financial analysis, the actual cost of not taking action could potentially be high in both economic and environmental terms. Recent wildfires on the Black Hills and elsewhere in the western United States have incurred costs in the millions of dollars for suppression alone. In the Black Hills, suppression costs for the recent Battle Creek Fire were estimated at $6.5 million and the Jasper Fire around $11.5 million. Costs of rehabilitation, economic loss of resources, and lost property values are significant additional costs of these wildfires. Likewise, widespread areas of beetle killed trees would represent a loss of potential economic gain through loss of timber value and could potentially impact the tourism industry and private home values through the decline in aesthetics, as has been seen in areas of Colorado that have been heavily impacted by mountain pine beetle epidemics.
Alternative B (Proposed Action)

The cost of fully implementing Alternative B exceeds the revenues generated by approximately $11.7 million. Revenues, generated solely from the sale of commercial timber, would be approximately $0.4 million based on current market prices. Implementation costs of Alternative B would be approximately $12.2 million. To fully implement the proposed action, additional funding, such as appropriated fuels dollars or other sources, would be necessary. As implementation of Alternative B would reduce the fire hazard in the project area and potentially reduce the costs of suppressing large wildfires in the future, but no method exists for predicting how much those savings would be or if the savings would occur.

Alternative C

The cost of fully implementing Alternative C exceeds the revenues generated by approximately $14.5 million. Revenues, generated solely from the sale of commercial timber, would be approximately $0.6 million based on current market prices. Implementation costs of Alternative C would be approximately $15.1 million. Alternative C would generate more timber revenue than Alternatives B or D, but would also generate higher costs related to road construction, maintenance, timber sale administration and post-sale activities. To fully implement this alternative, additional funding, such as appropriated fuels dollars or other sources, would be necessary. Implementation of Alternative C would reduce the fire hazard in the project area and potentially reduce the costs of suppressing large wildfires in the future, but no method exists for predicting how much those savings would be or if the savings would occur.

Alternative D

The cost of fully implementing Alternative D exceeds the revenues generated by approximately $11.7 million. Revenues, generated solely from the sale of commercial timber, would be approximately $0.3 million based on current market prices. Implementation costs of Alternative D would be approximately $11.9 million. Alternative D would generate less timber revenue than Alternatives B or C, but would also result in the lowest costs compared to the other action alternatives, largely due to the absence of new road construction. To fully implement this alternative, additional funding, such as appropriated fuels dollars or other sources, would be necessary. Implementation of Alternative D would reduce the fire hazard in the project area and potentially reduce the costs of suppressing large wildfires in the future, but no method exists for predicting how much those savings would be or if the savings would occur.

3.15 Irreversible and Irretrievable Commitments of Resources

NEPA requires consideration of “any irreversible or irretrievable commitments of resources” (40 CFR 1502.16). 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 road.

No irreversible commitments of resources would be associated with any of the alternatives.
Irretrievable commitments of resources include the following:

- Soil productivity and timber productivity would be lost where construction of new roads occurs. New road construction is proposed under Alternatives B and C.
- There would be a short-term irretrievable loss of habitat for some wildlife species due to direct disturbance during project implementation under Alternatives B, C and D. See the Wildlife section above for details.
- Noxious weed infestations may cause an irretrievable commitment of resources if allowed to persist. Weeds can negatively affect native plant communities, leading to losses of wildlife habitat, forage and vegetation diversity.
- Commercial harvest of timber represents an irretrievable commitment of resources. Once live trees are cut, that tree is removed from the environment. However, harvested trees are replaced by regeneration on harvested units.
- Construction of new roads involves an irretrievable commitment of timber resources as long as that road is maintained as such and not allowed to revegetate.

3.16 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).

Alternatives B, C and D would result in a short-term reduction in the amount of standing timber volume in the area. Proposed commercial timber harvest would remove trees that could grow larger and provide timber in the future if left uncut. Proposed regeneration harvests would be expected to improve long-term timber yields by creating young stands where there are currently few and improving the distribution of pine age classes. Increasing young stands would be expected to produce more sustainable yields in the future. Proposed commercial and non-commercial thinning would reduce stocking in treated stands to levels optimal for growth. The decrease in stocking would also improve the vigor of the remaining trees, reducing susceptibility to attack by insects and disease.

