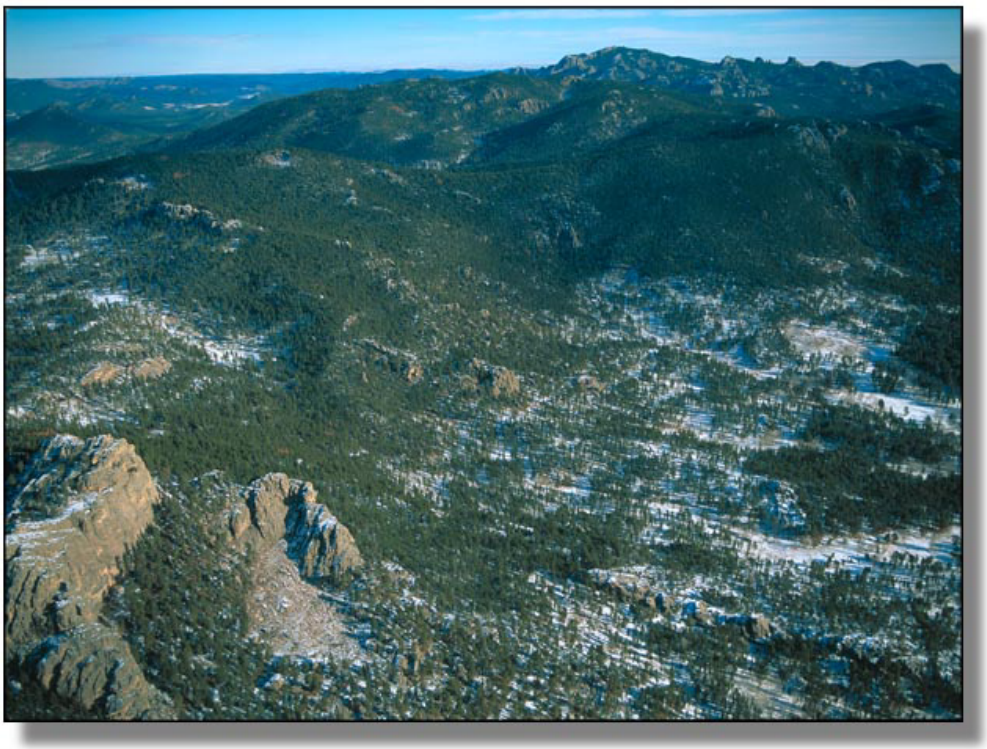
Citadel Project Area

Draft Environmental Impact Statement

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

May 2007



Commonly Used Acronyms and Abbreviations

ATV	All-Terrain Vehicle
BA	Basal Area
BCR	Bird Conservation Region
BF	Board Foot
BHNF	Black Hills National Forest
BLM	Bureau of Land Management
BMP	Best Management Practices
CAR	Community at Risk
CCF	Hundred Cubic Feet
CDA	Connected Disturbed Area
CEQ	Council on Environmental Quality
CF	Cubic Feet
CFR	Code of Federal Regulations
CMAI	Culmination of Mean Annual Increment
DBH	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
EA	Environmental Analysis
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
GIS	Geographic Information System
HUC	Hydrologic Unit Code
ID Team	Interdisciplinary Team
MA	Management Area
MBF	Thousand Board Feet
MIS	Management Indicator Species
MMBF	Million Board Feet
MPB	Mountain Pine Beetle
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System Road
NOA	Notice of Availability
NOI	Notice of Intent
NRHP	National Register of Historic Places
OHV	Off-Highway Vehicle
PFC	Proper Functioning Condition
POL	Products Other than Logs
R2	Forest Service Region 2 (Rocky Mountain Region)
RN	Roaded Natural
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective
SMU	Soil Mapping Unit
SOLC	Species of Local Concern
SS	Structural stage
SVS	Stand Vegetation Simulator
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TFB	Thin from Below
TSI	Timber Stand Improvement
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
WCP	Watershed Conservation Practice
WUI	Wildland-Urban Interface

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Citadel Project Area
Draft Environmental Impact Statement
Lawrence County, 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 Citadel project area as guided by the Black Hills National Forest Land and Resource Management Plan (Forest Plan) as amended. The focus of the proposed actions is modification of stand structure across the planning area to reduce the potential for high intensity wildfires, reduce fuel loads, reduce the risk of mountain pine beetle outbreaks, and to maintain or enhance wildlife habitat. Actions used to achieve these goals include prescribed burning, mechanical fuel reduction, non-commercial thinning, and commercial timber harvest, which will also provide lumber to the local timber industry. The District also proposes to improve the road system and reduce soil and water damage related to the roads and motorized vehicles. Three alternatives are considered in detail. Alternative A is the no action alternative; no management actions associated with this project would occur. Alternative B is the proposed action and includes silvicultural treatments designed to reduce fire hazard, limit the potential of mountain pine beetle infestations, and enhance or maintain wildlife habitat. Alternative C, the preferred alternative, expands on the treatments in Alternative B, emphasizes reducing hazardous fuels in the wildland urban interface (WUI), and includes treatments specifically designed to improve wildlife habitat. This DEIS discloses the direct, indirect, and cumulative environmental impacts resulting from the proposed action and alternatives.

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Summary

The Northern Hills Ranger District of the Black Hills National Forest proposes to implement multiple resource management actions within the Citadel project area as guided by the Black Hills National Forest Land and Resource Management Plan (Forest Plan) and Phase II Amendment. The Citadel project area covers a total of 32,217. It includes approximately 28,135 acres of National Forest System (NFS) land and approximately 4,082 acres of interspersed private land. The project area is south of Spearfish, South Dakota, east of the Wyoming-South Dakota state line, and west of Spearfish Canyon (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 Citadel project area does not contain any designated wilderness, roadless, or research natural areas.

The focus of the proposed action is to modify stand structure across the planning area to reduce the potential for high-intensity wildfires and epidemic mountain pine beetle infestations. In addition, the proposal will maintain and enhance wildlife habitat and provide a supply of commercial timber for local industry. The preferred action (Alternative C) calls for vegetative and fuels treatments on a total of 17,780 acres to reduce the density of pine stands,and fuel loads, decrease the potential for crown fires, increase tree growth and vigor, and lessen the risk of mountain pine beetle infestation. The Forest Service would achieve this by using commercial harvest to remove merchantable trees and by using non-commercial methods to thin small, unmerchantable trees. The proposed action includes construction of 18 miles of new roads and improvement of 35 miles of existing roads. Fuel loads would be reduced by decreasing the volume and arrangement of existing fuels.

The Black Hills National Forest has experienced a great deal of change over the past 130 years. Euro-American settlement of the area beginning in the 1870s has resulted in widespread cattle grazing, timber harvest, mining, road construction, private land development, and wildfire suppression. Over the past decade, the Black Hills have experienced several large wildfires, drought conditions, and an increase in mountain pine beetle infestations.

The threat of large wildfires to human improvements and natural resources has become a major public concern. Demand exists for the Forest Service to reduce the potential for high-severity wildfires. For the Citadel project area, the proposed action was developed to manage vegetation to reduce the potential for high-severity wildfires and widespread mountain pine beetle outbreaks. The primary focus is the removal of vegetation and associated fuels, which would reduce the unnaturally high concentration of biomass in the forest. Reduction of biomass would reduce the risk of epidemic pine beetle infestations, which create large patches of dead, dry, fire-susceptible timber. The overall intent is to limit the effects of large wildfires to the environment and to reduce the potential for loss of property or life.

Comments on the proposed action, potential concerns, and opportunities for managing the Citadel project area were solicited from members of the public, other public agencies, adjacent property owners, and organizations. Methods used to request comments included a scoping letter mailed on May 26, 2006 to approximately 240 interested parties, local newspaper articles advertising the project on June 9, 2006, a public open house held at the Northern Hills District Office in Spearfish, South Dakota, on June 27, 2006, and a Notice of Intent (NOI) to prepare an EIS posted in the *Federal Register* on Wednesday, August 2, 2006.

Comments received during the scoping process were used to identify issues and develop alternatives and mitigation measures. Through review and analysis of the scoping comments and input, the Citadel project area Interdisciplinary Team (ID Team) identified four signficant issues related to the proposed activities:

(1) fire hazard in the wildland urban interface, (2) mountain pine beetle infestation, (3) wildlife habitat, (4) volume of commercial timber.

These issues, along with ID team discussions, led the team to develop alternatives to the proposed action. 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. Under the no action alternative no effort to modify existing vegetation or related fuels and habitat conditions in the project area would occur. Actions such as ongoing Forest protection efforts and recurring road maintenance on system roads would continue as directed by the Forest Plan. Actions analyzed under past projects or proposed by future projects may still occur.

Alternative B (Proposed Action) – Alternative B is the proposed action. It was developed in response to the purpose of and need for action. This alternative would modify stand structure across the planning area to reduce the potential for uncharacteristically intense wildfire behavior, reduce fuel loads, reduce the risk of large pine beetle outbreaks, and provide for diverse wildlife habitat. A variety of vegetation management tools, including commercial timber harvest, would be used to thin dense ponderosa pine stands to reduce the risk of pine beetle outbreaks and crown fire hazard. 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 while at the same time providing cover and structural diversity for the benefit of wildlife. Harvest methods would include both ground-based and cable systems.

Construction of up to 19 miles of new roads and improvement of 35 miles of existing roads would be necessary to implement the proposed treatments. Under Alternative B, 31 miles of non-system roads would be decommissioned. Off-road motorized travel regulations would not change from their current state. Newly constructed roads would be closed to motorized vehicles following timber harvest.

Alternative C (Preferred Alternative) – Alternative C is the preferred alternative. Like the proposed action, this alternative responds to the purpose of and need for the project. However, it places additional emphasis on providing structural diversity for wildlife and reducing fire hazard in WUI areas. The total area treated would be greater than Alternative B due to increased thinning and prescribed fire treatments in WUI areas. Many of the areas designated for silvicultural treatments under Alternative B would be the same, but treatment prescriptions would differ for selected stands (often south facing slopes and ridgetops) treated specifically to enhance wildlife habitat. Overall, treatment prescriptions and resulting stand structure across the area would be more diverse than Alternative B.

Approximately 18 miles of road construction and 35 miles of road improvement would be necessary to access stands for Alternative C treatments. Off-road motorized travel regulations would not change from their current state. All newly constructed roads would be closed following the completion of management activities. In addition, 32 miles of non-system roads would be decommissioned.

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1. PROPOSED ACTION AND PURPOSE OF AND NEED FOR ACTION

1.1. DOCUMENT STRUCTURE

The Northern Hills Ranger District of the Black Hills National Forest 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. These alternatives were developed in response to significant issues raised by the public, by other agencies, and by Forest Service resource specialists. Chapter 2 also provides a discussion of proposed design criteria, mitigation measures, and monitoring. Finally, this section includes summary tables displaying the activities planned by alternative and a comparison of how the alternatives respond to the issues.

***Chapter 3. Affected Environment and Environmental Consequences*:** This chapter describes the environmental effects of implementing the proposed action and other alternatives. The analysis is organized by resource area (Fire and Fuels, Recreation and Travel Management, Wildlife Habitat, Watershed 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: 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. Appendix A includes a series of maps displaying the project area, associated watersheds and management areas, proposed treatments by alternative and proposed transportation systems by alternative. Appendix B includes a discussion of Culmination of Mean Annual Increment (CMAI) to support the analysis of effects presented in the Forest Resources section (3.4.1).

Appendix C contains the design criteria applicable to activities proposed under both action alternatives. Appendix D is a summary of the botany and wildlife Biological Assessment/Biological Evaluations. Additional documentation, including more detailed analyses of project-area resources, may be found in the Project File located at the Northern Hills Ranger District office in Spearfish, South Dakota.

1.2. INTRODUCTION

This Draft Environmental Impact Statement (DEIS) discloses the environmental effects of vegetation management activities proposed in the Citadel Project Area. These activities are proposed by the Northern Hills Ranger District of the Black Hills National Forest to improve project area forest conditions by reducing the amount of hazardous fuels, reducing the risk of severe wildfires, providing a diversity of wildlife habitat and using commercial and non-commercial timber harvest to alter structural stages and promote regeneration. 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 the Final Environmental Impact Statement (FEIS).

The environmental analysis documented here is tiered to:

1) The 1997 Revised Land and Resource Management Plan for the Black Hills National Forest As Amended by the 2005 Phase II Amendment (Forest Plan) (USDA-Forest Service 2006).
2) The Final Environmental Impact Statement for the 2005 Phase II Amendment (Phase II FEIS) (USDA-Forest Service 2005c).
3) The Record of Decision for the 2005 Phase II Amendment (Phase II ROD) (USDA-Forest Service 2005e).
4) The Final Environmental Impact Statement for the 1997 Revised Land and Resource Management Plan (Revised Forest Plan FEIS) (USDA-Forest Service 1996b).

The Citadel project area is located in Lawrence County, South Dakota, in the northwestern Black Hills. The project area includes all or portions of the area shown in Table 1-1. Citadel Project Area Location

Table 1-1. Citadel Project Area Location

Citadel Project Area Location Legal Description		
Township	**Range**	**Sections**
4 North	1 East	4,5,6
5 North	1 East	1,2,3,4,5,6,7,8,9,10,11,12,14, 15,16,17,18,19,20,21,22,28,29, 30,31,32,33
5 North	2 East	3,4,5,6,7,8,9,10,11,14,15,16,17
6 North	1 East	10,14,15,19,20,21,22,23,24,25, 26,27,28,29,30,31,32,33,34,35,36
6 North	2 East	19,20,26,27,28,29,30,31,32,33, 34,35
Black Hills Meridian		

1.3. BACKGROUND

The Black Hills has experienced a great deal of change since the Custer Expedition's discovery of gold in the area in 1874 which led to rapid Euro-American settlement. With settlement came mining, logging, road construction, grazing, non-native plant and animal species, human-caused fires, suppression of

natural fires, and many other activities that have affected the forest. All of these actions have altered the natural forest health regime.

The Black Hills Forest Plan was revised in 1997 and further amended by the Phase I Amendment, which provided interim direction until the Phase II Amendment was completed and went into 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 wildfires and mountain pine beetles.

Wildfires

One of the greatest impacts that human 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-severity fires than the southern Black Hills, which likely experienced more regular, low-intensity fires. Brown (2003) contends that crown fires occurred infrequently 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 Black Hills National Forest) prior to Non-Native 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 (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 and has encroached upon many areas that were once open meadow areas or hardwood stands. After a particularly severe fire season nationwide in 1910, the Forest Service adopted a policy of suppressing all fires as quickly as possible, often referred to as the "10 AM Rule" with the goal of suppressing all fires by 10:00 AM on the morning following detection (Maclean 1992). This practice 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 Black Hills NF (USDA-Forest Service 2005c). Since 2000, wildfires have burned over 35,000 acres annually (USDA-Forest Service 2005c). 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 2005c). From 1900 to 1980, large fires (those greater than 300 acres) burned about 147,900 acres in the Black Hills. Since 1980, a dramatic increase in acreage burned has occurred. Wildfires that have occurred in the last 20 years including Jasper, Battle Creek, Little Elk, Roger's Shack, Elk Mountain II, Grizzly Gulch, Flagpole, Galena, and Westberry Trails have burned approximately 238,500 acres (USDA-Forest Service 2005c).

Mountain Pine Beetles

Another forest health issue affecting the Black Hills NF is the mountain pine beetle. Mountain pine beetles are native to western ponderosa pine forests and are a natural part of the Black Hills ecosystem. 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. Western South Dakota is currently under the influence of a prolonged drought, and beetle infestations are currently widespread across the Black Hills NF with epidemic populations near Sturgis in the Northern Hills, and near Deerfield Lake and Custer in the Central Hills.

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 limits 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 increase the amount of available foraging and nesting habitat for woodpeckers, provide open forage areas for big game, and allow aspen and birch to propagate in new openings. However, 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 represent pockets of readily consumable fuel that have the potential to increase fire spread and intensity. Large infestations also decrease scenic values as the dead trees support red needles for two or three years.

Project Area

The Citadel project area covers a total of 32,217 acres including approximately 28,135 acres of National Forest System (NFS) land and approximately 4,082 acres of interspersed private land. The project area is located immediately south and southwest of Spearfish, South Dakota (see Appendix A – Map 1). In addition, there are several housing developments and numerous ranches adjacent to the project area to the north and west, which are home to hundreds more people.

Because of its proximity to Spearfish, Lead, Deadwood, Belle Fourche, Sturgis, and Rapid City, South Dakota, and Sundance, Newcastle, and Gillette, Wyoming, the project area is a popular recreation destination. The Citadel project area contains approximately 11 miles of snowmobile trails, which are open seasonally from December 15 to March 31 and are a popular draw for winter recreation. The entire Crow Peak trail system is located within the project area, and its proximity (within two miles) to Spearfish makes it a popular hiking destination. Portions of the Big Hill and Old Baldy trail systems are also located in the project area and are used for both hiking and cross country skiing. The main travel routes within or near the project area include U.S. Interstate 90 to the north, U.S. Highway 14A (Spearfish Canyon Highway, a Forest Service-designated Scenic Byway) to the east, and Forest Service Roads 214.1, 134.1, and 222.1 within the project area. The project area is popular for big game and turkey hunting, and these roads receive heavy hunter traffic in the spring and fall. Recreational use of the area continues to increase.

Project History

The Citadel project area was originally part of a larger project area called Rubicon. The project area was reduced in size in late 2005 to remove a portion of Spearfish Canyon, allowing the entire canyon to be analyzed under a single future project. This reduction also removed Rubicon Gulch from the project area and led to the project being renamed, in reference to Citadel Rock, to maintain geographical accuracy. The scoping period for the Citadel project began on May 26, 2006, when a letter describing the proposed action was sent out for public comment to nearby 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 Spearfish, South Dakota on June 27, 2006. An

additional comment period began on August 2, 2006, following the publication of the Notice of Intent in the Federal Register. This comment period ended on September 1, 2006.

1.4. MANAGEMENT DIRECTION

1.4.1. Forest Plan Direction

The Forest Plan, as amended, supported by the final environmental impact statement (FEIS) for the revision and the Phase II Amendment (USDA-Forest Service 1996b, 2005c, 2006), 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 amended Forest Plan is to provide direction for the multiple use of and sustained yield of goods and services from National Forest System lands in an environmentally sound manner.

The Phase II Amendment to the Forest Plan (USDA-Forest Service 2005c, 2006) was approved 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 infestation.

The Forest Plan identifies 11 goals, each with associated objectives, for multiple-use management of the Black Hills NF. 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). Goals 1 through 4 and 10 provide management emphasis and direction applicable to the Citadel 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 amended Forest Plan also sets management allocations for specific uses of Management Areas (MAs) within the forest to meet multiple-use objectives. The Citadel project area is comprised of the following six MAs:

MA 3.1 (Botanical Areas) – 4,130 acres
MA 3.32 (Backcountry Non-motorized Recreation Emphasis) – 945 acres
MA 4.1 (Limited Motorized Use and Forest Product Emphasis) – 915 acres
MA 5.1 (Resource Production Emphasis) – 845 acres
MA 5.4 (Big Game Winter Range) – 9,018 acres
MA 5.6 (Forest Products, Recreation and Big Game Emphasis) – 12,282 acres

Each of these MAs is managed according to its own set of standards and guidelines, in addition to those established for the overall Forest Plan. When Forest Plan and MA standards and guidelines conflict the more stringent standard or guideline applies (USDA-Forest Service 2006).

1.5. PURPOSE OF AND NEED FOR ACTION

The purpose of and need for action in the Citadel project area is to reduce the risk of large, high-intensity fires, reduce the potential for epidemic mountain pine beetle infestation, and to provide for a diversity of wildlife habitat while providing commercial timber to local industry.

The Responsible Official for the Citadel project has chosen to propose resource management actions that respond to amended Forest Plan goals 1, 2, 3, 4, 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 Forest Plan goals and objectives not mentioned below also provide guidance and are achieved to varying degrees depending on project accomplishment (USDA-Forest Service 2006).

1.5.1 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 to 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.

Sedimentation has occurred in locations on some streams in the project area due to off-road motorized vehicle use and damaged or inadequate drainage structures on existing roads. Sedimentation reduces water quality and overall water flow. This project provides opportunities to maintain and improve stream health by repairing, reconstructing, re-routing, or closing roads.

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 Citadel project area contains numerous riparian areas, all associated with the Sand Creek, Bear Gulch, Crow Creek or Lower Spearfish Creek 6th-level watersheds. Several of these riparian areas are crossed by roads, both NFS and unclassified.

The opportunity exists to meet this objective by decommissioning unclassified roads, minimizing the number of new roads that cross riparian areas, closing new roads after timber harvest, and reconstructing existing NFS roads that cross riparian areas to minimize their impact.