Proposed activities are designed to decrease the risk of mountain pine beetle infestation and crown fire hazard in treated stands and potential for development of large insect epidemics and stand-replacing fires across the landscape. Short-term adverse effects on resources such as soils and wildlife could occur, but these would be expected to be less severe and persistent than effects of a widespread epidemic or high intensity wildfire.

3.17 Unavoidable Adverse Impacts

NEPA requires consideration of “any adverse environmental effects which cannot be avoided” (40 CFR 1502.16).

Prescribed burning would result in air quality decreases in some locations due to smoke, which would be expected to last from a few hours to several days.
Individuals of various wildlife and fish species could be adversely affected. Habitat for some species would increase while habitat for others would decrease. None of the alternatives would be expected to result in a loss of viability of any species across the Black Hills National Forest.

Proposed activities could negatively affect unknown rare plant occurrences in the project area. Habitat would generally be protected. None of the alternatives would be expected to result in a loss of viability of any species across the Forest.

Adverse effects on soils and hydrology could include localized, short-term erosion, sedimentation, compaction and creation of hydrophobic soils.

Previously unknown or unrecorded heritage resources could be disturbed or destroyed. If previously unknown heritage resources are discovered during project implementation, ground-disturbing actions at the site would stop and the district or forest archeologist would be notified.

Scenic quality would be adversely affected in some locations during and up to several years after the project.

Recreational opportunities may be adversely affected if implementation of project activities results in temporary closure of roads or areas for public safety.

3.18 Consistency with the Forest Plan

Alternatives B and D are consistent with the applicable Forest Plan goals and objectives and would comply with standards and guidelines.

Alternative C would require a project-specific Forest Plan amendment to exempt it from Forest Plan standard 3108, which defines the level of treatment allowable in existing or historical goshawk nest areas. Alternative C would reduce basal area in known goshawk stands below the level considered by standard 3108 as suitable goshawk nesting habitat. Therefore, if Alternative C is selected, the Forest Plan must be amended or the alternative must be modified to comply with standard 3108.

3.19 Other Required Disclosures

3.19.1 Wildlife

No waters would be impounded or diverted as part of the project so coordination with the U.S. Fish and Wildlife Service (USFWS) under the Fish and Wildlife Coordination Act is not required.

No coordination with the USFWS is required under the Endangered Species Act, as no Threatened or Endangered species, nor any habitat for such species, occurs in the project area.

3.19.2 Botany
No coordination with the USFWS is required under the Endangered Species Act, as no Threatened or Endangered species, nor any habitat for such species, occurs in the project area.

3.19.3 Hydrology and Soils

E.O. 11988 – Floodplain Management
The Steamboat Project would be in compliance with and meets the requirements of the Executive Order for Floodplain Management.

E.O. 19990 – Protection of Wetlands
The Steamboat Project would be in compliance with and meets the requirements of the Executive Order for Protection of Wetlands.

Clean Water Act of 1977
None of the alternatives for the Steamboat Project would degrade water quality and all alternatives would be in compliance and meet the requirements of the Clean Water Act.

Section 402
Discharge Permits – This permit applies to point sources. There would not be any point sources of pollutants as a result of this project; silvicultural activities are exempt from this permit. Any potential source of pollutants as a result of this project would be labeled as non-point and this project would meet and comply with the Forest Plan standards, which incorporate WCP and BMP that are designed to meet water quality standards through control of non-point sources of pollutants.

Storm Water Associated with Construction Activities – Silvicultural activities, including road construction to access treatment areas, are exempt from this permit. As mentioned above, Forest Plan standards would be implemented to prevent and minimize pollution.

Section 404
Silvicultural activities and roads associated with these activities are exempt from this permit as long as the 15 mandatory BMP are implemented as listed in 33 CFR 323.4. Those BMP are listed below:

(i) Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

(iii) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv) The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(v) Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;
(vi) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

(vii) The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(viii) Borrow material shall be taken from upland sources whenever feasible;

(ix) The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(x) Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi) The discharge shall not be located in the proximity of a public water supply intake;

(xii) The discharge shall not occur in areas of concentrated shellfish production;

(xiii) The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv) All temporary fills shall be removed in their entirety and the area restored to its original elevation.
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6  GLOSSARY

A

Alternative—A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project that reflects identified public and management concerns for the Project Area.

Best Management Practices (BMP)—Practices determined by the state to be the most effective and practical means of preventing or reducing the amount of water pollution generated by nonpoint sources to meet water quality goals.

Big Game—Those species of large mammals normally managed as a sport hunting resource. In the Black Hills, the term generally refers to white-tailed deer, mule deer and elk.

Biological Diversity (Biodiversity)—The relative distribution and abundance of different plant and animal communities and species within an area.

Biological Evaluation—A documented USFS review of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Board Foot (bf)—The amount of wood equivalent to 1 foot by 1-inch thick.

Broadcast Burn—Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of a fuel hazard or as a silvicultural treatment or both.

Browse—Twigs, leaves, and young shoots of trees and shrubs on which animals feed.

C

Canopy—The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees.

Code of Federal Regulations (CFR)—The listing of various regulations pertaining to management and administration of the National Forests.

Compaction—The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Condition Class—A grouping of timber stands into size-age-stocking classes for Forest planning.

Conifer—Any of a group of needle and cone-bearing evergreen trees.

Council on Environmental Quality (CEQ)—An advisory council to the President, established by NEPA. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover—Vegetation used by wildlife for protection from predators or to escape the adverse effects of weather.

Cultural Resources—The remains of sites, structures, or objects used by humans in the past-historic or prehistoric.
Cumulative Effect—The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor, but collectively significant, actions taking place over a period of time.

Decision Area—The geographic area defining the scope of this document and the alternatives proposed by it.

Decommissioning—This term is used to refer to a specific type of road closure. On a decommissioned road, access would be controlled by means of a moderately sized berm or “tank trap” impassable to vehicles but capable of being easily bulldozed to permit vehicle passage if the road is recommissioned in the future. For all decommissioned roads, water bars are installed, the road bed is seeded, all culverts are removed, and self-maintaining cross-road drainage is provided.

Developed Recreation—Recreation dependent on facilities provided to enhance recreation opportunities in concentrated use areas. Examples are ski areas, resorts, and campgrounds.

Diameter at Breast Height (DBH)—The diameter of a tree measured 4 ft, 6 inches above the ground.

Dispersed Recreation—Recreation that occurs outside of developed recreation sites requiring few, if any, facilities or other improvements and includes such activities as hunting, hiking, viewing scenery, and cross-country skiing.

Displacement of Soil—The movement of the forest floor (litter, duff, and humus layers) and surface soils from one place to another by mechanical forces such as a blade used in piling and windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation is not considered displacement.

Ecosystem—Any community of organisms along with its environment, forming an interacting system.

Effects (or Impacts)—Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.

Endangered Species—Any plant or animal species that is in danger of extinction throughout all or a significant portion of its range (Endangered Species Act of 1973).

Endemic—Native to or confined to a certain region.

Environment—The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental Assessment (EA)—A concise public document which serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a finding of No Significant Impact, (b) aid an agency’s compliance with NEPA when no EIS is necessary, or (c) facilitate preparation of an EIS when necessary.
Environmental Impact Statement (EIS)—A detailed summary prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and the effects analyzed.

Epidemic—The populations of plants, animals and diseases that build-up, often rapidly, to highly abnormal and generally injurious levels.

Erosion—The detachment and transport of individual soil particles by wind, water, or gravity.

Fauna—Animals, including lesser forms such as insects, mites, etc.

Fire Regime Condition Class—A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation.

Floodplain—The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Flora—Plants

Forage—All browse and non-woody plants that are available to livestock or game animals and used for grazing or harvested for feeding.

Forb—An herbaceous plant that is not a graminoid.

Foreground—That part of a scene, landscape, etc., that is nearest to the viewer, and in which detail is evident, usually ¼ to ½ mile from the observer.

Fuel Treatment—Manipulation or reduction of natural or activity fuels (generated by a management activity such as slash left from logging) to reduce fire hazard.

Fuels—Combustible materials present in the forest that potentially contribute a significant fire hazard.

Habitat—The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

Habitat Type—An aggregation of all land areas potentially capable of producing similar plant communities at climax stage.

Immediate Foreground—The part of the foreground that is extremely critical for visual detail, usually within 400 feet of the observer.

Indicator Species—See Management Indicator Species.