1.5.2 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 Citadel project area include approximately 2,055 acres of aspen, 477 acres of paper birch, and 998 acres of bur oak. Ponderosa pine encroachment into hardwood stands is occurring forest-wide. Pine is sometimes able to out-compete aspen regeneration, eventually taking over the stand and reducing total hardwood acreage. Aspen 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 and immediately adjacent to hardwood stands to reduce competition and rejuvenate the hardwood component. This would be expected to increase the likelihood that current aspen, bur oak, and paper birch stands could 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.*

The project area includes 998 acres of bur oak forest. Some high-density stands have become stagnant, resulting in a thick, brushy stand. These overgrown stands are unable to progress toward the old-growth stage, thereby reducing the diversity of wildlife habitat. They also represent a higher fire hazard because of the high density of fuels close to the forest floor.

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 Citadel project area includes 477 acres of paper birch. 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.

Lodgepole pine, limber pine, and Douglas-fir are not known to occur in the Citadel 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 365 acres of open meadow. Meadows are an important aspect of the Black Hills ecosystem as they provide critical habitat for a variety of plant and animal species. Many meadows are being overtaken by encroaching ponderosa pine. Conservation and restoration of grassland areas is desirable in maintaining a diversity of habitat types and providing natural fuel breaks that could help to slow or stop wildfires.

The opportunity exists to remove ponderosa pine regeneration from open meadows. 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 2005c). 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. Data on the number of snags per acre across the forest is incomplete.

The opportunity exists to 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 pre-commercial treatments. Provide this tonnage no later than the removal cut (overstory removal) or a combination of removal cut and pre-commercial 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 the Sand Creek, Bear Gulch, Crow Creek, and Lower Spearfish Creek 6th level watersheds. 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 has the potential to 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 Beaver Gulch, Bear Gulch, Higgins Gulch, Crow Creek, and Mill Creek. 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 Citadel 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 220: *Conserve or enhance habitat for federally listed threatened, endangered, or proposed species.*

The only federally listed threatened species known to occur in the project area is the bald eagle, which has been documented in the area during the winter. No endangered or proposed species or critical habitat of any other threatened, endangered or proposed species is known to exist in the project area.

Wintering eagles require roosting sites, often large trees or snags, and open areas for hunting. The opportunity exists to carry out timber management and prescribed fire activities which would enhance or preserve these areas.

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.

Six animal species and one plant 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, changes to the transportation system (limiting motorized access to critical areas), and avoidance of these 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.

Noxious weeds pose the greatest non-native threat to the Citadel project area. Weed infestations can be controlled through monitoring and spraying. In addition, ensuring that only certified weed-free seed is used to re-seed disturbed areas and that weed-free gravel is used during road construction or improvement activities could help minimize the number of new infestations.

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 Citadel 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 Citadel project area contains all or part of three separate Botanical Areas (BAs). Severe wildfires originating outside these areas and burning across them have the potential to negatively impact the unique botanical resources within them.

Where dense stands of pine border BAs, the opportunity and need exists to reduce crown density and overall fuel loading to reduce the risk of a severe wildfire negatively impacting the unique botanical resources found in each BA.

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).*

a. 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).

b. *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)*
c. *Maintain habitat for golden-crowned kinglets, as outlined in specific direction pertaining to spruce habitat (e.g., Objective 239-LVD).*
d. *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 will affect an associated group of species (e.g., using golden-crowned kinglets as an indicator for species that prefer spruce habitat). These species are theoretically more sensitive to change than other species in their habitat, so if the indicator species experiences a decline in population, then that can be used as an indicator that other species may soon be affected also.

Habitat for ruffed grouse, beaver, song sparrow, grasshopper sparrow, white-tailed deer, brown creeper, black-backed woodpeckers, and golden-crowned kinglets exists in the project area. The opportunity exists to maintain or enhance habitat for these species as described elsewhere in this section.

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 2005c). Given the relative rarity of white spruce in the Black Hills, it is an important aspect of habitat diversity.

The Citadel project area includes 41 acres of white spruce. These 41 acres are divided into three separate stands. Of these three stands, two partially border private land and are possibly within 200 feet of buildings. None of the white spruce stands are adjacent to hardwood stands. The opportunity exists to maintain spruce in all three stands while conducting treatments to reduce fire risk in areas within 200 feet of buildings.

1.5.3 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 need exists to continue providing lumber to the timber industry in a manner that meets multiple use objectives defined by the Forest Plan.

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 Citadel 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]:*

Road Construction	280 miles/decade
Road Reconstruction	870 miles/decade
Road Obliteration	140 miles/decade
Two-track Obliteration	270 miles/decade

The Citadel area currently includes approximately 138 miles of roads. Open road density for the project area is approximately 3.1 miles of road per square mile of land. Many of the roads in the Citadel area are unclassified (non-National Forest System) and are candidates for closure. 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 (Roads Analysis Report for the Citadel project area, located in the project file) 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. Additionally, Forest Service Manual 7700 and Road Management Rule direction dictate that unclassified roads be either removed (decommissioned) or converted to a NFS road. The opportunity exists to construct new roads or improve existing roads necessary to conduct proposed management activities while closing unclassified roads.

1.5.4 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 Citadel project area contains approximately 4,082 acres of private land all of which has a ½ mile WUI buffer as defined by the Lawrence County Wildfire Protection Plan (LWCPP). The project area is also close enough to the cities of Spearfish, Lead, and Deadwood, South Dakota, that a wildfire ignited in the project area could conceivably threaten those towns. 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 including mechanical removal and prescribed burning. The opportunity exists in the Citadel project area to work toward achieving this objective by incorporating the proposed management actions.

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.

Risk, hazard, and value ratings are assigned to a specific area based on the risk of a fire occurring, the hazard (flammability) of the fuels, and the resource values of the area. There are three ratings for each category: low, moderate, and high. A "high" rating under any category results in an overall rating of "high" for the area. An area with an HHH rating has High risk, High hazard, and High value while an area with an LML rating has Low risk, Moderate hazard, and Low value. The Citadel project area has three rating areas, which each account for roughly 1/3 of the project area. The ratings for these areas are HHH, MMM, and MHM. The area rated as HHH is generally located in the northeastern third of the project area (nearest the city of Spearfish, South Dakota) and along the northern boundary. Based on these ratings, the opportunity exists to reduce the risk and hazard ratings for moderately to high value resource areas in Citadel.

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 represents a high fire hazard and negatively impacts many of the natural resource values of the area. Active management in areas where beetle populations are increasing may prevent them from reaching epidemic levels.

Aerial surveys conducted in 2005 indicated several mountain pine beetle outbreaks in the project area, all of which are currently at endemic levels. Beetle infestations have killed scattered trees across the project area. Dense stands of ponderosa pine are at the highest risk of mortality by mountain pine beetle. The opportunity exists to decrease mortality risk due to beetles through silvicultural treatments and prescribed fire.

1.5.5 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 (USDA-Forest Service 2006). 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 on the Citadel project area.

Management Area 3.1 – Botanical Areas

3.1-201: *Maintain or enhance the botanical features of these areas. Monitor to determine if botanical features are being maintained. (Objective)*

Botanical areas are designated based on unique botanical features present in the area. These features include rare plants and habitat types. Protection of botanical areas and their associated features is necessary to preserve unique ecosystem features that may not occur anywhere else on the Black Hills National Forest.

Three designated botanical areas exist partially or wholly within the Citadel project area: Upper Sand Creek (shared with the Bearlodge Ranger District), Bear/Beaver Gulches, and Higgins Gulch. These three areas represent 4,024 acres of the NFS lands in the project area. The opportunity exists to minimize impacts to these areas and to avoid degrading their biological integrity.

Management Area 3.32 – Backcountry Non-motorized Recreation Emphasis

3.32-401: *Emphasize visually appealing landscapes such as vista openings, rock outcroppings, and diversity of vegetation. (Objective)*

Management Area 3.32 is managed for backcountry non-motorized recreation. Hiking is the most common activity in areas designated as MA 3.32. In the Citadel area, MA 3.32 surrounds Crow Peak, which is the highest point overlooking Spearfish, South Dakota, the foothills and prairies to the north, and the Black Hills to the west, south, and east. Because of its proximity to Spearfish, it is a popular hiking destination. Maintaining the visual appeal of the landscape surrounding Crow Peak is important to preserving the outdoor experience that draws people to the area.

The area around Crow Peak features a variety of terrain, forest structure, and vistas of the surrounding landscape. The opportunity exists to use low-impact vegetative management techniques and prescribed fire to create or maintain a visually appealing landscape in this area.

Management Area 4.1 – Limited Motorized Use and Forest Product Emphasis

4.1- 201: *Emphasize wood-fiber production, wildlife habitat, and visual quality. (Goal)*

This goal calls for managing forest stands in MA 4.1 in a multiple-use manner. As mentioned previously, the overall direction of the Forest Plan is to manage the resources of the Black Hills NF in a multiple resource manner. Doing so provides benefit to the widest variety of wildlife, commercial, and recreational uses.

Opportunities exist to use commercial harvest to provide a timber supply to local sawmills while creating a mosaic of wildlife habitat and maintaining or enhancing the visual quality of the area.

4.1-202: *Manage forest cover types to provide variety in stand sizes, shape, crown closure, age structure and interspersion. (Goal)*

A variety of stand sizes, shape, crown closure, age structure and interspersion in forest cover types provides for a variety of potential wildlife habitat and visual quality. It also enhances overall forest health by allowing some stands to progress toward a climax (old growth) condition while encouraging new growth in others.

This goal calls for using a variety of silvicultural techniques to create some multi-structured, uneven-aged stands while maintaining other stands in an even-aged condition. An opportunity exists to accomplish this goal by treating some stands and allowing others to progress on their own.

4.1-203: *Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes. (Objective)*

SS1	*5%*	*SS4A*	*25%**
SS2	*5%*	*SS4B*	*25%**
SS3A	*10%*	*SS4C*	*5%**
SS3B	*15%*	*SS5*	*5%***
SS3C	*5%*		

**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 relates to maintaining a diversity of stand structure across the forest. Doing so provides a variety of potential wildlife habitat while maintaining a healthy forest capable of meeting timber demands and providing high visual quality for visitors. Current ponderosa pine structural stage distribution for MA 4.1 in the Citadel project area is:

SS1	*0%*	*SS4A*	*3%*
SS2	*0%*	*SS4B*	*36%*
SS3A	*0%*	*SS4C*	*40%*
SS3B	*0%*	*SS5*	*17%*
SS3C	*4%*		

This objective defines the variety of structural stages desired for MA 4.1 as a whole across the forest. The opportunity exists to move toward these percentages in the Citadel area by using a variety of silvicultural techniques to create ponderosa pines stands of varying shapes and sizes.

Management Area 5.1 – Resource Production Emphasis

5.1-101: *Sustain or enhance water yield through timber management. (Objective)*

Water is a valuable aspect of the forest ecosystem. Vegetation surrounding riparian areas, wetlands, and other water sources is vital to maintaining the overall health of the associated waterway. Loss of vegetation can lead to erosion and siltation and an eventual decrease in water yield.

The opportunity exists to use timber management techniques which would not negatively impact riparian areas through erosion, sedimentation, or degradation of the stream bed. An opportunity also exists to restore some hardwood communities near streams through removal of encroaching ponderosa pine. Doing so could potentially promote beaver activity in the area which could raise the water table. Control of noxious weeds near waterways would also benefit water yield because the presence of native vegetation often makes an area less conducive to erosion than those areas that are infested by non-natives.

5.1-201: *Manage tree stands to emphasize timber products, forage production, and water yield. (Goal)*

Management Area 5.1 is managed with an emphasis on resource production. Water, timber, and forage provided by these areas are all important to wildlife and local industry. There is a need to manage these areas to provide for multiple uses.

This goal calls for managing forest stands in a multiple-use manner. The opportunity exists to use a variety of silvicultural management techniques that would provide timber products while promoting understory forage growth for grazing by wildlife and livestock, and maintaining or improving water yield.

5.1-202: *While meeting other objectives for this management area, provide variety in stand sizes, shape crown closure, age structure, and interspersion. (Objective)*

This objective requires that MA 5.1 stands be managed for resource production while achieving the varied forest structure described for *Management Area 4.1-202* above. Forest stands of varying shapes, sizes, and age classes provide a variety of habitats for associated plant and animal species and also have high scenic quality.

A variety in forest structure already exists in the Citadel project area and the opportunity exists to increase or enhance this by using a variety of silvicultural treatments to promote different size, shape, and age class qualities in forest stands across the management area.

5.1-203: *Maintain or enhance hardwood shrub communities where biologically feasible, and within management objectives. (Objective)*

Shrub communities represent important habitat for a variety of wildlife. Small birds and mammals use shrub communities for nesting or shelter while big game species use shrubs as browse. Maintenance of shrub habitat is important for a variety of wildlife species present in the Citadel project area.

The opportunity exists in the Citadel area to promote shrub growth through silvicultural treatments. Removal of encroaching pine will prevent current shrub communities from being eventually converted to forest.

5.1-204: *Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes. (Objective)*

SS1	*5%*	*SS4A*	*25%**
SS2	*5%*	*SS4B*	*25%**
SS3A	*10%*	*SS4C*	*5%**
SS3B	*15%*	*SS5*	*5%***
SS3C	*5%*		

**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.*

As described in *Management Area 4.1-203*, this objective applies to MA 5.1 across the Forest. There is an opportunity in the Citadel project area to contribute towards meeting this objective on a Forest-wide basis. The current structural stage distribution for MA 5.1 in the Citadel project area is:

SS1	*0%*	*SS4A*	*26%*
SS2	*6%*	*SS4B*	*42%*
SS3A	*0%*	*SS4C*	*11%*
SS3B	*3%*	*SS5*	*0%*
SS3C	*13%*		

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 create, maintain, and enhance big game winter range in the Citadel project area by creating open areas for grazing and 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 Citadel 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)*

SS1	*5%*	*SS4A*	*25%**
SS2	*5%*	*SS4B*	*25%**
SS3A	*10%*	*SS4C*	*5%**
SS3B	*15%*	*SS5*	*5%***
SS3C	*5%*		

**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.*

As described for MAs 4.1 and 5.1 above, this objective applies to MA 5.4 across the Forest. There is an opportunity in the Citadel project area to contribute towards meeting this objective on a Forest-wide basis. The current structural stage distribution for MA 5.4 in the Citadel project area is:

SS1	*1%*	*SS4A*	*16%*
SS2	*3%*	*SS4B*	*50%*
SS3A	*3%*	*SS4C*	*20%*
SS3B	*0%*	*SS5*	*7%*
SS3C	*1%*		

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 Citadel project area has an open-road density of approximately 3.1 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 Citadel is 3.5 miles of road per square mile. NFS roads 130.1, 134.1, and 214.1 are primary routes and remain open year round. All other NFS roads are closed from December 15-May 15 each year. 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.

Management Area 5.6 – Forest Products, Recreation and Big Game Emphasis

5.6-202: *Manage forest cover types to provide variety in stand sizes, shape, crown closure, age structure and interspersion. (Goal)*

MA 5.6 direction calls for multiple use management with a focus on resource production, recreation, and big game habitat. Forest stands of varying shapes, sizes, and age classes provide a variety of habitats for associated plant and animal species, provide forage for livestock and wildlife grazing, provide timber for commercial harvest, and have a high scenic quality that is important to recreationists.

The opportunity exists to achieve this objective by using a variety of silvicultural treatments to promote different size, shape, and age class qualities in forest stands across the management area.

5.6-203: *Improve forage on range areas. (Goal)*

Ponderosa pine encroachment represents the most serious threat to open meadow areas in the Citadel 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 and livestock.

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

5.6-204-FC: *Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes. (Objective)*

SS1	*5%*	*SS4A*	*25%**
SS2	*5%*	*SS4B*	*25%**
SS3A	*10%*	*SS4C*	*5%**
SS3B	*15%*	*SS5*	*5%***
SS3C	*5%*		

**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.*

As described for MAs 4.1, 5.1, and 5.4 above, this objective applies to MA 5.6 across the Forest. There is an opportunity in the Citadel project area to contribute towards meeting this objective on a Forest-wide basis. The current structural stage distribution for MA 5.6 in the Citadel project area is:

SS1	*1%*	*SS4A*	*24%*
SS2	*2%*	*SS4B*	*33%*
SS3A	*4%*	*SS4C*	*28%*
SS3B	*1%*	*SS5*	*5%*
SS3C	*1%*		

1.6 PROPOSED ACTION

1.6.1 Development of the Proposed Action

Development of the proposed action was strongly influenced by public involvement. A baseline proposed action was included in the public scoping letter distributed on May 26, 2006. Input on this initial proposed

action was also collected at a public meeting held on June 27, 2006. Another comment period began on August 2, 2006, following the publication of the Notice of Intent, and lasted until September 1, 2006. Comments received during the comment periods and at the public meeting were used to refine and develop the final proposed action. Alternatives to the proposed action, as discussed in Chapter 2 of this EIS, were based on public input to provide different approaches to address the purpose and need. The intent was to provide a range of approaches and activities that the public and decision maker could compare and evaluate.

The proposed action was presented during the scoping period (see the Public Involvement and Scoping Section discussed later in Chapter 1). This proposal was based on the purpose of and need for action, which contained four elements: 1) reduce the potential for large-scale intense wildfire, 2) reduce risk of mountain pine beetle infestations, 3) enhance wildlife habitat, and 4) utilize commercial and non-commercial vegetative treatments to achieve the first three elements while providing commercial timber to the local logging industry. The purpose and need has remained the same.

During the comment periods, feedback was received from the public both supporting and opposing the proposal. The public voiced a concern about a wide range of topics including fire hazard in the WUI, wildlife degradation of private range land, mountain pine beetle infestation, negative impacts associated with road construction, off-road vehicle use (both for and against), conservation of wildlife habitat, preservation of non-motorized recreational opportunities, and intensive management of project areas on a landscape scale.

Overall, respondents favored treatments that would reduce fire hazard and pine beetle risk and improve wildlife habitat on National Forest System land. Strong public support was given to expanding thinning and fuel treatments and conducting vegetation treatments that would help reduce impacts of wildfire to private land. We also received strong support from local government and industry for continuing to harvest timber on a sustainable basis to meet multiple use objectives.

Construction of new roads raised some concerns regarding associated negative impacts such as erosion, weed infestations, increased ATV use, and dust associated with increased traffic.

Respondents were split on the issue of off-road motorized access: some were in favor of creating new ATV trails or designating some existing trails for ATV use while others were opposed to any form of off-road motorized use. In response to the differing opinions on off-road motorized access, the ID Team decided to defer any travel management decisions to the upcoming revision of the Forest-wide Travel Management Plan. It was determined that making large-scale travel management changes is not within the scope of the Citadel project. The Citadel project will focus on road construction, modification, or deconstruction related to specific management actions and goals.

1.6.2 Summary of Proposed Action

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

Proposed activities include:

- Vegetative and fuels treatments on a total of 13,035 acres of National Forest System land in the project area. Most prescriptions include a combination of commercial treatment followed by non-commercial thinning and/or prescribed fire:
    - Commercial treatment is proposed for 10,541 acres.
    - Non-Commercial treatment is proposed for 12,928 acres.

  - Prescribed fire is proposed for 8,952 acres.
- Construction of 18 miles of new roads and reconstruction of 35 miles of existing roads necessary to access timber stands. These roads would be closed following timber harvest.
- Closure of 31 miles of unclassified (non-NFS) roads, resulting in a net decrease in the miles of open roads.

1.7 DECISION FRAMEWORK

The Forest Supervisor, who is the Responsible Official, will decide which actions, if any, to implement. This decision will be based on:

- Whether the proposed activities and alternatives address the issues, are responsive to national policy/guidance and direction in the Forest Plan, as amended, and meet the purpose of and need for action in the Citadel project area.
- Whether the information in this analysis is sufficient to implement proposed activities.

If an action alternative is selected, project implementation could begin in the first half of 2008. 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 Citadel 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:

- A scoping letter was mailed to approximately 240 interested parties, including adjacent property owners, tribal members, state and federal agencies, and other organizations on May 26, 2006. 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 news release was submitted to the local news media on June 9, 2006. This advertisement introduced the project to the public by providing a description of the project area and an explanation of the proposal. The advertisement also solicited public comment on the project.
- A public open house meeting was held at the Northern Hills Ranger District office in Spearfish, South Dakota, on June 27, 2006. The meeting was attended by 7 interested parties who met with Forest Service officials to view maps of 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.
- The Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* on August 2, 2006. The NOI asked for public comment on the proposal through September 1, 2006.
- Other information sharing, communication and interaction with interested parties, agencies, and individuals has occurred on a continuing basis during project planning.