Indirect Effects—Secondary effects that occur in locations other than the initial action or significantly later in time.
Interdisciplinary Team (IDT)—A group of professional specialists with expertise in different resources that collaborate to develop and evaluate management alternatives.

Interdisciplinary Approach—Utilization of one or more individuals representing areas of knowledge and skills focusing on the same task, problem, or subject. Team member interaction provides needed insight to all stages of the process.

Intermittent Stream—A stream that runs water in most months, but does not run water during the dry season of most years.

Invertebrates—Animals having no backbone such as earthworms, insects, and lesser animals.

Irretrievable—Applies to losses of production, harvest, or a commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports (recreation) site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible—Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Issue—A subject or question of public discussion or interest to be addressed or discussed in the planning process.

Landtype—A unit of land with similar designated soil, vegetation, geology, topography, climate, and drainage. The basis for mapping units in the land systems inventory.

Limiting Factor—The environmental influence that exceeds the tolerance limit of an animal to restrict it in its activities, functions, or geographic range.

Litter—An organic surface soil layer usually composed of identifiable leaves, branches, or other vegetative material, and animal remains.

Management Area (MA)—Geographic areas, not necessarily contiguous, that have common management direction, consistent with the Forest Plan allocations.

Management Direction—A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Management Indicator Species (MIS)—A species selected because its welfare is presumed to be an indicator of the welfare of other species sharing similar habitat requirements. A species of fish, wildlife, or plants that reflect ecological changes caused by land management activities.

Middleground—The part of a scene or landscape that hits between the foreground and background zones.

Mitigation—Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impacts of a management practice.
**Monitoring**—The periodic evaluation on a sample basis, of management practices to determine how well objectives have been met and how closely management standards have been applied.

**Mortality**—In forestry, trees in a stand that die of natural causes.

**National Environmental Policy Act (NEPA) Process**—An interdisciplinary process that concentrates decisionmaking around issues, concerns, alternatives, and the effects of alternatives on the environment.

**National Forest Management Act (NFMA)**—Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Regional Guides and Forest Plans, and the preparation of regulations to guide that development.

**Natural Regeneration**—Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

**Noxious Weed**—A plant species that is highly injurious or destructive and has a great potential for economic impact.

**Obliteration**—Obliteration of an existing road would involve removal of all culverts, establishing permanent drainages, and recontouring of the road surface.

**Pathogen**—A specific causative agent of disease, such as a virus.

**Peak Flow**—The greatest flow attained during the melting of the winter snowpack.

**Perennial Streams**—Streams that flow continuously throughout the year.

**Pioneer Species**—A plant capable of invading a bare site (newly exposed soil surface) and persisting there until replaced by another species or community as succession progresses.

**Plant Community**—An assembly of plants living together.

**Preferred Alternative**—The alternative recommended for implementation in the EIS.

**Prescribed Burning**—The application of fire to fuels in either a natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

**Prescription**—Management practices selected and scheduled for application on a designated area to attain specific goals and objectives.

**Project Area**—The land area being considered for the proposed activities.

**Proposed Action**—The alternative that was presented to the public during the scoping period. Comments on this alternative are used to identify significant issues and to develop additional alternatives that address those issues. The proposed action may not be the preferred alternative in the EIS, nor is it necessarily the alternative that is most likely to be chosen.
Recreation Opportunity Spectrum (ROS)—A system for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given area might be able to provide. It is used for planning and managing the recreation resource and recognizes recreation activity, setting, and experience opportunities.

Restricted Road—A National Forest road or segment that is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be specified. The closure is legal when the Forest Supervisor has issued and posted an order in accordance with 36 CFR 261.

Riparian—Pertaining to areas of land directly influenced by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream sides, lake borders, or marshes are typical riparian areas. Riparian vegetation borders watercourses, lakes, or swamps; it requires a high water table.

Road—A vehicle travel way of over 50 inches wide.

Road Maintenance—The upkeep of the entire Forest Development Transportation Facility including surface and shoulders, parking and side areas, structures, and any traffic control devices as are necessary for its safe and efficient utilization.

Roadless Area—A National Forest System area that is larger than 5,000 acres or, if smaller than 5,000 acres, is contiguous to a designated wilderness or primitive area; contains no roads, and has been inventoried by the Forest Service for possible inclusion into the wilderness preservation system.