1.9 ISSUES

Comments received during the scoping process were used to identify issues and to develop alternatives. A total of 17 parties provided feedback via letters, faxes, public meeting transcripts, hand-delivery, or

electronic mail during the formal scoping process. Many concerns were raised in relation to management activities in the Citadel area. Many of these concerns (e.g., dust abatement, fence damage, weed control) were relatively minor and are addressed through mitigation measures and design criteria. Other concerns brought forth during scoping, such as reduction of fire hazard, wildlife habitat management, and minimizing mountain pine beetle infestation, are large-scale issues that were considered by the ID Team during alternative development. Comments received and the agency's responses to those comments are summarized in the Citadel Project File located at the Northern Hills Ranger District office in Spearfish, South Dakota.

Significant issues represent those that were important in development of alternatives and received the most public and internal specialist attention during the scoping period. In some cases they represent unresolved conflicts regarding the proposed action. Significant issues are also characterized by the need to address broad-based internal or external resource management concerns, the need to meet national and Forest-level direction, and the desire to address the purpose of and need for action within the Citadel project area.

Several scoping comments addressed the issue of ATV use in the project area, both for and against. Because the Black Hills National Forest is amending the Travel Management Plan forest-wide in 2007, the Responsible Official elected to defer any specific changes regarding ATV use to the Travel Management Plan and only address road issues that pertain to specific Citadel area management actions, such as road construction necessary to access a stand for vegetative treatments and subsequent closure of that road.

Based on the scoping comments, management direction, Forest Service specialist knowledge of the project area and internal discussions of the Forest Service ID team, four significant issues were identified that drove the development of the alternatives. A brief description of the significant issues follows.

1.9.1 Fire Hazard in the Wildland Urban Interface

Wildfire hazard in WUI areas and the need to reduce hazardous fuels are major public concerns in the Black Hills. These issues have become more prominent due to the large wildfires that have occurred in recent years, some of which have destroyed homes. The prevailing public attitude and that of local, state, and federal elected officials is that the Forest Service should do more to address fire hazard where National Forest System land borders private property. This point of view is supported and amplified at the national level through a series of initiatives and streamlining of processes related to fuel and fire hazard reduction. It is also supported by the Forest Plan Phase II Amendment, which sets direction for aggressively managing fuels and reducing fire hazard, including specific objectives for reducing fire hazard in WUI areas.

Reduction of fuels and fire hazard in the WUI is a focus of the Citadel project. The project area lies within a heavily forested, fire-adapted ponderosa pine ecosystem that is interspersed with more than 4,000 acres of private land. Additionally, the project area is adjacent to other WUI areas, including the city of Spearfish, South Dakota, and several residential sub-divisions near Spearfish. Wildfire cannot be

eliminated from this setting, but deliberate management of fuels and other vegetation can reduce the potential for uncharacteristically large wildfires that could impact the WUI. Mountain pine beetle infestation has increased hazardous fuels in the Black Hills National Forest. Most commenting parties supported decreasing the risk of beetle infestation to minimize economic loss and the creation of additional hazardous fuels. Feedback received during the early stages of this project indicates that there is broad support in most public sectors for reducing fuels and fire hazard in the WUI through practices such as prescribed burning and tree thinning.

The indicators listed below will be used in this document to measure fuel and fire hazard reduction in the WUI. These indicators allow the public and decision maker to compare the effects of the alternatives. A comparison of alternatives is displayed in table format at the end of Chapter 2 (page 2-13). Also, a narrative description of the comparative differences in effects is presented briefly in the Comparison of Alternatives section in Chapter 2 and in more detail under the Fire and Fuels section in Chapter 3.

- Fire hazard in WUI (acres in very high/high/moderate/low crown fire hazard categories)
- Level of vegetation management (acres treated)
- Prescribed burning (acres)

1.9.2 Mountain Pine Beetle Infestation

The Citadel project area contains relatively few outbreaks of mountain pine beetle. However, infestations are active in areas surrounding Citadel, and conditions within the project area make it susceptible to future beetle infestations. Approximately 75%, of the ponderosa pine in the project area is currently at moderate or high risk of beetle infestation. Mountain pine beetle is currently at endemic levels in the project area, but with a majority of the pine at high or moderate risk, the potential for an epidemic infestation is greater.

Part of the difficulty in dealing with mountain pine beetle infestations in the Black Hills NF is the time necessary to complete analysis and documentation for a project before it can be implemented on the ground. It is easy to identify those areas where beetles are, but by the time a project proposal to treat that area is ready for implementation, the problem has often become worse and spread to nearby areas. Therefore, it is important that we take a proactive approach to managing beetle infestations whenever possible. By conducting widespread treatments across the Citadel area and reducing stand density before pine beetles become well established, we can minimize the damage they may incur in the future. Public comments, internal Forest Service discussions, and Forest Plan direction identified consideration of mountain pine beetle risk as an important issue in the Citadel project area.

Under Alternative A, the acres of pine at moderate or high risk are expected to increase over time. Thinning treatments proposed by Alternatives B and C would shift some pine acres into the low risk category. Overall, Alternative C would result in the lowest acreage at high risk, Alternative A would result in the most acres at high risk and Alternative B would be intermediate.

The indicators listed below will be used in this document to measure response to the issue of mountain pine beetle infestation:

- Level of vegetation management (acres treated)

- Acres at Low, Moderate, and High risk of infestation.

1.9.3 Wildlife Habitat

The project area includes winter range and important fawning and calving habitat for big game. MA 5.4, which focuses on management of big game habitat, comprises 9,018 acres (approximately 28%) of the project area. An additional 12,282 acres (38%) is designated as MA 5.6, which focuses on big game, forest products and recreation. In total, MAs 5.4 and 5.6 account for two-thirds of the Citadel project area. The project area includes 6 different MAs and potential exists for a wide variety of available wildlife habitat. A wide range of wildlife species other than big game are found across the project area. Based on Forest Plan direction and comments received from the public, management of wildlife habitat is a key issue.

Proposed activities could affect wildlife habitat in various ways. Activities such as motorized recreation can disturb animals during sensitive periods. Habitat for a variety of species could be improved by diversifying landscape-level structure of pine stands. Conservation of habitat for some wildlife species can result in increased fuel loading or risk of mountain pine beetle infestation. Other wildlife habitat treatments, such as intensive thinning of forest stands on south facing slopes, can reduce the potential for pine beetle infestation in that area while providing wildfire buffers. No single vegetative treatment will benefit all wildlife in the area, just as treatments to improve habitat for a specific wildlife species will not always result in reduced fuel loads or reduced pine beetle risk. A mosaic of treatments across the landscape can provide the best variety of wildlife habitat while also reducing hazardous fuels and pine beetle risk overall.

The indicators listed below will be used in this document to measure response to the issue of wildlife and fish habitat:

- Ponderosa pine structural stage diversity (resulting structural stage distributions)
- Hardwood and meadow communities (acres enhanced)
- Big game habitat enhancement actions (acres of south slopes and ridgetops treated)
- Open road density (miles of road per square mile of land)

1.9.4 Volume of Commercial Timber Produced

Logging has occurred in the Black Hills since Euro-American settlement began during the gold rush in the 1870s. Settlers first harvested timber for construction materials and later for commercial purposes. The first recorded timber sale on federal land took place near Nemo, South Dakota, on what is now the Northern Hills Ranger District, in 1898. Since that time nearly every accessible acre of the Black Hills has been harvested at least once. Nearly all of the trees growing in the Black Hills National Forest today are the result of natural regeneration. The Black Hills ecosystem has shown an extraordinary ability to produce trees, and re-planting of harvest units or

wildfire areas has proven unnecessary. Timber harvest on a sustainable basis continues today, and the Black Hills National Forest is one of the top timber producers in the National Forest System.

The timber industry is an important component of the economy of communities in and around the Black Hills. Wisely planned harvest treatments not only produce commercial timber, but can also decrease hazardous fuels, decrease the risk of pine beetle infestation, create or enhance wildlife habitat, and encourage the regeneration and development of forest stands. Comments received during scoping indicated the desire by some for the Forest Service to harvest more commercial timber across the project area.

The indicators listed below will be used to measure response to the issue of providing commercial timber.

- Acres treated commercially
- Board feet projected for harvest
- Projected net value of harvested timber

2. ALTERNATIVES

2.1 INTRODUCTION

This chapter provides a detailed description of the proposed action (Alternative B), an additional action alternative (Alternative C), and the no action alternative (Alternative A) for the Citadel project area. Maps of each alternative considered in detail are located at the end of this document.

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 EIS.

This chapter includes a brief overview of alternatives considered by the ID Team and the decision maker but eliminated from detailed development and study. The last section of the chapter contains a tabular summary of effects relative to the significant issues presented in Chapter 1.

2.2 ALTERNATIVES CONSIDERED IN DETAIL

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

2.2.1 Alternative A - No Action

The National Environmental Policy Act (NEPA) requires study and use of a 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 activities described in the proposed action or the other action alternative would take place in the Citadel project area. 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 and access management would not take place unless authorized by other decisions. Vegetation structure would change over time through growth, natural mortality, and events such as wildfires, storms, and insect and disease outbreaks. Existing access and travel management would persist until modified by future decisions. Ongoing activities such as scheduled road maintenance, treatment of noxious weeds, livestock grazing, and fire suppression would continue.

2.2.2 Alternative B - Proposed Action

Alternative B would treat stands across the project area to reduce the overall risk of mountain pine beetle infestation and to reduce the overall fire hazard. Proposed treatments, as well as project design criteria and project-level mitigation measures are described following the description of action alternatives in this chapter.

This alternative would modify stand structure across the planning area to reduce the potential for uncharacteristically intense fire behavior, reduce fuel loads, reduce the risk of large insect outbreaks, and provide for diverse wildlife habitat. A variety of vegetation management tools, including commercial timber harvest, would be used to thin dense ponderosa pine stands to reduce the risk of insect outbreaks and crown fire hazard. By strategically locating fuel treatments and prescribed burning across the landscape, the continuity and density of fuels would be modified to reduce the risk of stand-replacing wildfires. These actions would also provide cover and structural diversity that could benefit a variety of wildlife species. Under this alternative, several stands identified as old growth (Structural Stage 5) would be treated to enhance old growth conditions. Ponderosa pine old growth varies greatly in canopy structure and ground cover density. The goal of managing some stands of old growth and leaving others is to mimic the natural variety of old growth characteristics.

Construction of approximately 18 miles of new road and reconstruction/improvement of 35 miles of existing road would be necessary to implement proposed treatments. Harvest methods would include both ground-based and cable yarding systems. Off-road motorized vehicle restrictions would not change.

Treatments proposed under Alternative B are summarized in Table 2-1 and described in detail below. Proposed post-sale treatments would take place as funding allows. Figures are approximate.

Table 2-1. Proposed Activities - Alternative B

Vegetation and Fuels Treatments	Alternative B
Commercial thinning followed by pre-commercial thinning and prescribed burning (acres)	7,400
Commercial seed cut followed by pre-commercial thinning and prescribed burning (acres)	707
Commercial overstory removal followed by pre-commercial thinning (acres)	2,327
Commercial hardwood restoration (acres)	107
Pre-commercial thinning (acres)	1,621
Non-commercial hardwood restoration (acres)	28
Prescribed burning (acres)	845
Total Acres Treated	**13,035**
Timber Volume and Value Estimates	
Sawtimber (MBF)	46,000
Total timber (CCF)	109,000
Projected net value (dollars)	-$5,098,797
Transportation System (miles)	
Road construction (miles)	18
Road reconstruction (miles)	35
Road pre-use maintenance or use as is (miles)	56
Unclassified Roads decommissioned (miles)	31

2.2.3 Alternative C - Preferred Action

Alternative C was developed in response to public comments and internal concerns regarding the threat of wildland fire to private property and the condition of wildlife habitat in and around the

Citadel project area. Proposed treatments, as well as project design criteria and project-level mitigation measures are described following this description of Alternative C.

One focus of Alternative C is on reducing hazardous fuels in the WUI. Silvicultural treatments (commercial and non-commercial thinning) and prescribed burning would be used to reduce fire hazard on NFS lands adjacent to private property and along the northern and eastern boundaries of the project area, which are near private land, the city of Spearfish, South Dakota, and Spearfish Canyon, which is a National Forest scenic byway and includes private residences. Timber harvest would be used to decrease the density of pine overstory adjacent to private land. Commercial and non-commercial thinning would reduce the amount of fuels in the understory. Where possible, low intensity prescribed fire would follow timber harvest or mechanical treatments to further reduce the amount of fuels on the forest floor.

The second focus of this alternative is to create structural diversity across the project area by conducting intense silvicultural treatments designed to improve or maintain wildlife habitat. This includes conducting intensive vegetative treatments on south facing slopes to open the canopy of overstocked stands and create additional foraging areas for wildlife. Wherever possible, vegetative treatments would be followed by prescribed burns to encourage the growth of grasses, forbs and other browse species. Intensive thinning on south slopes would also create scattered buffer zones across the project area where wildfires would have less available fuel. These buffer zones could aid in slowing or stopping future wildfires. North slopes adjacent to the thinned areas would be left untreated to maintain cover habitat and travel corridors for wildlife. Another habitat-specific action proposed under this alternative is removal of encroaching ponderosa pine from hardwood and meadow areas to maintain a mosaic of available habitat across the project area. The third wildlife oriented action included in Alternative C is the preservation of selected stands as old growth (Structural Stage 5-Late Succession). No Structural Stage 5 stands would be treated under this alternative; they would be left to progress naturally.

This alternative addresses the concerns of both private individuals and the Forest Service regarding the danger that wildland fires represent to private property and human lives while creating and enhancing important wildlife habitat characteristics. In contrast to Alternative B, this alternative includes more treatments overall with a broader range of treatment types across the area to create mosaic habitat for wildlife while focusing additional treatments on those areas where National Forest System lands directly border or are near private property.

Treatments proposed under Alternative C are summarized in Table 2-2. Proposed post-sale treatments would take place as funding allows. Figures are approximate.

Table 2-2. Proposed Activities - Alternative C

Vegetation and Fuels Treatments	Alternative C
Commercial thinning followed by pre-commercial thinning and prescribed burning (acres)	6,883
Commercial seed cut followed by pre-commercial thinning and prescribed burning (acres)	604
Commercial overstory removal followed by pre-commercial thinning (acres)	1,878
Commercial overstory removal followed by pre-commercial thinning and prescribed burning (acres)	256
Commercial hardwood restoration (acres)	362
Commercial uneven aged management followed by pre-commercial thinning and prescribed burning (acres)	380
Commercial clearcut followed by prescribed burning	82

Vegetation and Fuels Treatments	Alternative C
(acres)	
Pre-commercial thinning (acres)	800
Pre-commercial thinning followed by prescribed burning (acres)	802
Non-commercial hardwood restoration (acres)	425
Non-commercial meadow enhancement (acres)	106
Prescribed burning (acres)	5,202
Total Acres Treated	17,780
Timber Volume and Value Estimates	
Sawtimber (MBF)	47,000
Total Timber (CCF)	113,400
Projected Net Value (dollars)	-$7,606,081
Transportation System (miles)	
Road construction (miles)	17
Road reconstruction (miles)	35
Road pre-use maintenance or use as is (miles)	56
Unclassified roads decommissioned (miles)	31

Description of Proposed Vegetation Treatments

Commercially treated sites may be whole-tree yarded (the preferred method) depending on individual site characteristics. This would 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. Treatment of logging slash after timber harvest is a provision of the standard timber sale contract. Mechanical treatment of these “activity fuels” would take place in all harvest units where fuel loading would exceed amended Forest Plan direction.

Commercial Thinning
Commercial thinning involves removal of mature pines to reduce stocking levels in overstocked stands. Doing so will result in increases in the growth rate and quality of the remaining trees. The remaining trees would be left at an approximate basal area between 20 and 60, depending on the stand as well as the alternative. Conifers may be removed from within and up to 30 feet from the edge of aspen pockets greater than ¼ acre in size. Alternative B proposes commercial thinning on a total of 7400 acres, while Alternative C proposes this treatment on a total of 6883 acres. Both alternatives would allow for pre-commercial thinning and prescribed burning to follow the initial treatment.

Commercial Seed Cut
Commercial seed cut involves thinning overstory trees to create optimal regeneration conditions. The best formed overstory trees would be retained at approximately 30 square feet of basal area (~35 foot spacing). Whole tree logging is the preferred method to achieve light ground disturbance, opening up mineral soil for seedling establishment. Alternative B proposes commercial seed cut on 707 acres, and Alternative C proposes this treatment on 604 acres. Both alternatives would allow for pre-commercial thinning and prescribed burning to follow the initial treatment.

Commercial Overstory Removal
Commercial overstory removal involves removal of the overstory trees to liberate the regeneration established in the understory. This treatment provides commercial sawtimber and releases stands that have become stagnant. Whole tree logging is the preferred method in stands

adjacent to private land to reduce fuels. This treatment is proposed for 2327 acres in Alternative B and 2134 acres in Alternative C. Both alternatives would allow for pre-commercial thinning to follow the initial treatment. Alternative C would allow for prescribed burning to follow the initial treatment on 256 acres.

Commercial and Non-commercial Hardwood Enhancement
Commercial and non-commercial hardwood enhancement involves removing conifers >9” dbh to maintain and/or encourage growth of aspen. Whole tree logging is the preferred method. This treatment is proposed for a total of 135 acres in Alternative B (107 acres commercial treatment and 28 acres of non-commercial treatment). Alternative C includes a total of 787 acres of hardwood enhancement (362 acres commercial treatment and 425 acres of non-commercial treatment).

Commercial Uneven Aged Management
Uneven-aged management involves removing trees either singly or in small groups (generally <1/2 acre in size) depending on site conditions. This treatment is designed to mimic small-scale natural disturbances. By creating small openings scattered across an otherwise dense, even-aged forest, we can create structural diversity across the landscape and encourage regeneration in the cut areas. Alternative B does not propose this treatment for any portion of the project area. Alternative C proposes this treatment for 380 acres, and would allow for pre-commercial thinning and prescribed fire to follow the initial treatment.

Commercial Clearcut Harvest
Clearcut harvest involves removal of all trees within a stand. This treatment is proposed for 82 acres under Alternative C to improve the balance of structural stages in the project area and to maintain some oak stands. The alternative would also allow for prescribed burning in pine stands following the initial treatment to help maintain Structural Stage 1 conditions. Timber production would be forgone on these sites until regeneration and subsequent growth occurs. Alternative B does not propose this treatment for any portion of the project area.

Pre-commercial Thinning
Pre-commercial thinning involves removal of pine saplings to reduce stand density, improve growth, preclude stand stagnation, and reduce continuity of fuels. Standing stems less than 9 inches diameter would be reduced so that stand density was 200-400 stems per acres (~12 foot spacing). Cut material would be lopped and scattered across the stand to retain nutrients on the site. Alternative B proposes pre-commercial thinning on 1621 acres. Alternative C proposes this treatment for a total of 1602 acres. In addition, Alternative C would allow for prescribed burning following initial treatment on up to 802 acres to hasten fuel decomposition and reduce fire risk. Burn intensities would be kept low to minimize the risk of mortality for overstory trees.

Meadow Enhancement
This treatment involves removal of pine in historical meadow areas to increase vegetative diversity and grass production in meadow communities. Alternative C proposes meadow enhancement for 106 acres. Alternative B does not propose this treatment.

Prescribed Burn
Prescribed fire can be used as a treatment to achieve a variety of objectives. Performed in the absence of other treatments, prescribed burning can help create forest conditions that mimic natural fire regimes by consuming ground fuels and removing lower branches of trees. As a follow-up treatment to thinning, it can also reduce surface fuels, diversify stand structure, and increase stand resistance to wildfire by slowing development of ladder fuels. Alternative B would

allow for prescribed burning on a total of 8952 acres and would be the sole treatment planned for 845 of those acres. Alternative C would allow for prescribed burning on a total of 14,209 acres and would be the sole treatment planned for 5202 of those acres. Both low- and moderate-complexity burns are proposed. Fire lines and a detailed prescribed burn plan would be required for moderate complexity burns. Existing roads may serve as firelines. A prescribed burn plan would be prepared for low-complexity burns, but constructed fire lines may not be necessary if burning is conducted in winter.

Design Criteria Applicable to Action Alternatives

Forest Plan standards and guidelines, Regional Watershed Conservation Practices (WCPs, Forest Service Handbook 2509.25), and other management requirements apply to the proposed activities. Design criteria applicable to activities proposed under the action alternatives are listed in Appendix C. Other management requirements such as applicable Forest Plan standards are repeated here only if clarification is required.

Project-level Monitoring Applicable to the Action Alternatives

The Northern Hills Ranger District would monitor implementation of the selected alternative. The timber sale administrator or other contract administrators would complete some of the project implementation monitoring. Other resource specialists would be involved in monitoring of specific mitigation measures relating to their particular resource area. Specific monitoring requirements are listed in Appendix C.

2.2.4 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 and C 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:

- Pre-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.

2.2.5 Activities Common to All Action Alternatives

Dakota 50 Trail

The Dakota 50 is an annual race/tour conducted by a local mountain biking club. The course for the race begins in Spearfish, SD, continues south and then loops back and also finishes in

Spearfish. As the name suggests, the entire length of the loop course is approximately 50 miles. The course traverses NFS roads, non-NFS roads, and non-system trails. A relatively small portion of the course crosses the Citadel project area; most of it lies to the east. To protect the integrity of the course, none of the non-system roads or trails that comprise the Dakota 50 trail would be decommissioned under this EIS. A 50-foot non-harvest buffer would surround the trail to maintain scenic integrity and the current structure of the course. A short section (approximately ½ mile) of the trail near Citadel Rock would need to be rerouted due to hydrology concerns associated with the current route location, which is adjacent to a stream. Management actions carried out adjacent to the trail would avoid placing piles of debris or otherwise blocking the trail.

Watershed Improvements

Two segments (approximately 0.9 miles total) of existing NFS roads would be decommissioned and recontoured, as Knutson-Vandenburg Act funding allows, to reduce long-term impacts on nearby streams. The roads proposed for decommissioning are FSR 131.2A (0.3 miles), which crosses Chicago Gulch, and FSR 626.1C (0.6 miles) near Citadel Rock. These roads have not been maintained for many years and are severely damaged, which is causing significant resource damage to their adjacent streams.

Post-sale Activities

The Knutson-Vandenburg (KV) Act authorizes the U.S. Forest Service to collect money from a timber sale for resource enhancement, protection, and improvement work in the timber sale vicinity. Actions proposed as KV activities for the Citadel project area are listed below. Specific descriptions and locations of these actions are found in the Silviculture, Wildlife, and Hydrology/Soils specialist reports in the Citadel project file.

- Pre-commercial thinning, release and weed cleaning, and product-other-than-log (POL) thinning: Thinning of stems 0-9” 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 pre-commercial thin, overstory removal, commercial thin, seed cut, uneven aged management or prescribed fire treatments.
- Regeneration surveys 3rd and 5th year post-harvest: Essential KV; Monitoring will determine if mortality rate of tree less than 9” dbh is less than 75% after prescribed burning. At least one survey must be conducted post-burn. Would be conducted following overstory removal and 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 seed 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.
- Removal of encroaching pine from meadow areas: Removal of pine from selected meadows. All activity-created material would be lopped and scattered.

- Repair of wildlife guzzlers: Conduct minor repairs on six existing guzzlers located across the project area.
- Installation of bat gates: Install bat gates on three abandoned mine/adit openings for safety reasons.
- Watershed improvement projects: Bank stabilization, grass planting, removal of fill material, and possible willow planting along specified reaches of Beaver Creek, Lightning Creek, Potato Creek, Chicago Gulch, and Higgins Gulch.
- Noxious weed treatment and monitoring: Spray and monitor noxious weeds following all ground disturbing activities.

2.2.6 Alternatives Considered but Eliminated from Detailed Analysis

A range of alternatives, using different approaches to address the purpose and need, are presented in this EIS. Following are brief descriptions of alternatives the ID Team did not analyze in detail and the reasons for eliminating them from detailed analysis.

Off-road Travel Emphasis

Comments were received suggesting that the ID Team consider designating some existing trails or creating new trails within the Citadel project area specifically for ATV use. The Responsible Official chose not to pursue an alternative related to ATV use because of the ongoing revision of the forest-wide Travel Management Plan. Any decisions regarding new or designated ATV trails within the Citadel area could possibly be superceded by the revised Travel Management Plan so it was determined that designating or creating ATV trails is outside the scope of the Citadel EIS.

No Road Construction

The ID team internally considered an alternative that would not have included any new road construction and would have limited timber harvest and other management actions to those areas accessible by the current road system. It was determined that such an alternative would not meet the purpose and need of the project area because much of the high fire hazard areas identified for treatment are inaccessible without new road construction, including several stands in the WUI. Of the 18 miles of proposed road construction under Alternatives B and C, approximately 4.5 miles are not necessary to access stands within or adjacent to WUI areas. Also, the issue of not constructing any new roads is analyzed under Alternative A (the no-action alternative).

Late Succession Emphasis

The ID team considered an alternative that would have encouraged forest stands across the project area to progress toward late succession by limiting the amount of regeneration harvest and using thinning and prescribed fire to remove trees from the understory, reducing competition to overstory trees. It was determined that focusing on late succession across the project area would not meet the purpose and need because of the resulting lack of structural diversity across the project area. Instead, the ID Team elected to select specific stands for late succession treatments and incorporate aspects of this emphasis into Alternatives B and C.

Fuel Reduction Emphasis

Initially, in addition to the proposed action, the ID team considered two other alternatives, one which focused on fuel reduction treatments and another which focused on south-slope wildlife treatments. It was determined that neither one of these alternatives would sufficiently respond to the purpose and need on its own. After consideration, the Responsible Official decided that the treatments proposed under each of the original alternatives would fit well together and the alternatives were combined, with a few changes where treatments conflicted, into the first draft of Alternative C.

Wildlife Habitat Enhancement Emphasis

See explanation under "Fuel reduction emphasis" heading above.

Wildlife/Fuels Emphasis

The original iteration of Alternative C included only wildife and fuels treatments, with few silvicultural treatments. After some discussion, the ID team decided that the alternative would better fit the purpose and need of the Citadel project by incorporating the wildlife and fuels treatments with the silvicultural treatment from Alternative B, with some changes to create more structural diversity across the project area. This combination of the silvicultural, wildlife and fuels treatments became the current version of Alternative C.

2.3 COMPARISON OF ALTERNATIVES

This section presents a brief comparative discussion of the three alternatives given detailed study in the EIS. The alternatives are described and compared in terms of the effects each alternative has on the signficant issues identified in Chapter 1.
Table 2-3 displays comparative summaries of the effects of each alternative and their respective treatment activities. The environmental consequences of the alternatives to the resources affected in the Citadel project area are described in more detail in Chapter 3 of this EIS and also in the resource specialist's reports held in the project file.

2.3.1 Fuel and Fire Hazard Reduction

Alternative A, the no action alternative, would not treat any of the Citadel project area under this analysis. Consequently, fuels would continue to accumulate and the density of timber stands would continue to increase. The combination of a large amount of available fuel on the forest floor with dense canopies overhead creates the potential for a high-severity crown fire that would have an overall detrimental impact on the environment and, potentially, to human lives or property. Under Alternative A, forest stands that are already at higher risk of severe wildfire than they were historically would only become more so.

Alternative B involves an array of silvicultural treatments to reduce the density of ponderosa pine stands across the project area. Not all of the project area is prescribed for treatment. Some areas, such as all areas of MA 3.1 (Botanical Areas) and MA 3.32 (Backcountry Non-motorized), were left untouched to account for other resource concerns. Other stands were recently treated under other projects and are not yet ready to be treated again. Some stands are simply inaccessible due to steep, rugged terrain. The silvicultural treatments under Alternative B create a mosaic of

densities (and available fuels) across the project area that would aid in slowing or stopping wildfires. Many of the treatment units under Alternative B are also candidates for prescribed fire following treatment. Burning after harvest is an effective way to reduce the slash created during harvest activities.

Alternative C expands on the silvicultural treatments proposed under Alternative B by altering some of the prescriptions to better suit wildlife habitat requirements and by adding additional thinning and prescribed fire treatments in Wildand Urban Interface (WUI) areas. Overall, more of the project area would be treated with most of the increase due to more prescribed fire treatments aimed at reducing hazardous fuels through active management. As in Alternative B, all of the Botanical Areas would be left untouched, but prescribed fire treatments are proposed for MA 3.32, which surrounds Crow Peak and is susceptible to wildfires started both by lightning and the high number of hikers who use the Crow Peak trail each summer. The wildlife-oriented prescriptions in Alternative C would also decrease fire hazard. Many of these treatments involve thinning of south-facing slopes. This benefits wildlife by opening up new foraging areas and increasing the availability of grass and brush. It also reduces fire hazard by creating scattered fuel breaks on south-facing slopes, which are typically warmer and drier and consequently carry fire more easily if left untreated.

Overall, because Alternative C proposes additional thinning near WUI areas and more prescribed burning, it would be the most effective in reducing the hazardous fuel load and the threat of large wildfires. Alternative B would also lead to a reduction in fuels and fire hazard, but at a slightly lower level while Alternative A would not reduce fuels. Taking no action could result in increased hazardous fuels and wildfire risk over time.

2.3.2 Mountain Pine Beetle Risk

As a result of over 100 years of fire suppression, pine stands in the Black Hills have increased in density. These high density stands are highly susceptible to infestation from mountain pine beetles; the closer trees in a stand are to one another, the easier it is for beetles to spread and destroy large patches of timber. Research by Schmid and Mata (1992) has shown that stands with a basal area greater than 120 are highly susceptible to mountain pine beetle infestation. In the Black Hills, if a stand is treated to a residual basal area of 60 it will take between 25-50 years for the density to return to 120 BA (high hazard level). For stands thinned to 80 BA, they will return to 120 BA in 13-36 years and stands thinned to 100 BA will return to 120 BA in 9-16 years. The more intensively a stand is thinned, the longer it will remain resilient to mountain pine beetle infestation.

Currently, 31% of the ponderosa pine stands in the Citadel project area are at moderate risk of beetle infestation and 44% are at high risk. Combined, 75% of the project area is classified as moderate or high risk of beetle infestation. Nineteen percent is classified as low risk and the remaining 6% has no risk (no timber present).

Alternative A would not thin any stands and therefore no reduction in the acres at risk would occur. Without any silvicultural treatments, stands in the Citadel area are expected to continue increasing in density and consequently increasing in susceptibility to pine beetles.

Alternative B proposes vegetation and fuel treatments on a total of 13,035 acres. As a result of the treatments proposed under Alternative B, approximately 34% of the project area would be at moderate risk of infestation, a slight increase over the existing condition. However, the area at

high risk would drop from 44% to 38% and the area at low risk would increase from 19% to 28%. Under Alternative B, more acres would be at low risk of beetle infestation and fewer acres would be at high risk than Alternative A.

Alternative C proposes vegetation and fuel treatments on a total of 17,780 acres including pre-commercial thinning, commercial harvest, and prescribed burning. The area at moderate risk to beetle infestation would increase from 31% to 38%. The area at low risk would increase from 20% to 28% and the area at high risk would decrease from 44% to 34%. Alternative C would result in the lowest acreage at high risk of beetle infestation.

Overall, Alternatives B and C both decrease the number of acres at high risk to beetle infestation. Under both of these alternatives the total area at moderate or high risk would be approximately 72%, which is only a 3% decrease from Alternative A, however, the action alternatives would shift more acres into the moderate risk category, resulting in fewer acres at high risk (6% fewer under Alternative B and 10% fewer under Alternative C).

2.3.3 Wildlife Habitat

Alternative A would not actively affect wildlife habitat because no treatments would occur. Natural changes caused by fires, storms and natural progression of the forest would still occur. Hardwood stands and meadows that are currently being encroached upon by ponderosa pine would continue to shrink as the pine forest becomes more dominant. The acreage of open grazing areas for big game could be expected to decrease over time. No non-system road closures would take place, meaning that wildlife would continue to be disturbed by unauthorized motorized vehicles. Overall, Alternative A would result in the project area tending toward late successional stages and wildlife species associated with that habitat type would benefit the most.

Alternative B would have a positive impact on wildlife habitat. The silvicultural treatments prescribed under Alternative B would thin stands across the project area, but not with a particular focus on creating or maintaining big game habitat. Treatments such as seed cuts and overstory removals would open up stands significantly in the short-term and create temporary open grazing areas. Some pine would be removed from meadow and aspen areas where they are within treatment stands, but meadow and aspen restoration would not be carried out on a large scale.

Alternative C would result in the greatest benefit to wildlife habitat. The silvicultural treatments from Alternative B would be expanded upon to include more intensive thinnings on selected stands, usually on south-slopes which are favored by big game, especially during the winter because they generally warm faster and lose snow sooner, creating winter forage areas. The south slope treatments under Alternative C would thin the stands drastically to allow grass to become well established in the understory. Adjacent stands would not be thinned, or at least not intensely thinned, to preserve travel corridors and to provide hiding and roosting/nesting cover. In addition to the higher-intensity south slope treatments, Alternative C would include much more aspen and meadow restoration. Deer and elk favor these areas for foraging. Alternative C would help prevent these areas within Citadel from being converted to pine forest. Alternative C also proposes more prescribed burning, which in the short-term would create additional foraging opportunities for big game as burned areas generally support a significant amount of new, succulent plant growth the growing season after the burn. In short, Alternatives B and C would both create a mosaic of stand structure across the Citadel project area, but Alternative C would create a more diverse mosaic.

Riparian areas are important habitat components for many wildlife species because of the presence of water, which is relatively rare across the Black Hills, and the presence of plant communities that are associated with water. Several riparian areas across the project area are being negatively affected by factors such as improperly located roads, illegal motorized traffic, and livestock grazing. Sedimentation, changes in vegetation composition and structure, trampling and resource damage, and decreased water quality are all a result of these negative impacts. Under Alternative A, nothing would be done to reverse or stop these effects and we could expect increasingly degraded waterways and water quality. Watershed improvement projects described in Section 2.2.5 Activities Common to All Action Alternatives) are potential KV activities under both action alternatives. These projects would stabilize banks, decrease sedimentation, and lead to an increase in water quality. The action alternatives also include the closure of non-system roads, which would decrease the impact of illegal motorized travel on those areas where streams are crossed. Additionally, vegetative treatments under both action alternatives would reduce the density of adjacent pine communities resulting in increased water available to riparian communities. This effect is expected to be approximately the same for each action alternative. Treatments proposed under each action alternative would require the construction of new roads, some of which would cross riparian areas. These roads would be constructed in accordance with BMPs and WCPs and stored following use, so their impact on watershed health is expected to be minimal.

Snags are dead, standing trees that are created through natural processes. They provide nesting and foraging habitat for several bird and mammal species in the Black Hills. Every green tree currently standing is a potential future snag, so the alternative that leaves the most green trees is also expected to have the highest potential to create snags. Alternative A does not propose any timber harvest, so it is expected to create the most snags in the long run. Both action alternatives include the harvest of green trees but would leave live trees across the project area in a variety of structural stages and stand conditions, allowing snags to continue to develop. In comparison, Alternative B would likely leave slightly more green trees than Alternative C because of the more intensive south slope treatments proposed under Alternative C. Neither action alternative proposes to remove snags, but some snags could potentially be cut for safety reasons during timber harvest or prescribed fire activities.

In addition to snags, natural forest processes lead to the generation of dead and down woody material, which provides nesting and foraging habitat for certain wildlife species and is also an important component of the ecosystem’s nutrient cycle. As with snags, Alternative A is expected to leave the highest amount of dead and down material because no fuel reduction or prescribed fire treatments are proposed. Alternatives B and C would both provide less dead and down material than Alternative A, with Alternative C probably providing the least because of the higher proposed prescribed burn acreage. Under both action alternatives, dead and down material would remain in treated stands, but to a lesser degree than under Alternative A.

Open road density can have a significant impact on wildlife. The current open road density for the Citadel project area is 1.7 miles/square mile. Roads displace habitat and vehicle use can disturb wildlife and decrease habitat suitability. A high number of open roads also increases accessibility for a variety of human activities, including poaching, that can have a negative impact on wildlife. Under Alternative A, all of the existing roads, both system and non-system, would remain open. Open road density would not decrease and the impact on wildlife would at least be the same. Because the project area is easily accessible from Interstate 90 through Spearfish, SD, it’s reasonable to expect that over time the number of people using the road system would increase, thereby increasing the impact on wildlife. Alternatives B and C would both decrease the open road density to 1.2 miles/square mile, by closing non-system roads. Although both action

alternatives include the construction of new roads all of them would be closed after treatment, resulting in a net decrease in the number of open roads. The Black Hills National Forest Travel Management Plan is currently undergoing revision, and changes to the transportation network may result, but the magnitude of those changes within the Citadel project area can not be predicted at this time.

2.3.4 Commercial Timber Harvest

Alternative A would not contribute any additional commercial timber to the local economy. One timber sale from a previous planning decision is still active in the project area but once it is complete, no new sales would be initiated under Alternative A.

Alternative B and Alternative C would provide approximately 46,000 mmbf and 47,000 mmbf of commercial timber respectively, with a gross worth of $3,570,000 and $3,650,000. Both of the action alternatives include follow-up treatments to actions conducted previously in the project area. These treatments are aimed at maintaining a healthy, sustainable forest that will continue to produce commercial timber.

2.3.5 Alternative Comparison

The public and decision maker can compare the alternatives based on specific measurement indicators developed for each issue. Table 2-3 below provides a comparative display of the alternative effects and/or outputs relative to the key issues in the Citadel project area.

Table 2-3. Comparison of Alternatives

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Preferred Action)
Fuel and Fire Hazard Reduction			
Issue Indicators			
WUI Acres at Very High Fire Hazard (% of WUI Acres)	3,160 (48%)	1,802 (27%)	1,823 (28%)
WUI Acres at High Fire Hazard (% of WUI Acres)	1,856 (28%)	2,450 (37%)	1,902 (29%)
WUI Acres at Moderate Fire Hazard (% of WUI Acres)	614 (10%)	1,363 (21%)	1,777 (27%)
WUI Acres at Low Fire Hazard (% of WUI Acres)	938 (14%)	953 (15%)	1,066 (16%)
Project Area –Acres Thinned	0	12,190	12,578
Project Area –Acres of Prescribed Burning	0	8,952	14,209
Mountain Pine Beetle Risk			
Issue Indicators			
Total Acres Thinned	0	12,055	11,685
Mountain Pine Beetle Risk[a] – Acres at Low Risk	4,550	6,247	6,146
Mountain Pine Beetle Risk – Acres at Moderate Risk	7,432	7,672	8,698
Mountain Pine Beetle Risk – Acres at High Risk	10,702	8,697	7,759

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Preferred Action)
Wildlife Habitat Diversity			
Issue Indicators			
SS 1 – Grass/Forb (MAs 4.1, 5.1, 5.4, and 5.6)	135 acres 1%	135 acres 1%	209 acres 1%
SS 2 – Shrubs/Seedlings (MAs 4.1, 5.1, 5.4, and 5.6)	444 acres 2%	2,730 acres 14%	2,537 acres 13%
SS 3A – Sapling/Pole <40% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	758 acres 3%	617 acres 3%	608 acres 3%
SS 3B – Sapling/Pole 40-70% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	148 acres 1%	108 acres 1%	108 acres 1%
SS 3C – Sapling/Pole >70% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	310 acres 1%	249 acres 1%	249 acres 1%
SS 4A – Mature <40% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	4,202 acres 19%	6,088 acres 31%	6,966 acres 36%
SS 4B – Mature 40-70% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	9,274 acres 42%	7,497 acres 39%	6,243 acres 32%
SS 4C – Mature >70% canopy cover (MAs 4.1, 5.1, 5.4, and 5.6)	5,876 acres 26%	1,053 acres 5%	1,191 acres 6%
SS 5 – Late Succession (MAs 4.1, 5.1, 5.4, and 5.6)	1,140 acres 5%	977 acres 5%	1,274 acres 7%
Hardwood Enhancement (acres)	0	135	787
Meadow Enhancement (acres)	0	0	106
South Slope/Ridgetop Treatments (acres)	0	3,146	4,306
Density of Yearlong Open Roads (Miles per Square Mile)	1.2	0.8	0.8
Density of Seasonally Open Roads (Miles per Square Mile)	0.5	0.4	0.4
Effect on Threatened or Endangered Species	No Impact	No Impact	No Impact
Effect on Region 2 Sensitive Species	No Impact	May Impact Individuals; No Trend Toward Federal Listing	May Impact Individuals; No Trend Toward Federal Listing
Effect on Species of Local Concern	No Impact	May Impact Individuals; No Trend Toward Federal Listing	May Impact Individuals; No Trend Toward Federal Listing
Commercial Timber Production			
Issue Indicators			
Sawtimber Harvested (MMBF)	0	46,000	47,000
Total CCF	0	109,900	113,400
Present Net Value	$0	-$5,098,797	-$7,606,081

[a]The values presented here for mountain pine beetle risk represent pine stands for which an insect risk rating was available. The values presented for mountain pine beetle risk for each of the action alternatives account for the conversion of pine stands to other forest cover types.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

This section describes the affected environment and discloses estimated 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 interdisciplinary team considered the following:

- The probable consequences of each alternative on environmental resources.
- Achievement of project objectives.
- Adherence to amended Forest Plan standards, guidelines and objectives.
- Compliance with federal and state laws and regulations.