Scoping—The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignment.

Sediment—Any material carried in suspension by water that will ultimately settle to the bottom. Sediment has two main sources—from the channel itself and from upslope areas.

Seedlings and Saplings—Non-commercial size young trees.

Sensitive Species—Those 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 habitat capability that would reduce a species’ existing distribution.

Site Productivity—Production capability of specific areas of land.

Slash—The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning of trees.

Snag—A standing dead tree usually without merchantable value for timber products, but may have characteristics of benefit to some cavity nesting wildlife species.

Special Use Permit—A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.
Stand—A community of trees or other vegetation uniform in composition, constitution, spatial arrangement, or condition to be distinguishable from other adjacent communities.

Stand Replacing Fire—A fire that consumes an entire stand of trees. These fires are generally quite hot and can burn hundreds of acres.

Structural Stage—A classification based upon tree sizes and canopy closure. It is used for management purposes, habitat classification and fire hazard determinations.

Succession—The progressive changes in plant communities toward climax habitat.

Successional Stage—A stage or recognizable condition of a plant community which occurs during its development from the bare ground to climax habitat.

Thermal Cover—Vegetative cover used by animals to modify the adverse affects of weather.

Thinning—Cutting in even-aged stands to redistribute growth potential or benefit the quality of the residual stand.

Threatened Species—Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tiering—Refers to the coverage of general matters in broader EISs or EAs with subsequent other related statements in the EAs incorporated, by reference. The discussions contained in the previous document are incorporated, solely for issues specific to the statement subsequently prepared.

Unclassified Road—A road that is not constructed, maintained, or intended for long-term highway use, such as roads constructed for temporary access and other remnants of short-term use roads associated with fire suppression, timber harvest, and oil, gas, or mineral activities, as well as travel ways resulting from off-road vehicle use. These roads are not part of the National Forest System. Also referred to as “non-system roads”.

Understory—Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Vertebrates—Animals having a backbone, or a spinal column, including mammals, fishes, birds, reptiles, and amphibians.

Viewshed—Subunits of the landscape where the scene is contained by topography similar to a watershed.

Visual Quality Objective (VQO)—A US Forest Service system of indicating the potential expectations of the visual resource by considering the frequency an area is viewed and the type of landscape.

Visual Resource—The composite of landforms, water features, vegetative patterns, and cultural features which create the visual environment.

Water Yield—The measured output of the forest’s streams.
**Watershed**—Entire area that contributes water to a drainage system or stream.

**Wetlands**—Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, wet meadows, river overflows, mud flats, and natural ponds.

**Wilderness**—All lands included in the National Wilderness Preservation System by public law; generally defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation.

**Wildfire**—Any wildfire not designated and managed as a prescribed fire with an approved prescription.

**Wildland Fire Use**—Naturally caused wildfires that are allowed to burn within controlled areas to achieve natural resource objectives.

**Wildlife Diversity**—The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features.
## LIST OF PREPARERS

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8  RECIPIENTS OF PLANNING DOCUMENTS

8.1  Recipients of DEIS

Hardcopies of the Steamboat DEIS were sent to local, state and federal government agencies, tribes, organizations, businesses and individuals who either requested to receive the document, are required to receive it by law, or who submitted comments during the scoping period. In addition, cover letters announcing the availability of the DEIS were mailed to other individuals and organizations. A full mailing list of cover letter recipients is located in the Steamboat Project file.

The document can be accessed electronically at the Black Hills National Forest web page at: http://go.usa.gov/2QI.

Government
Lawrence County
Meade County
Pennington County
South Dakota Department of Agriculture
South Dakota Department of Environment and Natural Resources
South Dakota Department of Game, Fish and Parks
United States Department of Agriculture
United States Department of the Interior
United States Environmental Protection Agency, Region 8
United States Environmental Protection Agency, Washington Office
United States Fish and Wildlife Service, South Dakota Field Office

Organizations
Biodiversity Conservation Alliance
Black Hills Forest Resource Association
Norbeck Society
Prairie Hills Audubon Society

Businesses
Neiman Timber Company

Individuals
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Bill Coburn
Betty Green
Steve Hoier
Henry Kohlbrand
Ralph Kopp
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Jean Public
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