Chapter 3 of the Forest Plan FEIS and the Phase II Amendment 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 environment. This EIS is tiered to Chapter 3 of the Forest Plan FEIS and Phase II Amendment FEIS to avoid repetition and to allow this description to focus on the site-specific effects that would result from implementation of the proposed action and alternatives.

3.2 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIVITIES

A number of activities have already occurred, are occurring, or are planned in the project area. Past activities have contributed to the current condition of resources as described in this chapter. Ongoing and future activities may contribute to effects on resources that would also be affected by the proposed project. The need to include these activities in the cumulative effects section of each individual resource analysis depends on the extent of the cumulative effects analysis area and the duration of effects on each resource. Future activities described in this section are not part of the decision to be made for this EIS. Most have already been approved by other decisions or would require separate environmental analysis and public involvement.

3.2.1 Past Activities

The Black Hills have been subject to extensive human activities since the 1870s. Humans have altered vegetation structure, composition, and patterns by harvesting timber, suppressing natural fire, introducing exotic species, causing wildfires, nearly extirpating beaver, and grazing domestic livestock. As a result, more of the landscape is forested, though the trees are generally smaller (Parrish et al 1996). The water table is generally lower in drainages now; historically, numerous beaver dams were present, which kept the water table higher. This change has contributed to alterations in plant communities.

The project area is dominated by the ponderosa pine vegetation series, with interspersed areas of quaking aspen, paper birch, and open meadows (Shepperd and Battaglia 2002). Climatic conditions, along with applications of silvicultural systems and fire suppression over the last 100 years, have contributed to the structure, composition, and appearance of the majority of this existing forest, but the effects of wildfires and unregulated timber harvest in the late 1800s are still evident in places.

Approximately 138 miles of road have been developed in the project area on both public and private land. Private land has also been subject to timber harvest, livestock grazing, water diversions, and a limited amount of development. The extent of each type of past activity is listed below.

Fuel Treatment

No management actions aimed specifically at treating fuels (e.g. fuel break construction, mechanical thinning, and prescribed fire) have occurred prior to the Griggs fuel management project (see below).

Grazing

Livestock grazing has occurred in the Citadel area for over a century. The majority of grazing has been by cattle, with some sheep.

Mining

Mining claims are scattered across the project area, and the Tinton mine is located along the South Dakota/Wyoming border on the western edge of the Citadel area. No active mining claims are located in the Citadel project area.

Noxious Weeds

Herbicide application has occurred in various locations, mainly along roads and at other areas of soil disturbance related to past management activities.

Private Land In and Around the Project Area

Livestock grazing, haying, livestock water developments, and limited timber harvest have occurred on private lands. Site-specific data are not available.

Roads and Travel Management

Approximately 138 miles of roads exist in the Citadel area. Most of theses roads have been in place for several decades. The project area also includes approximately 10.1 miles of designated snowmobile trails and 11.5 miles of non-motorized NFS trails.

Timber Harvest

Records indicate that harvesting within the area has occurred regularly as far back as the late 1800’s. Significant harvesting occurred around the turn of the century, during and after World

War II and extending into the early 1950's. Harvest levels remained relatively constant from the 1950's through the 1990's. A list of timber sales that were active in within the Citadel project area between 1983 and 2000 is displayed below in Table 3-1. No new timber sales have been initiated since 2000, although post-sale activities are ongoing in some sale areas.

Table 3-1. Past Timber Sales (1983-2000) in the Citadel Project Area

Sale	Year	Acres
Beaver Ridge	1983	1,254
Long Bear	1983	1,257
Short Bear	1983	1,144
Higgins Gulch	1985	1,786
Big	1986	118
Boundary	1986	626
Game Range #3	1986	1,036
Jay	1986	46
Mill	1987	467
Chicago Gulch	1988	843
Knight	1990	647
Ridge	1991	175
Arrow	1992	114

Sale	Year	Acres
Baldy	1992	1,180
Asphalt Salvage	1994	86
Finger Salvage	1994	2,464
Griggs	1994	786
Lone	1995	1,054
Beaver	1996	667
Maurice	1997	1,559
Rimrock	1998	346
Soldiers	1998	665
Seventy	1999	296
Tollgate	1999	16
Crow	2000	821

3.2.2 Ongoing Activities

A variety of activities are ongoing in the project area. Post-sale activities related to the Maurice timber sale are currently active on public land in the project area. Timber harvest is not known to be taking place on other ownerships. Livestock grazing occurs on National Forest System and private lands. No mining operations are currently active. Fire suppression takes place as needed. Maintenance of roads and electric utility lines continues as budget allows and needs arise. Water is diverted in various locations to livestock watering tanks. Development of private land is currently minimal. The extent of each type of ongoing activity is listed below.

Fuel Treatment

A portion of the Griggs Fuel Management Area overlaps the Citadel project area. The Griggs area is located along Griggs Gulch and Higgins Gulch in the northeastern corner of the Citadel area. The area was rated "high" for risk, hazard, and value by the Black Hills National Forest Fire Protection Assessment. The Griggs plan calls for 43 acres of mulching, 1,170 acres of thinning, 500 acres of prescribed burning, and 326 acres of fuel break construction to reduce hazardous fuels and create defensible space near wildland urban interface (WUI) areas. A Decision Memo (DM) was completed for the project in 2001. Treatments associated with the project are ongoing.

Grazing

Grazing occurs in the project area on a permit basis. For a list of grazing allotments, permits, grazing systems and seasons, see the Range Specialist Report (section 3.4.3).

Noxious Weeds

Noxious weed treatment is ongoing.

Private Land In and Around the Project Area

Private land uses appear to be similar to past uses (see above) within the project area, with the addition of limited subdivision and development in some areas. Adjacent to the project area, residential development is occurring at a high rate in the area surrounding Spearfish, South Dakota, immediately to the north and along Spearfish Canyon to the east.

Recreation

Because of its proximity to Spearfish, South Dakota, the project area experiences a high amount of recreational use throughout the year. Activities include: hiking, horseback riding, sightseeing, driving, mountain biking, ATV riding, snowmobiling, cross-country skiing, bird watching, wildlife viewing, camping, hunting, and fishing. Unauthorized off-road use of motor vehicles is an on-going problem.

Special Use Permits

Several activities take place under special use permit within the project area. These activities include guided hunting, mountain bike races, and foot races.

Timber Harvest

No timber sales are currently active within the Citadel project area, although post-sale activities are ongoing in the Crow, Maurice, Rimrock, Seventy, and Tollgate timber sale areas.

3.2.3 Reasonably Foreseeable Future Activities

Reasonably foreseeable future actions in the Citadel project area include fire suppression, fuel treatment, vegetation management, treatment of noxious weeds, road decommissioning, road and utility maintenance, livestock grazing, and dispersed recreation. Other timber harvests may take place in the future on public lands, but specific locations and treatment types are not known at this time. The extent of each type of future activity is listed below.

Fuel Treatment

Where opportunities exist to implement the National Forest Plan and Healthy Forest Initiative, fuel treatments will continue to occur across the project area to reduce the threat of wildfire to human lives and property.

Grazing

A Record of Decision (ROD) for the North Zone Range allotments project (North Zone Range 2005) was signed in September 2006. Proposed actions include adaptive management of range resources with an emphasis on modifying grazing systems as necessary based on results of monitoring.

Noxious Weeds

Continued treatment of known infestations and continued survey for new infestations of noxious weeds are anticipated.

Private Land In and Around the Project Area

No foreseeable changes to private land uses from current uses are anticipated.

Recreation

Future recreational use is expected to be similar to current uses. If trends elsewhere are an indication, increased use of ATVs is likely. Potential effects of the ongoing Black Hills National Forest travel management planning effort (expected to be completed by 2008) are not currently foreseeable.

Timber Harvest

No additional timber harvests are proposed at this time outside of those affiliated with this project.

3.3 PHYSICAL ENVIRONMENT

This section describes the affected environment and environmental consequences for each resource of the physical environment (Hydrology and Soils, Transportation and Lands/Minerals/Special Uses).

3.3.1 Hydrology and Soils

Affected Environment

The main stream channels in the Citadel project area are Bear Gulch and Beaver Creek, which flow in a northerly direction into Redwater Creek (also called Redwater River) and Crow Creek respectively. The drainages of Higgins Gulch, Johnston Gulch, and Fish Hatchery Gulch flow into Spearfish Creek. Both Crow Creek and Spearfish Creek eventually flow into Redwater Creek (the 5th level watershed) north of Spearfish, South Dakota.

The four 6th level sub-watersheds in the area include Sand Creek, Bear Gulch, Crow Creek, and Lower Spearfish Creek. Nine 7th level drainages are in the analysis area and are presented in Table 3-2 below. Cumulative effects will be considered at the bottom of each of the four 6th level sub-watersheds.

Table 3-2. Sixth and seventh-level Hydrologic Units (HU) for the Citadel Analysis Area

Forest Plan Watershed #	HU Name – 6th level	HU Code – 7th level	HU Name – 7th level	7th level Acres
83-05	Sand Creek	10120203020305	Sand Creek	8,520
83-07	Bear Gulch	10120203020501	Shepherd Gulch	7,417
		10120203020502	Bear Gulch	8,596
83-08	Crow Creek	10120203010501	Upper Beaver Creek	6,943

		10120203010502	Lower Beaver Creek	5,029
		10120203010503	Upper Crow Creek	7,390
85-03	Lower Spearfish Cr.	10120203030401	Upper Higgins Gulch	7,958
		10120203030402	Lower Higgins Gulch	8,449
		10120203030404	Fish Hatchery Gulch	9,127
			Total Acres	69,429

Regulatory Framework and Analysis Methods

The Forest Plan, Forest Service Manual and Handbook direction, and the Clean Water Act guide this analysis. Analysis of soil and water resources for the Citadel area focuses on two indicators:

1. Planned activities on highly erosive or unstable soils.
2. Connected disturbed areas (CDAs), current and new.

This analysis addresses the first indicator by comparing the number of new road miles constructed on highly erosive/unstable soils and the number of treatment units on highly erosive/unstable soils in each alternative. The second indicator will be analyzed by describing the number and extent of CDAs under each alternative.

Beneficial Uses

The State of South Dakota has assigned beneficial or protected uses of the surface waters in the analysis area. These uses include coldwater permanent fish life, fish/wildlife propagation, stock water, limited contact recreation, and irrigation waters. These uses are protected by water quality standards. Intermittent streams or intermittent drainages are included in the definition of surface waters of the state, and any intermittent and perennial stream segments with assigned beneficial uses will be protected to prevent impairment of those beneficial uses.

Protection of Wetlands

Executive Order 11990 directs all federal agencies to avoid impacts to wetlands. The Army Corps of Engineers protects wetlands under the Clean Water Act Section 404 regulations. The local regulatory source of protection for wetlands is found in the Administrative Rules of South Dakota, Chapter 74:51:01:11, Protection of wetlands as waters of the state. The provisions of Chapters 74:51:01:06 to 74:51:01:10, inclusive, 74:51:01:12, 74:51:01:34 to 74:51:01:39, inclusive, 74:51:01:52, and 74:51:01:63 to 74:51:01:65, inclusive, apply to all wetlands.

Natural Watershed Characteristics

The natural characteristics of a watershed, such as annual precipitation, topography, soil types, geology, and vegetation cover contribute to the extent which ground disturbing activities can be expected to affect channel morphology, flow regime, water quality, and ultimately downstream beneficial uses.

Climate and Topography

The average annual air temperature is about 43 degrees Fahrenheit. The average annual precipitation for this area is about 18 to 19 inches. Of this total, 8 to 9 inches occurs during the winter (October 1 – April 30) and 10 to 11 inches occurs during the summer (May 1 – September

30). There is some potential for rain-on-snow events which may induce peak streamflows. These high flows are important for maintaining natural channel morphology. However, where stream channel conditions are unstable, these flows can lead to degraded stream channel conditions as well as damage to road drainage and stream crossing structures.

Landtype associations (LTAs) in this area include LTA 3 – North Gently Dipping Plateau Lands, LTA 6 – Volcanic Hills and Ridges, and LTA 9 – Steeply Dipping Plateau Lands (USDA-Forest Service 1996b). LTA 3 is characterized by broad and narrow ridges and valley bottoms, moderately sloping to steep sideslopes and rock outcrops. Sideslopes are generally 15-30 percent. Major soils in riparian areas are Cordeston, Maitland, Marshbrook, and Marshdale with Cordeston and Maitland dominant. LTA 6 is characterized by broad and narrow ridges and valley bottoms, moderately sloping to steep sideslopes and rock outcrops with sideslopes of 35-40 percent. Valley bottoms are generally less than 300 feet wide. Major soils in riparian areas are Marshbrook and Maitland with Maitland dominant. LTA 9 is characterized by broad and narrow ridges and valley bottoms, moderately sloping to steep sideslopes and rock outcrops with sideslopes of 35-50 percent. Valley bottoms are generally less than 300 feet wide. Major soils in riparian areas are Cordeston and Winetti.

The highest point in the Citadel project area is approximately 6,600 feet, above the Beaver Creek headwaters in the southwestern corner of the area. The lowest point is at 3,920 feet along Beaver Creek on the northwestern boundary of the project area. Streams have an average slope of 3.1 percent and drain in a northerly direction. The total perennial channel length determined using GIS is approximately 63 miles, occurring mainly within the downstream reaches of each 7th level drainage. Field validation indicated that more perennial flow occurs in the headwater reaches, where springs are relatively common, than is represented by the GIS streams layer. Additionally, many streams identified as perennial in GIS are intermittent or even ephemeral in nature.

Soils

Soil Productivity

The long-term maintenance of site productivity is a goal of the Forest Plan and part of the mission of the Forest Service. Soil erosion, soil compaction, nutrient removal, soil heating and regeneration hazards can limit the long-term productivity of forested sites. All analysis is based on Natural Resource Conservation Service (NRCS) soil surveys (USDA-Soil Conservation Service 1979). These factors are discussed below.

Soil Disturbance (Erosion and Compaction)

In the summer of 2006, a soil health monitoring assessment was conducted in Rimrock and Maurice Timber Sale units, the Griggs Fuel Treatment area, and historic wildfires in the Citadel project area. Assessed units overlapped with potential treatment stands for Citadel. Average slope of these sites ranged from 11 to 40 percent and occurred on Citadel, Vanocker-Citadel, Virkula, and Grizzly-Virkula soil associations. Detrimental disturbance was 8 to 15 percent due to compaction in the Rimrock harvest unit in stand 070602-53, greater than 15 percent due to compaction in a Maurice Sale unit in stand 070804-3, and 8 to 15 percent in the Griggs Fuel Treatment stand 071004-4. Compaction in the Griggs stand was not attributed to an observable disturbance (e.g. skid trails or prescribed burning). This area may have been severely burned in the past. Eight other stands were surveyed, documenting detrimental soil disturbance below 7 percent.

These data indicate that in areas harvested using ground-based equipment, detrimental soil disturbance can occur. Therefore, during sale planning, the skid trail system should be designed

in advance to minimize soil disturbance, skid trail and landing locations could be reused where possible, and skid trail and landing obliteration could be considered directly following the completion of treatments when necessary.

Across the Black Hills National Forest, Forest-wide monitoring of soil compaction indicates that timber harvest and cattle grazing have not caused excessive detrimental compaction (USDA-Forest Service 2002).

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 1996b). Past events in the project area have had limited effects on soil nutrients. The biomass has been increasing over the years, which continually puts nutrients back on the soils.

Soil Heating
"Soil heating is caused by severe fires that occur when humus and large fuels are dry and large fuels 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 1996b). There have been no severe wildfires in the project area for many years. Soil heating may have occurred in small areas where slash piles have been burned, but these areas have revegetated and show now lingering effects of soil heating.

Regeneration Hazards
"Forests must be restocked within 5 years after regeneration harvest. Regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors" (USDA-Forest Service 1996b). Past activities have not affected regeneration in this project area. The area is generally overstocked with trees, and no problems with regeneration have been encountered.

Mass Movement
Soils having a mass movement potential found in the watershed analysis area include (in order of abundance) the Citadel association, Vanocker-Citadel association, Grizzly-Vanocker association, Rock outcrop-Vanocker complex, and Lakoa-Santanta loams (see Table 3-3). Each of these soils has specific concerns, relative to forest management. Activities are not planned on the Rock outcrop-Vanocker complex and Lakoa-Santanta loams soils since they occur outside the project area.

Table 3-3. Mapped Soil Units Having Mass Wasting Potential

Mapped Soil Unit	Soil Unit Acres	Erosion Hazard	Equipment Limitation	Seedling Mortality	Windthrow Hazard
CBE (Citadel association, 10-30% slopes)	16,884	Moderate	Slight	Moderate	Slight
GBE (Grizzly-Virkula association, 25-60% slopes)	6,293	Moderate to Severe	Slight to Severe	Moderate	Slight
VBF (Vanocker-Citadel association, 25-60% slopes)	12,832	Moderate to Very High	Severe	Moderate	Slight
96 (Lakoa-Santanta loams, 10-30% slopes)	3	High to Severe	--	--	--
155 (Rock outcrop-Vanocker complex, 50-75% slopes)	2,870	High	--	--	--

Source: Lawrence County and Crook County Soil Surveys

Forest Plan Standard 1108 requires an on-site slope-stability examination on slopes over 30 percent on Citadel and Lakoa soils and on slopes over 55 percent on all other soils prior to design of roads or activities that remove all or most of the timber canopy. Approximately 81 percent of the project area is on Citadel or Vanocker-Citadel association soils.

During the summer of 2006, a slope stability survey was conducted for the Citadel analysis area. One hundred two potential stands were surveyed. Of these, 52 percent (53 stands) showed signs of some type of soil movement. Of particular concern are those areas that exhibited at least one of the following characteristics: Poorly developed drainage systems accompanied by luxuriant growth of water loving plants; downslope strips of even aged timber parallel to strips of new growth willow; crescent shaped scars (fresh cracks and bare scarps); backward rotated benches and terraces; and linear trenches or depressions paralleling slope contours. Eight stands (070702-48, 070803-9, 071001-41, 071005-4, 071005-10, 071005-45, 071005-51, and 071106-26) had at least one of these five characteristics. These stands would be mitigated to reduce the risk of mass wasting by not harvesting or building road through the at-risk sections of the stand or by using skyline yarding methods, leaving at least 25 percent canopy cover.

Vegetation

The majority of the project area is forested with ponderosa pine (*Pinus ponderosa*). Ponderosa pine dominates the ridge tops and dry slopes. Spruce (*Picea glauca*), quaking aspen (*Populous tremuloides*), paper birch (*Betula papyrifera*), and grass/forb meadows cover the remainder of the area. Stands dominated by spruce or birch occur on moist north to east-facing slopes, in drainage bottoms, and on low slopes. Aspen patches are present on a variety of slopes and aspects.

Existing Stream Conditions

Rivers and streams are complex and dynamic natural systems. The physical, chemical and biological conditions that exist between their banks and across their floodplains are a result of all the natural and man-made characteristics within the watershed. Stream system dynamics can be understood best by subdividing it into three areas: streamflow regime, water quality, and stream channel morphology.

Streamflow Regime

Peak flows in the Black Hills result from both rainfall and snowmelt. An examination of annual peak flows by the U.S. Geological Survey (USGS) indicates that rainfall-only peaks account for 90 percent of the peak flows in the Black Hills. Thus, most damaging floods in the Black Hills are due to severe spring and summer thunderstorms. Approximately 50 percent of the annual precipitation occurs in the months of April, May, and June.

There is little surface water in much of the analysis area. Springs occur in several of the headwater reaches and contribute perennial streamflow that can remain in downstream channels for miles or only for a few feet depending on the level of the local water table. Eventually flow goes subsurface until storm and/or snowmelt events produce sufficient runoff and soil moisture to feed surface flow. Most main channels are ephemeral or intermittent drainages. The limestone geology of the area causes most of the surface flow to be lost to groundwater aquifers. Almost all tributaries – ephemeral reaches – are dry, grassy, and timbered draws that route water only during infrequent and intense run-off events. Most of these draws do not exhibit evidence of recent flow, and contain neither a defined channel nor channel scour exposing gravel or sand substrate.

The headwater reaches of Bear Gulch and Beaver Creek act as areas of water storage in wetlands and riparian areas that slowly release streamflow over time with only moderate fluctuation in annual discharge. The streamflow regime is likely to be modified from pre-management because of the current road network and changes in stream channel condition, specifically an increase in compacted area and a loss of floodplain area, respectively. The modification to the streamflow regime is depicted by increases in peak flow magnitude and a decrease in the time of the flow to peak.

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 (timber harvest, grazing, recreation, etc.) and the private activities (grazing, construction, mining, etc.) 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.

Levels of sediment, temperature, pH, nutrients, heavy metals, and bacteria are currently within the thresholds of South Dakota water quality standards, with some minor violations typically occurring in pH. This elevated pH may be due to the natural limestone geology of the area and not to unnatural inputs (SDDENR 2002). Perennial streams in the analysis area support several fish species. Sources of sediment are mainly from instream erosion of stream bed and banks in reaches that have or are in the process of downcutting. Other sources of sediment are from cattle trampling stream banks and from the road network that parallels or crosses streams. Water temperatures may be altered in reaches where streamside vegetation has been removed by grazing activities or the presence of a road. Currently, surface waters in the analysis area fully support designated beneficial uses.

Watershed Condition Class

Watershed classes were assigned to sixth level watersheds during revision of the Black Hills NF Land and Resource Management Plan (USDA-Forest Service 1996b). The determination of class was accomplished by comparing natural sensitivity and impact indexes (data and mapping exercises used in analysis for the Forest Plan revision) and monitoring information. The sensitivity and impact indexes are explained in Appendix J of the 1996 Forest Plan FEIS.

Table 3-4 below presents the watershed condition class information from the 1996 Forest Plan FEIS Appendix J, and the corresponding 7th level drainages.

Table 3-4. Watershed Condition Class for the Citadel Analysis Area

Forest Plan Watershed #	7th level Watershed Names	Condition Class
83-05	Sand Creek	III
83-07	Shepherd Gulch, Bear Gulch	III
83-08	Upper Beaver Creek, Lower Beaver Creek, Crow Creek	III
85-03	Upper Higgins Gulch, Lower Higgins Gulch, Fish Hatchery Gulch	III

Watershed Condition Class III is defined as: "…are of high concern. These are watersheds in which management activities must be done with great care…Management activities can still

occur in these watersheds, but watershed improvement projects, or other activities which will improve the health of the watershed, must be a part of the project planning."

Channel Morphology

In the analysis area, drainages with wide flat valley bottoms, particularly those with perennial flowing stream channels, have been extensively managed for cattle grazing in the past. Many of these areas, such as the headwater streams of Beaver Creek and Bear Gulch, had numerous stock ponds constructed in the valley bottoms to provide abundant sources of water for livestock. These structures dramatically altered stream conditions and degraded water quality. Before these activities, streams were in a stable form efficiently moving flow and sediment without notable bed and bank erosion. Remnants of this stable channel type are present in sections of stream throughout the upper Beaver Creek and Bear Gulch area, and are defined by Rosgen (1996) stream classification as "E" stream types with a predominantly gravel bottom. These streams are narrow in width, relatively deep, and have a wide, well vegetated floodplain area that is accessed by flood flows on a near annual basis.

Today many of the constructed stock ponds have breeched and livestock management techniques have improved to the benefit of water quality, with lower numbers and seasonal closures. However, the legacy of past cattle management remains on many valley bottom floodplains and stream channels. Stream channels have made notable recovery from past impacts, and now have many stable reaches. Because of the altered state of many valley bottoms and continued disturbance, unstable stream reaches persist today.

Mining of side slopes and within the floodplain/channel has also impacted floodplains and channel conditions. These impacts do not appear to be as extensive on federal land as those associated with past cattle grazing. An observed exception to this is the lower reach in Higgins Gulch where the stream flows intermittently through tailings piles from past dredge mining.

On other landscape types characterized by relatively narrow valley bottoms, stream channels are defined by "B" and "A" type stream channels that are predominantly stable in channel form (bed and banks). Channels within the steep canyon landscape, such as the lower reaches of Beaver Creek and Bear Gulch, have little opportunity for erosion because of intermittent flow and abundant boulder and bedrock channels. Higgins Gulch does not occur in a canyon and was found to be mostly stable, with bank erosion and sloughing of side slopes occurring at a low to moderate frequency.

Visual stream surveys of Beaver Creek, Potato Creek, an unnamed tributary to Potato Creek, Lightning Creek, and Ladyfinger Gulch were conducted during October 2006. Each of these streams is tributary to upper Beaver Creek where intensive range management occurred historically and grazing continues today. These channels are defined predominantly by perennial flow in "E" stream types that represent a reference and stable condition and channels in an altered, less stable state, characterized by a "G" stream type. These surveys identified notable characteristics of the stream channel, such as sites of instability and man-made structures. Two reaches were surveyed in Beaver Creek totaling 1.5 miles. The headwater reach surveyed had numerous instream structures placed to harden banks and create pool habitat. These structures appear to be effective. This reach still has sections of bank instability totaling about 4.4 percent of the reach. The second reach also has sections considered to be unstable totaling about 4 percent of the length. Sections of unstable bank are defined by unvegetated banks with steep vertical slopes. These sites can be large sources of sediment to the stream channel during high streamflow events.

In the Potato Creek drainage, the 0.5 miles of the unnamed tributary to Potato Creek and 0.9 miles of Potato Creek were surveyed. The tributary was found to be stable with numerous old beaver dams creating wetland habitat. Unstable bank sections occurred in 6.5 percent of the reach of Potato Creek. Lightning Creek had an estimated length of unstable stream bank of 710 feet over the 0.8 mile surveyed reach, thus almost 17 percent of the reach was a potential source of sediment to the channel during high flows. Ladyfinger Gulch had an estimated length of unstable stream bank of 672 feet over the 0.5 mile surveyed reach, thus almost 26 percent of the reach was a potential source of sediment to the channel during high flows. Although these reaches of stream are within the FSH 2509.25-2006-2, Management Measure 3.1(k) for stream bank stability of 74 percent, improving stream stability is important for maintaining channel integrity and necessary to improve overall stream health.

Floodplains

Floodplains within the analysis area are most affected by old dams constructed many years ago to form stock ponds. These dams when functioning as designed eliminated floodplains by creating ponds. Typically, when they would fill and spill over, another pond was just downstream to retain the flows. Over time, these ponds filled in, forming wetland conditions and eventually stream channels formed at the new elevation determined locally by the downstream dam. Currently, many of these dams have fully or partly breeched, resulting in varying affects on the floodplain. In some cases the channel remained stable and in contact with its floodplain, while in other cases the stream bed downcut and abandoned its original floodplain forming deep eroding gullies. Over time, these downcut channels have begun to build new floodplains within the gully. As this process occurs, bank erosion is typically extensive as the channel decreases its slope by increasing its length through an increased meander pattern or sinuosity.

Also affecting floodplains within the analysis area are existing roads. Because valley bottoms are often the easiest and cheapest location to build a road network, many early travel and subsequent road construction occurred there. Many miles of existing road in the analysis area parallel streams and occupy area within a floodplain. In addition to roads that parallel streams are roads that cross the valley bottom. Although designed to pass flow for a designed flood, many crossings concentrate flood flows from the floodplain and into a culvert or other feature, thus reducing floodplain effectiveness.

Riparian Ecosystems

Most riparian ecosystems in the analysis area are associated with perennial streams and spring areas. Some intermittent and ephemeral drainage bottoms contain plants associated with riparian areas as well; however, these areas are often separated by open, dry meadows and are not continuous. Roads on floodplains that cross or closely parallel stream channels (e.g. FSR 131.2A, 222.1O, and 626.1C) have reduced riparian habitat. Also, cool stream bottom areas that harbor riparian vegetation attract cattle in the summer. Where cattle use of these areas is extensive, damage to the riparian area can occur. Cattle are certainly present in the upper Beaver Creek and Bear Gulch areas where they frequent riparian areas for water. It is unlikely that the current use of riparian areas by cattle is resulting in detrimental disturbance in these areas, but it is inhibiting full recovery. The loss of riparian ecosystem in these areas is largely a result of channel downcutting and loss of floodplain accessibility. The Johnston Gulch valley bottom was found to have high levels of cattle disturbance, likely to the extent that riparian ecosystems have degraded.

Wetlands

The National Wetlands Inventory (NWI) was used to initially delineate wetlands in the Citadel area. There are additional wetlands associated with springs and perennial stream channels,

although the NWI does not delineate them. Delineated wetlands are largely in the upper Beaver Creek area (Beaver Creek and Lightning Creek) and lower in the drainage in Mill Creek. In the Bear Gulch drainage, a delineated wetland occurs at the headwaters of Chicago Gulch, but is the result of a constructed stock pond. Higgins Gulch has one delineated wetland near the road junction of FSRs 214.1 and 639.1. The upper Beaver Creek area streams have wetland area along much of the perennial reaches. Many of these were created by the construction of stock ponds historically that have filled in with sediment over time.

Constructed Watershed Features

Road Condition Inventory

A full inventory and report of the existing condition of the roads within the Citadel project area can be found in the Citadel Transportation Plan located in the project file.

In the upper Beaver Creek drainage, sream crossings on FSR 633.1, 633.1B, and 222.1R had obvious connectivity between the road and stream channel, and road erosion contributed to sedimentation. The 222.1O road parallels Potato Creek and is contributing to flow and sediment increases. In the Higgins Gulch drainage, FSR 214.1 had four locations contributing sediment from road erosion (including one ford) and one crossing causing erosion of the channel at the outlet. Spur roads FSR 214.1D and 214.1F were sources of sediment to Higgins Gulch and FSR 626.1A and 626.1C were sources of flow and sediment increases to East Fork of Higgins Gulch. The Bear Gulch drainage had three crossings on FSR 131.2A and 131.2B of Chicago Gulch. These crossings were sources of increased sediment and flow due to poor road conditions. Culvert maintenance, particularly clearing of debris from culverts, was needed across the analysis area.

Connected Disturbed Areas (CDAs) are a measure of sediment sources and peak flow conditions (USDA-Forest Service 2005c). CDAs may include bare soil patterns, compacted soils, roads, severely burned areas or mine spoils. When a disturbed area flows into a water body without sufficient delay from vegetated filter strips or sediment detention structures, it is connected to the water body. CDAs contribute sediment to streams or wetlands causing degradation of physical function, degraded water quality, and increased peak flows that may alter physical channel processes. Most roads that cross streams will create a CDA. Forest Service Handbook 2509.25, chapter 10, directs the Forest Service to “progress toward zero connected disturbed area as much as feasible.”

Grazing Improvements

Several fences and water developments exist throughout the analysis area. Most springs in the area have some water development associated with them. Pipes divert water from fenced and non-fenced springs into stock tanks. Fenced spring areas are protected from trampling and disturbance. Non-fenced springs remain vulnerable to overuse, particularly during dry years. Fences concentrate cattle into paths, and areas of bare, compacted earth are found adjacent to several fences. There are numerous stock pond dams in the upper Beaver Creek drainage area (e.g. Middle Beaver Creek, Lightning Creek, Beaver Creek, and Potato Creek). They also occur in Chicago Gulch and East Fork of Higgins Gulch. Many of these are no longer functioning as ponds since they have filled in and are now active wetlands or have breeched and are contributing to channel instability.

Stream Channel Improvements

Nine constructed log weirs are present in the Beaver Creek channel above Beaver Crossing. These structures were constructed to improve pool habitat for fish along this reach. Due to the relatively stable flow conditions of Beaver Creek through this reach, most of the structures are still intact and stable, providing plunges and pools for resident and stocked fish species. In sections of this Beaver Creek reach, Potato Creek, and Lightning Creek riprap size rock was placed on stream banks and side slopes to reduce the risk of erosion at those sites. These have been effective locally, but are likely transferring stream flow energy downstream to the next bend. These channels are attempting to establish a stable slope within the downcut channel and will do this by increasing channel length (meander pattern). Until this occurs, bank erosion at meander bends will continue.

Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects

Soil Erosion, Compaction, Heating, Nutrient Loss, and Mass Movement
This alternative proposes no new activities on erosive or compactable soils. Under the no action alternative, existing soil erosion concerns associated with stream channels and roads would persist. Ruts, gullies, and areas of standing water would continue to exist. Conditions may worsen without effective road closures and decommissioning of damaged, unnecessary roadways. Without new compaction caused by ground-based harvest equipment, and nutrient removal caused by harvest, soil productivity and soil nutrients may improve over time. However, fire risk would also increase over time and soil cohesion, soil productivity, and soil nutrients could be severely impacted in the event of a high-intensity fire event. Landslides are not expected to occur within the current planning cycle (next 5 years) due to the relative scarcity of landslide features in the planning area.

Streamflow Regime
No activities are associated with Alternative A, so water flow volumes would remain dependent on precipitation variability in the short term. Existing vegetation structures would persist until the next high intensity wildfire event. Until that time, vegetation growth may slightly diminish water yield.

No decommissioning or rehabilitation of existing roads would occur, so the current road system would continue to support increased water yield since the drainage network extension caused by the current road system 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 Citadel project, would improve some CDA problems along the stream channels. However, on roads needing more work than annual maintenance can provide, such as FSR 131.2A, 131.2B, 214.1F, 222.1O, 626.1A, 626.1C, 633.1 and several non-system roads, CDAs would not be improved.

Water Quality
Because no new activities would occur under Alternative A, no new effects to stream water quality would occur. However, doing nothing to areas with heavy fuels increases the risk of a severe wildfire that could have an adverse affect on water quality.

Existing roads would continue to contribute sediment to the drainage network where CDAs exist. The rate of sediment delivery to streams may increase from roads that require reconstruction or decommissioning. Since no new roads or skid trails would be built, there would be no new potential sources of sediment. The current conditions of temperature, dissolved oxygen (DO), and water purity would generally persist. The lack of stream channel improvements in this alternative would not help move the Class III watersheds toward improved watershed health.

Channel Morphology
Since there would be no new activities associated with Alternative A, no new effects to stream morphology would occur. However, doing nothing to areas with heavy fuels increases the risk of a severe wildfire that could have an adverse effect on water yield and sedimentation to streams.

Stream channels that are currently unstable would continue to decline in stability until some equilibrium is met between flow, sediment, channel form, and disturbance that allow the channel to change its trend. In some cases, such as Potato Creek, this could take decades. Existing roads that affect channel morphology, such as FSRs 214.1, 626.1A, 626.1C, 633.1, 222.1O, and several non-system roads would continue to do so. Stream reaches in Higgins Gulch, East Fork, Potato Creek, and upper Beaver Creek would continue to adjust to increased peak flows and sediment caused by the current road system. Stream reaches in upper Beaver Creek, Potato Creek, Middle Beaver Creek, Lightning Creek, Ladyfinger Gulch, and Chicago Gulch would continue to be unstable without active treatment of floodplain confinement, channel erosion, or riparian vegetation.

Floodplains
There would be no new effects on floodplains since additional vegetation management or road building would not take place in this alternative. Roads currently affecting floodplains would continue to do so.

Riparian Ecosystems
There would be no new impacts to riparian ecosystems under this alternative. Existing impacts resulting from roads, grazing, and past harvest activities would persist. Degraded conditions in upper Beaver Creek, Potato Creek, Middle Beaver Creek, North Beaver Creek, Lightning Creek, Ladyfinger Gulch, Chicago Gulch, and Johnston Creek could either improve or worsen over time depending on management of grazing, off-road vehicle traffic, and channel stability trends.

Wetlands
Wetlands in the area are expected to persist as they currently do or degrade under Alternative A. They would remain vulnerable to existing roads, off-road vehicle traffic, grazing, and stream channel downcutting. Active channel migration in the vertical direction is found in North Beaver Creek, Middle Beaver Creek, Lightning Creek, and Chicago Gulch. If left alone, these reaches of stream would continue to downcut and subsequently drain local wetlands.

Alternative B (Proposed Action)

Direct and Indirect Effects

Soil Erosion, Compaction, Heating, Nutrient Loss, and Mass Movement
Timber harvest activities, including felling, skidding, decking, transporting of logs off-site, and slash disposal, can affect soil resources. Potential effects to soil resources include soil

compaction, displacement, and furrowing. Soil erosion can occur when rainstorms happen on sites where the ground cover has been removed. Loss of soil nutrients is a potential indirect effect of the action alternatives. The majority of soil nutrients are concentrated in the foliage, branches, and the root system of trees. Where whole-tree yarding is prescribed, some of the nutrients are removed while some remain on-site in the roots. The method of mechanical logging that removes the least amount of nutrients is the cut-to-length system where each tree is mechanically processed along the skid trail and only the bole is removed. Another advantage of the cut-to-length harvesting system is that forwarders are used as part of the system and provide full suspension of the logs, minimizing soil displacement and cover reduction. Yarding with grapple-skidders provides only one-end suspension and the skid trail is swept by the dragged tops, displacing soil and uprooting low vegetation. Tractor yarding with cables may not have the logs suspended at all, and can lead to more furrowing and displacement than grapple skidders.

Soil disturbance would be kept below the Forest Plan standard of 15 percent disturbance of each unit area. In proposed Citadel stands that have been managed in the past (e.g. Rimrock and Maurice Timber Sale units and Griggs Fuel Treatment) some level of disturbance is already present. This area of disturbance would be considered toward the 15 percent standard. Therefore, logging in previously disturbed units might need to use existing skid trails and landings to stay below the standard. Of the stands surveyed in 2006 having soil compaction occurring on 8 to 15 percent of the treated area (stands 07062-53 and 071004-4) Alternative B proposes commercial thinning, pre-commercial thinning, and prescribed burning in stand 071004-4. No activities are proposed in the one stand that had greater than 15 percent area disturbance, stand 070804-3. Other stands with recent disturbance proposed for management under Alternative B include: 071101-5, 071001-53, 071002-32, and 071004-37.

Prescribed burning would have little effect on erosion, productivity, and landslide risk in the Citadel analysis area. Burning activities may create small areas of bare mineral soil, vegetation removal, and soil heating. Ground cover vegetation in these areas generally recovers within a year or two. Wildfires typically recover protective vegetation within about 3 years (Driscoll et al 2004). Burning retains nutrients on site, and thereby maintains soil productivity. Bare areas that are exposed to erosion are receptive seedbeds, and vegetation usually occupies these sites within a year or two. Following prescribed burns, soils are rarely bare enough, and slopes are rarely steep enough, to contribute to increased risk of landslide events. The proposed stand thinning and fuels treatments in this alternative would reduce the risk of high-intensity wildfires and the adverse effects to soil often associated with such an event.

Alternative B proposes 1,282 acres of treatment on slopes over 30 percent on Citadel soils and 161 acres on slopes over 55 percent (see Table 3-5). These acres are considered in the Forest Plan as areas of concern relative to slope stability. Many of these areas were surveyed during 2006 and eight stands were found to have notable characteristics of slope instability. Of these stands, Alternative B proposes activity these stands would comply with Forest Plan Standard 1108 “Reduce resource damage and investment loss in areas that have a mass movement potential. Limit intensive ground-disturbing activities on unstable slopes identified during slope-stability exams.” Furthermore, FSH 2509.25-2006-2 directs the Forest Service to “Avoid new roads or heavy equipment use on unstable or highly erodible soils.” These stands would be mitigated to reduce the risk of mass wasting by not constructing roads across at-risk areas and implementing treatments that minimize ground disturbance and loss of all vegetation. This may include the use of skyline yarding methods, leaving at least 25 percent canopy cover (percent canopy cover retained is based on Regional direction).

Table 3-5. Treatments on Slopes over 30 % in Citadel soils and over 55 % by treatment type.

Treatment acres on Citadel soils on slopes >30%				Treatment acres on slopes >55%		
Soil Type	**Alt. B**	**Alt. C**			**Alt. B**	**Alt. C**
Citadel	487	423		**Treatment**	**Acres**	**Acres**
Vanocker-Citadel	795	756		COSR/pct	15	15
Total:	1282	1179		CSC30/pct/rx	10	3
				CT20/pct/rx	0	5
				CT40/pct/rx	92	75
				CT60/pct/rx	44	44
				Total:	161	142

Skyline cable harvest methods and non-mechanized fuel treatments are recommended for steep, erosive terrain (USDA-Forest Service 1991). Additional design criteria would be employed to reduce effects to the soil resource. Harvest activities would use low-impact harvest techniques such as skyline cable or tong-throwing equipment in order to avoid heavy equipment traffic on steep, unstable soils and avoid ground skidding on slopes with sustained grades steeper than 40 percent (FSH 2509.25-2006-2, Management Measures 9.1e & g).

This alternative proposes approximately 18 miles of new road construction, 35 miles of reconstruction, and 31 miles of decommissioning. One mile of new road would be located in soils identified as having a severe erosion potential with slopes greater than 20% (USDA-Soil Conservation Service 1979). To prevent substantial soil and water effects from this road construction, sediment produced by erosion from the road must be disconnected from downstream waters using Best Management Practices (BMPs).

Road reconstruction is expected to reduce the risk of erosion and mass wasting since problem areas would be stabilized and new ground disturbance would be minimal. Reconstruction activities include improving water drainage from the road with rolling dips, adding gravel to eroding or rutted surfaces, and improving road stream crossings. While some small-scale ground disturbance may occur during road decommissioning, some decommissioned roads would no longer be sources of soil erosion once the road surfaces have revegetated. Successfully decommissioned roads would result in a long-term beneficial effect to soils and hydrology.

Mitigation measures and BMPs would prevent noticeable negative effects on soil productivity and soil nutrients. Overstory and understory vegetation as well as slash and other down woody material would be retained in all treated areas, aiding the conservation of site moisture.

Streamflow Regime

Minimal increases in streamflow volume resulting from timber harvest are expected from Alternative B. However, because all proposed silvicultural treatments are designed to leave vegetation on site, regeneration and accelerated growth of remaining vegetation would balance the loss of evapotranspiration from harvested trees within several years.

The greatest potential for increasing water yield comes from increasing soil compaction, which decreases water movement into the soil causing surface runoff where it did not occur previously. These potential effects would be mitigated by keeping disturbed soil area below 15 percent of each unit area and leaving water influence zones (streamside zones) undisturbed with the exception of pre-commercial thinning and prescribed burning to buffer streams from ground disturbance. These streamside zones are, at a minimum, 100 feet from stream banks for all perennial flowing channels. These water influence zones in a perennial stream typically contain a

riparian ecosystem that transitions into terrestrial. The vegetation in this zone is important for filtering flow and sediment, and providing shade to the stream and future large woody debris necessary for aquatic habitat and channel stability.

Prescribed burning is proposed for 8,952 acres under Alternative B. Prescribed burning may cause the removal of forest vegetation as well as the thin 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 enough 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 analysis area. This would reduce harmful runoff and sedimentation (Robichaud 1996). The proposed stand thinning and fuels treatments in this alternative would reduce the risk of severe wildfire and the adverse effects to the streamflow regime often associated with such an event.

This alternative proposes approximately 18 miles of new road construction, 35 miles of reconstruction, and 31 miles of decommissioning. One perennial stream crossing is planned and has the potential of increasing CDAs in the Upper Beaver Creek 7th level drainage. To minimize substantial soil and water effects from road construction, the site would be a temprorary crossing implementing management measures and design criteria following FSH 2509.25-2006-2, Management Measures 10 and 11. No other stream crossings would occur. Draws that may flow water during heavy storm runoff events would be crossed with culverts.

Road reconstruction is expected to reduce concentrated water runoff from those roads treated by adding drainage features that take water off the road more frequently and therefore increase the efficiency of adjacent vegetated filter strips. Reconstruction activities, such as those on the FSR 222.1, 633.1, and 214.1 road networks, include improving water drainage from the road with rolling dips, adding gravel to eroding or rutted surfaces, and improving road stream crossings. Decommissioning sections of FSRs 131.2A and 626.1C and several non-system roads would reduce surface runoff to nearby streams and thereby reduce local peakflows. Successfully decommissioned roads would result in a long-term beneficial effect to the streamflow regime. Overall, there would be a reduction in the number of CDAs and an improvement in the streamflow regime from this alternative.

Water Quality

Activities proposed in Alternative B including timber harvest, prescribed burns, road construction, road reconstruction, road decommissioning, and stream restoration would not adversely affect water quality or beneficial uses in the Citadel project area with the implementation of management measures and BMPs. Treating heavy fuels would decrease the risk of high intensity wildfires that could have an adverse effect on water quality. Streams, springs, wetlands, and locations of potential instability would be buffered from activities with streamside management zones and vegetation buffers. Disturbed sites would be reseeded to prevent harmful runoff and sedimentation. To minimize substantial soil and water effects from road construction sites, management measures and design criteria would be used following FSH 2509.25-2006-2, Management Measures 10 and 11.

Road reconstruction and decommissioning would reduce CDAs, but may contribute to short-term sediment increases to the local drainage network within the first few months until erosion control measures become fully effective with the establishment of vegetation. The long-term benefit of these activities outweighs the possible short-term impacts; therefore, water quality improvement would occur. Decommissioning sections of FSRs 131.2A and 626.1C and several non-system

roads would reduce the surface runoff to nearby streams and thereby reduce road-derived sedimentation. Improvements in water quality from this alternative are expected.

Channel Morphology

Because increases in streamflow and sediment would be small from proposed timber harvest activities, road construction, and prescribed burning, changes in stream morphology are not expected from these activities. Improvement of CDA conditions following the reconstruction of the FSR 222.1, 633.1, and 214.1 road systems and the decommissioning of sections of FSRs 131.2A and 626.1C and several non-system roads would reduce the higher runoff volumes and accelerated water delivery caused by the current road network. These reductions would result in a more stable flow regime and a reduced risk of significant channel adjustment during flood events. The potential stream and riparian improvements in Upper Beaver Creek, Potato Creek, Middle Beaver Creek, North Beaver Creek, Lightning Creek, Ladyfinger Gulch, and Chicago Gulch would improve channel and streamside vegetation conditions and help move channel trends in the direction of improvement (see Section 2.2.5). Additionally, habitat and riparian vegetation enhancements proposed in Higgins Gulch would improve channel diversity and aquatic habitat. These improvements proposed in both alternatives would help improve channel morphology trends and move these Class III watersheds toward the goal of improved watershed health.

Floodplains

Alternative B proposes four new road/stream crossings. Two of these are proposed to cross streams having floodplains, while the other two crossings would occur on intermittent/ephemeral channels that do not have an active floodplain. One floodplain crossing is proposed on Beaver Creek and the other on Fish Hatchery Gulch. All new road/stream crossings would be installed to sustain bankfull dimensions. Stream crossings with identifiable floodplains would be designed favoring bridges, bottomless arches, and buried pipe arches instead of pipe culverts (FSH 2509.25-2006-2, Management Measure 4). The crossing planned for upper Beaver Creek, in Section 29, would go across the floodplain and cross the channel with a temporary bridge. Directly following the use of the road for sale activities, the bridge and road fill would be removed from the floodplain and the site would be stabilized to protect this perennial stream channel.

No effects are expected from harvest activities on floodplains since logging equipment would not work on these areas. In special cases, where floodplains need to be accessed, BMPs would be implemented. Some roads currently located in floodplains would be maintained, reconstructed, or decommissioned in both alternatives. This would generally improve the condition of floodplains in the planning area by reducing flow concentration along roads. It would also improve conditions by reducing compaction and soil displacement. Crossings with undersized pipes that restrict floodplain width would be increased in size to match bankfull width during reconstruction to pass bankfull flows (typically the 1.5 to 2-year flood flow), thereby reducing floodplain interference.

Many reaches in the upper Beaver Creek area and Chicago Gulch have experienced channel downcutting and loss of floodplain area because of past livestock management. New floodplains have formed or are forming currently under these altered conditions. Potential stream and riparian area improvements are possible under this alternative (see Section 2.2.5) that would impove channel and streamside vegetation conditions and help move channel trends in the direction of improvement.

Riparian Ecosystems
Designation of perennial water influence zones would establish areas adjacent to stream channels where no commercial harvest activity would occur. These zones and employment of appropriate design criteria would mitigate potential impacts from harvest activities on riparian ecosystems, and improve long-term stream health. To reduce fuels concerns, pre-commercial thinning and prescribed burning would not be excluded from these areas. This would exclude stands 070601-46 and 071005-35 for proposed pre-commercial thinning.

The Beaver Creek crossing would be built through that riparian ecosystem, but would be mitigated by placing temporary bridge abutments no closer than five feet either side of the top of the stream bank. Following the haul of timber across the creek, the bridge and fill material on the floodplain would be removed and the site stabilized.

Road decommissioning proposed for FSRs 131.2A and 626.1C and several non-system roads, would regain riparian ecosystems along several stream channels, including Potato Creek and Johnston Gulch. Potential riparian restoration activities (see Section 2.2.5) would improve the riparian ecosystem.

Wetlands
Two delineated wetlands are present in or near proposed harvest stands 070601-23 and 071104-18. For all activities planned in both alternatives, the integrity of all wetlands (nationally delineated or not) in the area would be protected through BMPs and timber sale contract provisions. Potential riparian restoration activities (see Section 2.2.5) would help improve watershed health.

Alternative C (Preferred Action)

Direct and Indirect Effects

Soil Erosion, Compaction, Heating, Nutrient Loss, and Mass Movement
Timber harvest and fuel treatments would have effects as described in Alternative B. This alternative proposes less overall acres of harvest, which also means fewer acres proposed on potentially unstable slopes than Alternative B (see Table 3-5). As with Alternative B, the proposed stand thinning and fuels treatments in this alternative would reduce the risk of severe wildfire and the adverse effects to soil often associated with such an event.

Alternative C proposes 1,179 acres of treatment on slopes over 30 percent on Citadel soils and 142 acres on slopes over 55 percent (see Table 3-5). These acres are considered in the Forest Plan as areas of concern relative to slope stability. Many of these areas were surveyed during 2006 and eight stands were found with notable characteristics of slope instability. Of these stands, Alternative C proposes activity in portions of four; 071001-41, 071005-4, 071005-51, and 071106-26. Activities in these stands would comply with Forest Plan Standard 1108, “Reduce resource damage and investment loss in areas that have a mass movement potential. Limit intensive ground-disturbing activities on unstable slopes identified during slope-stability exams.” Furthermore, FSH 2509.25-2006-2 directs the Forest Service to, “Avoid new roads or heavy equipment use on unstable or highly erodible soils.” These stands would be mitigated to reduce the risk of mass wasting by not constructing roads across at risk areas and implementing treatments that minimize ground disturbance and loss of all vegetation. This may include the use of skyline yarding methods, leaving at least 25 percent canopy cover (percent canopy cover retained is based on Regional direction).

Skyline cable harvest methods and non-mechanized fuel treatments are recommended for steep, erosive terrain (USDA-Forest Service 1991). Additional mitigation measures would be employed to reduce effects to the soil resource. Harvest activities would use low-impact harvest techniques such as skyline cable or tong-throwing equipment in order to avoid heavy equipment traffic on steep, unstable soils and avoid ground skidding on slopes with sustained slopes steeper than 40 percent (FSH 2509.25-2006-2, Management Measures 9.1e and g).

Soil disturbance is expected to be kept below to the Forest Plan standard of 15 percent disturbance of each unit area. In proposed Citadel stands that have been managed in the past (e.g., Rimrock and Maurice Timber Sale units and Griggs Fuel Treatment) some level of disturbance is already present. This area of disturbance would be considered in the 15 percent standard. Therefore, logging in previously disturbed units would need to use existing skid trails and landings to stay below the standard. Of the stands surveyed in 2006 having soil compaction occurring on 8 to 15 percent of the treated area (stands 070602-53 and 071004-4), Alternative C proposes commercial thinning, pre-commercial thinning, and prescribed burning (CT60/pct/rx) in stand 071004-4 and pre-commercial thinning on 070602-53. No activities are proposed in the one stand that had greater than 15 percent area disturbance, stand 070804-3. Other stands with recent disturbance, proposed for management under Alternative C include: 071101-5, 071001-53, 071002-32, 071005-28, and 071004-37.

This alternative proposes approximately 17 miles of new road construction, 35 miles of reconstruction, and 31 miles of decommission. One mile of new road would be located in soils identified as having a severe erosion potential with slopes greater than 20% (USDA-Soil Conservation Service 1979). To prevent substantial soil and water effects from this road construction, sediment produced by erosion from the road is expected to be disconnected from downstream waters using BMPs.

Road reconstruction is expected to reduce the risk of erosion and mass wasting since problem areas are to be stabilized, and new ground disturbance is expected to be minimal. Reconstruction activities include improving water drainage from the road with rolling dips, adding gravel to eroding or rutted surfaces, and improving road stream crossings. While some small-scale ground disturbance may occur during road decommissioning, some decommissioned roads would no longer be sources of soil erosion once the road surfaces have revegetated. Successfully decommissioned roads would result in a long-term beneficial effect.

Mitigation measures and Best Management Practices (BMPs) are expected to prevent noticeable negative affects on soil productivity and soil nutrients. Overstory and understory vegetation as well as slash and other down woody material would be retained in treated areas, aiding the conservation of site moisture.

Streamflow Regime

Minimal increases in streamflow volume, resulting from timber harvest and vegetation management are expected from Alternative C. However, because all proposed silvicultural treatments are designed to leave vegetation on site, regeneration and accelerated growth of remaining vegetation would balance the loss of evapotranspiration from harvested trees within several years.

The greatest potential for increasing water yield comes from increasing soil compaction, which decreases water movement into the soil causing surface runoff where it did not occur previously. These potential effects would be mitigated by keeping disturbed soil area below 15 percent of

each unit area and leaving water influence zones (streamside zones) undisturbed with the exception of pre-commercial thinning and prescribed burn to buffer streams from ground disturbance. These streamside zones are at a minimum, 100 feet from stream banks for all perennial flowing channels. These water influence zones in a perennial stream typically contain a riparian ecosystem that transitions into terrestrial. The vegetation in this zone is important for filtering flow and sediment, and providing shade to the stream and future large woody debris necessary for aquatic habitat and channel stability.

Prescribed burning is proposed for 14,209 acres under Alternative C. Prescribed burning may cause the removal of forest vegetation as well as the thin 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 enough 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 analysis area. As with Alternative B, the proposed stand thinning and fuels treatments in this alternative would reduce the risk of severe wildfire and the adverse effects to the streamflow regime often associated with such an event.

This alternative proposes approximately 17 miles of new road construction, 35 miles of reconstruction, and 31 miles of decommissioning. Like Alternative B, this alternative proposes one perennial stream crossing in Upper Beaver Creek 7th level drainage. To minimize substantial soil and water effects from road construction, the site would be a temporary crossing implementing management measures and design criteria following FSH 2509.25-2006-2, Management Measure 10 and 11. No other stream crossings would occur. Draws that may flow water during heavy storm runoff events would be crossed with culverts.

Road reconstruction is expected to reduce concentrated water runoff from those roads treated by adding drainage features that take water off the road more frequently, and therefore increase the efficiency of adjacent vegetated filter strips. Reconstruction activities, such as those on the FSR 222.1, 633.1, 214.1 road networks, include improving water drainage from the road with rolling dips, adding gravel to eroding or rutted surfaces, and improving road stream crossings. Road decommissioning sections of FSRs 131.2A and 626.1C and several non-system roads would reduce the surface runoff to nearby streams and thereby reduce local peakflows. Successfully decommissioned roads would result in a long-term beneficial effect to the streamflow regime. Compared to Alternative B, there would be near equal reductions in existing CDAs. Improvements in the streamflow regime from this alternative are expected.

Water Quality

Water quality would not be adversely affected by proposed vegetation treatments and prescribed burning under Alternative C. BMPs and stream course protection measures would be applied as described under Alternative B. Treating heavy fuels would decrease the risk of severe wildfire that could have an adverse effect on water quality.

To minimize substantial soil and water effects from road construction sites, management measures and design criteria would be used following FSH 2509.25-2006-2, Management Measure 10 and 11. Road reconstruction and decommissioning would reduce CDAs, but may contribute to short-term sediment increases to the drainage network. Road decommissioning sections of FSRs 131.2A and 626.1C and several non-system roads would reduce the surface runoff to nearby streams and thereby reduce road-derived sedimentation. Successfully decommissioned roads would result in a long-term beneficial effect to water quality. Compared to Alternative B, there would be equal reductions in, but fewer possibilities for new CDAs

occurring during storm runoff events since fewer miles of new road are proposed under Alternative C. Improvements in water quality from this alternative are expected.

Additionally, the potential stream and riparian improvements in the perennial streams of Bear Gulch, Upper Beaver Creek, and Higgins Gulch drainages (see see Section 2.2.5) would improve channel and streamside vegetation conditions and subsequently improve water quality conditions influenced by channel migration (sediment) and lack of shade (temperature). These improvements from Alternative C would help move the Condition Class III watersheds toward improved watershed health.

Channel Morphology
Increases in streamflow and sediment would be small from timber harvest activities, road construction, and prescribed burning. Because of mitigation efforts, changes in stream morphology are not expected from these activities. Improvement of CDA conditions following the reconstruction of the FSR 222.1, 633.1, 214.1 road networks and the decommissioning of sections of FSRs 131.2A and 626.1C and several non-system roads would reduce the higher runoff volumes and accelerated water delivery caused by the current road network. These reductions would result in a more stable flow regime and reduced risk of significant channel adjustment during flood events. As in Alternative B, the potential stream and riparian improvements in the Bear Gulch, upper Beaver Creek, and Higgins Gulch drainages would improve channel and streamside vegetation conditions and help move channel trends in the direction of improvement. These improvements, which are potential activities under both alternatives, would help move these Condition Class III watersheds (Bear Gulch, Crow Creek, and Lower Spearfish Creek) toward the goal of improved watershed health.

Floodplains
Alternative C would feature the same floodplain crossings described under Alternative B. All new road/stream crossings would be installed to sustain bankfull dimensions. Stream crossings with identifiable floodplains would be designed favoring bridges, bottomless arches, and buried pipe arches instead of pipe culverts (FSH 2509.25-2006-2, Management Measure 4).

No effects are expected from harvest activities on floodplains since logging equipment would not work on theses areas. In special cases, where floodplains need to be accessed, BMPs would be implemented. Some roads currently located in floodplains would be maintained, reconstructed, or decommissioned in both alternatives. This would generally improve the condition of floodplains in the planning area by reducing flow concentration along roads. It would also improve conditions by reducing compaction and soil displacement. Crossings with undersized pipes that restrict floodplain width would be increased in size to match bankfull width during reconstruction to pass bankfull flows (typically the 1.5 to 2-year flood flow), thereby reducing floodplain interference.

Riparian Ecosystems
Designation of perennial water influence zones would establish areas adjacent to stream channels where no commercial harvest activity would occur. These zones and employment of appropriate design criteria would mitigate potential impacts from harvest activities on riparian ecosystems, and improve long-term stream health. To reduce fuels concerns, pre-commercial thinning and prescribed burning would not be excluded from these areas. This would exclude stands 070601-33, 070604-70, 071001-36, and 071001-46 for proposed prescribed burning under Alternative C.

The Beaver Creek crossing would be built through that riparian ecosystem, but would be mitigated by placing temporary bridge abutments no closer than five feet either side of the top of

stream bank. Following the haul of timber across the creek, the bridge and fill material on the floodplain would be removed and the site stabilized.

Road decommissioning proposed on FSRs 131.2A and 626.1C and several non-system roads, would regain riparian ecosystems along several stream channels. Potential riparian restoration activities proposed under both alternatives in upper Beaver Creek, Potato Creek, Middle Beaver Creek, North Beaver Creek, Lightning Creek, Ladyfinger Gulch, and Chicago Gulch would improve the riparian ecosystem.

Wetlands
Two delineated wetlands are present in or near proposed harvest stands 070601-23 and 071104-18. For all activities planned in Alternative C, the integrity of all wetlands (nationally delineated or not) in the area would be protected through BMPs and timber sale contract provisions. Reaches of active channel downcutting in North Beaver Creek, Middle Beaver Creek, Lightning Creek, and Chicago Gulch would be stabilized by the potential stream restoration activities described in Section 2.2.5. These activities would improve watershed health.

CUMULATIVE WATERSHED EFFECTS

This discussion of cumulative effects is bounded in space by the four 6th level watersheds that include all soil and water features in the project area. The time period considered is 10 years, the expected extent of management activities.

Past, Present and Reasonably Foreseeable Future Activities

A discussion of the past, present and reasonably foreseeable future activities considered for cumulative effect is found in Section 3.2.

Alternative A (No Action)

Cumulative Effects

No new harvest, road, and fuel treatment activities are proposed under Alternative A. Post-sale activities in the Maurice timber sale unit would continue. No roads are currently planned for decommissioning. CDAs in the area would not be rehabilitated. Fuel treatments would continue under the Griggs project, but no prescribed burning would occur in the remainder of the area, resulting in an increased wildfire danger. Current grazing activities would continue under existing AMPs, with activities including maintenance of water developments, cattle guards, and fences, and spraying weeds with herbicides. The lack of stream channel improvements in this alternative would not help move the Class III watersheds toward improved health.

Alternative B (Proposed Action) and Alternative C (Preferred Action)

Cumulative Effects

Soils

Soil Heating
Proposed prescribed burning in addition to that occurring in the Griggs fuel treatments would consist of low-intensity fires; severe burning and soil heating are unlikely to occur in broadcast

burns, but could result where fuels are concentrated. However, design criteria requiring scarification and seeding of burn pile sites would reduce the effects of severe burning and soil heating effects and return the sites to production. Mechanical treatments that open the forest canopy can allow sunlight to heat exposed soil. Because most understory vegetation remains after timber harvest and tree regeneration is rapid, heating effects due to canopy reduction are likely to be minimal and temporary (USDA-Forest Service 1996b).

Soil Compaction
Soil compaction can take place any time vehicles travel across the soil surface. The degree of effects varies depending on conditions and the number of trips made over the same area. For example, vehicles traveling on dry soils have less effect than vehicles traveling on wet soils. Also, vehicles traveling on slash versus bare ground would have fewer impacts. One trip is generally expected to have less impact than multiple trips over the same area.

Soil compaction monitoring was conducted on the Forest during most years since 1998. In some years, baseline data was collected for areas that are planned for future timber harvest and those years did not produce any conclusions. In 2003, seven timber sales were sampled forest wide. The results showed that four sales had no change in soil compaction following harvest, two sales had a decrease in mean bulk density or soil compaction and one sale had a slight (3.9%) increase in compaction. In 2000, four sites on three timber sales were sampled. Two sales had no impact when comparing pre and post-harvest conditions. On the other sale, one site had a 3 percent increase in compaction and one had a 23 percent increase. The site that had the 23 percent increase in soil compaction, was sampled again the following year and the compaction was reduced to 6 percent. Author Ed Ensz stated, “The recovery of the compacted, sloping, area was fairly impressive given another year’s time” (Ensz 2001). This information shows that if soil compaction occurs, it is not permanent and with time will return to what it was before it was impacted. Soil compaction, if it occurs, is expected to be reduced with the freeze-thaw cycle, cycles of wetting and drying and plant growth found in the Black Hills.

Therefore, adverse cumulative effects to soil productivity are generally considered to be unlikely with the implementation of design criteria, BMPs and WCPs. However, where soil disturbance currently approaches or exceeds the 15 percent standard, designated skid trails and/or soil rehabilitation is planned to occur to bring detrimental disturbance in the unit below the standard. Thus through the application of design criteria, including BMPs and other measures, total soil disturbance would remain low in all activity areas, whether accessed for the first time or having cumulative disturbance.

Livestock grazing occurs on National Forest System Lands and private lands within the Citadel analysis area. Most grazing occurs in grassy valley bottoms. For this reason, timber harvest and fuel treatments do not usually occur on primary range. Effects are unlikely to be cumulative.

Soil Erosion
Other activities in the cumulative effects analysis area have combined to result in limited soil erosion. Monitoring has shown that activities such as those proposed under Alternatives B and C result in very little erosion on the same soil map units. Proposed activities, implemented using BMPs and other site-specific design criteria would have a negligible additive effect on cumulative soil erosion. Proposed road closures and repair would have reduced contributions to cumulative erosion. Continued OHV use may cause minor amounts of soil erosion, though implementation of closures has been shown to successfully reduce these effects (Boerman 2004).

Soil Displacement
Proposed activities would result in additional soil displacement. Soil would be moved during road construction proposed under both alternatives, but would be part of the permanent transportation system. Proposed road reconstruction and decommissioning would reduce soil displacement by stabilizing currently disturbed areas. Based on 2006 soil health monitoring, soil displacement was determined to be a small percent of total soil disturbance from past harvest activities. Therefore, adverse cumulative effects are not expected. Through the application of design criteria, including BMPs and other measures, total soil disturbance would remain low in all activity areas. Effects would be further reduced due to proposed activities being spread out across the project area and taking place over a period of 5-10 years; effects would not be concentrated in a single area or limited period of time.

Soil Nutrients
Timber harvest and fuel treatments totaling 13,035 acres under Alternative B and 17,780 acres under Alternative C would occur on soils that have low fertility and organic matter. These conditions occur on Citadel association (CBE), Vanocker-Citadel association (VBF), Grizzly-Virkula association (GBE), Virkula association (VCE), and Nevee-Spearfish rock outcrop complex (USDA 1979). Activities would leave enough residual material in the stand so that no special design criteria are needed. There would be no cumulative effects on soil nutrients under either alternative.

Regeneration Hazard
Problems obtaining sufficient regeneration are rarely encountered in this area or in the northern and central Black Hills in general. Proposed regeneration treatments are similar to those used in this area in the past and meet all Regional silvicultural guidelines for stand regeneration. Past activities have had no discernable effect on potential for regeneration; proposed activities are unlikely to result in any cumulative regeneration hazard.

Base on the above information, it is evident that neither action alternative would have more than a negligible accumulation of effects on soil productivity.

Mass Movement
As described above in the *Direct and Indirect Effects* section, design criteria for activities proposed on Citadel soils with slopes greater than 30% would minimize the risk of mass movement. Proposed treatments would leave 30-60% of the overstory trees intact and would retain most understory vegetation. Considering this partial-cut nature of past and proposed treatments, effects resulting from the proposed activities are less than the acreage to be treated indicates. This partial-cut method and application of design criteria would result in a negligible potential for harvest-related mass movement events. Other actions have combined to produce few areas of mass movement, and neither action alternative is likely to add to this cumulative effect. Alternative B has a greater chance of having an additive effect due to a greater length of proposed road construction; however, design criteria for proposed roads reduce the chance of this effect to an acceptable level.

Streamflows, Water Quality, and Channel Morphology
Both action alternatives would improve the streamflow regime, peak flows in particular, and reduce sedimentation to streams. Additionally, channel stabilization, flooplain improvements, and riparian ecosystem improvements would have beneficial effects on the degraded current watershed conditions. The objective of these activities is to move channel trends in the direction of improvement. These improvements would have beneficial cumulative effects on streamflow, water quality, and channel morphology and help move Watershed Condition Class III watersheds

(Bear Gulch, Crow Creek, and Lower Spearfish Creek) toward the goal of improved watershed health.

Grazing, off-road vehicle use, and private land development may have adverse cumulative effects with planned vegetation and road treatments if their scale increases in the near future. However, planned treatments would be such a small fraction of this cumulative effect that their independent contributions would not be measurable.

Floodplains, Wetlands, and Riparian Ecosystems
Vegetation treatments, roadwork, grazing, and off-road vehicle use would all occur under the action alternatives. Other than unmanaged off-road vehicle use, all activities on National Forest System lands would be managed using appropriate BMPs and would not lead to unacceptable cumulative impacts on floodplains, wetlands, and riparian ecosystems. Should off-road vehicle use increase, these areas may realize increased cumulative effects. Potential stream and riparian improvements in the Bear Gulch, Upper Beaver Creek, and Higgins Gulch drainages would improve floodplain and riparian conditions and help move channel trends in the direction of improvement. These actions are expected to provide a net benefit to riparian areas in the Citadel analysis area.

3.3.2 Transportation

Affected Environment

The existing transportation system was inventoried and reviewed in 2006. Timber harvest proposed in the project area would use existing transportation facilities with improvements and would require construction of new roads, reconstruction of some existing roads, pre-use maintenance of others, and conversion of existing unclassified roads to NFS roads.

Table 3-6. Existing Transportation System

Classification	Miles
Federal Highway	0.0
County Road	0.0
Arterial System Road	5.2
Collector System Road	15.5
Local System Road	82.8
Sub-total (System Roads)	**103.5**
Unclassified Road on NFS Lands	34.6
Total (All Roads)	**138.1**

As displayed in Table 3-6, there are currently 138 miles of road in the Citadel project area. This total includes system (classified, permanent) and non-system (unclassified) roads regardless of closure status. Current density of all roads, both open and closed, is 3.1 miles per square mile of land. Density of open roads is 1.2 miles per square mile. Density of roads closed either year-long or seasonally is 1.9 miles per square mile.

Roads in the Citadel project area are considered open for travel except for areas with yearlong closures, seasonal closures for soft roadbeds, or where prohibited by MA direction. Forest plan direction for each MA determines what type of motorized travel (on or off-road) is appropriate and when it is allowed. In MA 3.1, travel is restricted to designated routes; off-road motorized travel is prohibited year-round. MA 3.32 is closed to all motorized travel year-round. MA 4.1 is

closed to off-road motorized travel year-round. MA 5.4 is closed to off-road motorized travel from December 15-May 15 to reduce stress on wintering big game. Roads in MA 5.6 are generally open to on and off-road motorized travel, although area-specific closures can occur through a project decision (none are proposed under this project).

Rights of Way

For both action alternatives, the Forest Service would need to acquire the following rights-of-way to carry out the proposed management activities:

Table 3-7. Required Rights-of-Way

Road Number	Approximate Length	Legal Description
U650030	0.6 miles	T6N, R1E, Sec. 17
633.1	120 feet	T5N, R1E, Sec. 29
134.2M	120 feet	T6N, R2E, Sec. 29
U710038	0.1 miles	T5N, R1E, Sec. 32

Environmental Consequences

The cumulative effects area for the transportation resource is defined as the project area. The time period used for analysis is 10 years, the expected duration of activities proposed under the action alternatives.

Alternative A (No Action)

Direct and Indirect Effects

No new roads would be constructed under Alternative A nor would any be decommissioned. Existing non-system roads that are causing resource damage by providing illegal access, contributing to stream siltation, contributing to mass movement and erosion potential, damaging plant habitat, and creating disturbance to wildlife would remain in place.

No large-scale road maintenance would occur under Alternative A (routine site-specific maintenance could still occur as funding becomes available). Roads that are proposed for and in need of reconstruction would not be repaired resulting in the continuance and worsening of potentially unsafe driving conditions and continued contribution to resource damage, particularly siltation where roads are adjacent to riparian areas.

Cumulative Effects

There would not be any cumulative effects associated with Alternative A because no new actions associated with the Citadel project would occur.

Alternative B (Proposed Action) and Alternative C (Preferred Action)

Alternative B proposes 18.3 miles of new road construction or unclassified road conversion and 35.3 miles of road reconstruction to access treatment units. Alternative C proposes 17.4 miles of new road construction or unclassified road conversion and 35.3 miles of reconstruction. This would improve vehicle access to the area, cause a temporary increase in soil erosion from

construction activities, increase road maintenance needs and costs, and increase impacts on wildlife. In addition, both action alternatives propose 31 miles of road decommissioning.

Direct and Indirect Effects

Road construction and reconstruction could have the following effects.

1. Improved vehicle access to the area.
2. One- to two-year increase in soil erosion due to road construction and reconstruction (reduced by amended Forest Plan standards, BMPs, and design criteria).
3. Increased road maintenance needs and costs.
4. Increased impacts on wildlife.
5. Increased dust during log haul through private land (reduced by design criteria).
6. Stabilization of currently unstable road surfaces through improvement of drainage and/or application of gravel.

Road closures may affect motorized recreational activities such as hunting, driving for pleasure, and sightseeing. Decommissioning of non-system roads could also have beneficial effects on other resources such as hydrology, soils, wildlife, botany, and heritage by reducing resource impacts. Discussions of any effects of decommissioning on each resource can be found in the appropriate section of this chapter.

Cumulative Effects

The area considered for cumulative effects is the road network within the Citadel project area. The time span is identified as 10 years, the expected extent of project activities.

Past activities have resulted in an extensive road network in the analysis area. Alternatives B and C would add to the authorized road network. Both action alternatives would, however, result in a cumulative decrease in road density through closure of new road construction upon completion of management activities and decommissioning of non-system roads. If effective, these closures would decrease overall road maintenance costs and may preclude the need for future reconstruction.

3.3.3 Lands/Minerals/Special Uses

Affected Environment

Lands and Special Uses

Within the Citadel project area, special uses authorized by permit include recreation residences, utility corridors, and use of roads to access private land. The Citadel project area pattern of land ownership is typical for the Black Hills National Forest. The project area contains 4,082 acres of private land, several parcels of which are surrounded by National Forest System lands. Also typical of land ownership patterns in the Black Hills is the move towards subdividing many of the historic working ranches into rural residential home sites. The area immediately southwest of Spearfish is currently being developed into multiple rural residential subdivisions.

The project area also contains approximately 10 miles of utility corridors (power and telephone lines) that are authorized under special use permits. Protected improvements under special use permit include a monitoring well south of the Big Hill trail system adjacent to a proposed decommissioned road, a reciprocal road easement through the Aspen Hills sub-division, utility lines along 134.2U through the Red Lake area to Tinton, utility lines through the Iron Creek area to Tollgate, utility/phone lines along FSR 134, and a phone utility box at the intersection of FSRs 134 and 134.2U.

Many of the roads within and adjacent to the project area are used throughout the year to access permitted areas (utility line rights-of-way, recreation residences, and private property). Access roads and public and private road easements must be provided for maintenance and management activities. Private road easements have been granted for unclassified roads in the project area. These roads, so long as they remain unclassified, are maintained by the easement holder.

Two recreation residences are located within the Citadel boundary. These two residences are located in T5N, R1E, Section 4, on FSR 130.1K and T5N, R1E, Section 10, on unclassified road U710037 off of FSR 222.1. Utilities associated with this recreation residence tract include power and water. Communication with permit holders on these permitted sites is imperative during all phases of the project.

Unpatented Mining Claims

Mining has played a large role in the development of this area as evidenced by the numerous prospect pits, adits, shafts and abandoned mine workings. Minerals on National Forest System lands can be divided into three categories: locatable, leaseable, and saleable. Locatable minerals are those such as gold, copper, silver and other metals that can be claimed under the mining laws. A party files a mining claim when they have found something of value and must get approval from the Forest Service before conducting any surface-disturbing activities. The Bureau of Land Management manages all mineral claims for federal lands. A geological report for mineral claims indicates fourteen active claims within and adjacent to this project area. The claimant of these active claims has submitted a plan of operations for exploratory drilling. There are also numerous inactive claims.

Leaseable minerals include deposits such as oil, gas, or coal. Leases are awarded at the discretion of the government for these types of minerals. There are no mineral leases within the project area.

Saleable minerals include such things as sand, gravel, and building stones. The project area contains deposits of saleable types of minerals. There are no gravel pits or other active sources of saleable minerals in the project area.

Management Direction

Desired future conditions identified in the Forest Plan for lands and minerals include:

- The Citadel project area will continue to be maintained, used and managed for: utility corridors, private land in-holdings, recreation residences, land survey monuments/corners, private roads, National Forest System Roads (FSRs), and public highways,
- Grant FLPMA easements to landowners and/or landowner associations that need access across National Forest System lands to private property,
- Grant FRTA easements to County Highway Departments for subdivisions and county

maintained roads,
- Acquire easements from individuals across private property when access is necessary for management activities.

Environmental Consequences

All Alternatives

Direct and Indirect Effects on Lands and Special Uses

With implementation of design criteria, none of the alternatives would affect existing land survey improvements, easements or special use permits. One special use permit, a recreation residence cabin along U710037 could be affected if a right-of-way is not granted through private property. Alternatives B and C state if a right-of-way is not secured a new road will be built. This new road would pass adjacent to the recreation residence cabin and change the recreation experience from a relatively isolated recreation residence to a recreation residence with easy access which could lead to more public activity around this residence.

Direct and Indirect Effects on Mining Claims

Alternative A would have no effect on any activities associated with mineral exploration or development. Proposed activities under Alternatives B and C would not prevent mineral exploration in active mining claims or location and filing of additional claims. Claim markers would be protected, though it is possible that deteriorated markers could inadvertently be damaged or destroyed. Thinning and burning proposed under the action alternatives could facilitate exploration activities by removing vegetation and improving access.

Cumulative Effects on Lands/Minerals/Special Uses

Cumulative effects are not anticipated for Land/Minerals/Special Uses. There are few direct and indirect effects resulting from proposed activities in the action alternatives and the effects that are possible are negligible. No effects from ongoing or foreseeable Forest Service projects or known projects initiated by other agencies or individuals overlap with the direct and indirect effects anticipated for the Citadel project, so no accumulation of effects would occur.

3.4 BIOLOGICAL ENVIRONMENT

This section describes the affected environment and environmental consequences of each alternative on the biological environment (Forest Resources, Fire and Fuels, Range, Botany, Noxious and Invasive Weeds, and Wildlife).

3.4.1 Forest Resources

This section summarizes the comprehensive analysis of project area vegetation from a silvicultural perspective and is summarized from the silviculturist's report, which is located in the project file.

Affected Environment

Past Actions Affecting Existing Condition of Forest Resources

The Black Hills National Forest has been intensively and consistently managed for over a century. Timber was first harvested to support gold mining operations and to build the first towns that appeared in the Black Hills during the gold rush. Over time, timber harvest has continued on a sustainable basis in support of the local timber industry. For a list of recent timber sales that occurred within the Citadel project area, see Table 3-1.

Structural Stages

Structural stage is an important forest attribute, categorizing stands based on tree size and density. The Forest Plan identifies distribution objectives for some 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, there should be progress in that direction. Table 3-8 displays structural stage objectives for Management Areas within the Citadel project area. Management Areas 3.1 and 3.32, which are present in Citadel, are not represented here because the Forest Plan does not establish structural stage objectives for those MAs.

Table 3-8. Existing Structural Stages by Management Area

Structural Stages and Forest-wide Management Area Objectives for MAs 4.1, 5.1, 5.4, and 5.6	Existing Structural Stage Distribution within Management Areas			
	MA 4.1	MA 5.1	MA 5.4	MA 5.6
1 (5% of the MA)	0%	0%	1%	1%
2 (5% of the MA)	0%	6%	3%	2%
3A (10% of the MA)	0%	0%	3%	4%
3B (15% of the MA)	0%	3%	0%	1%
3C (5% of the MA)	4%	13%	1%	1%
4A (25% of the MA)	3%	26%	16%	24%
4B (25% of the MA)	36%	42%	50%	33%
4C (5% of the MA)	40%	11%	20%	28%
5 (5% of the MA)	17%	0%	7%	5%

The existing condition shows a preponderance of the area in 4B and 4C structural stages. These structural stages provide economical opportunities for adjustment.

Plant Species Composition

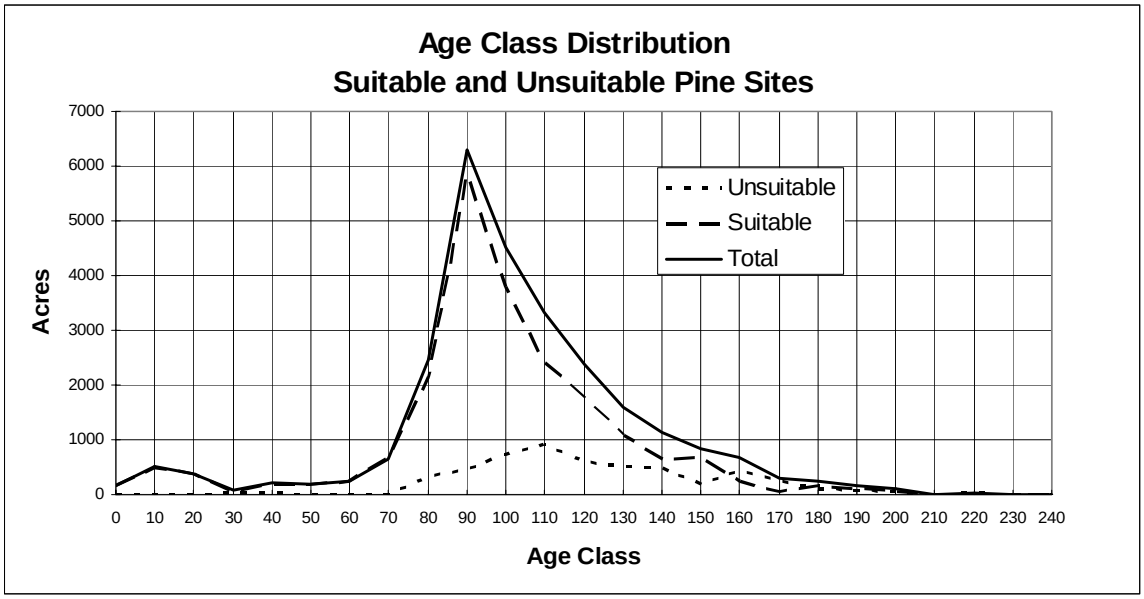
The majority of the forested acres in the Citadel project area are ponderosa pine (24,144 acres). Other cover types include 2,055 acres of aspen, 998 acres of bur oak, 55 acres of other hardwoods, 477 acres of paper birch, and 41 acres of white spruce. There are numerous small inclusions (10 acres and 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 if no treatment is done. In addition, there are 365 acres of grassland. Some of these areas also have pine encroaching on them.

Age Class Distribution

The existing age class distribution for the acres of pine forest within the project area that are suitable for harvest is as follows:

- Greater than 100 years of age: 8,690 acres (45%)
- Between 60 and 99 years of age: 8,880 acres (46%)
- 59 years of age or less: 1,759 acres (9%).

Figure 3-1. Age Class Distribution



The distribution of age classes ranges up to 250 years with the majority of stands in the 80 to 120 year age class. The age class curve is a bell shaped curve with the greatest acreage in the 90-year class. Most of the stands were regenerated after European settlement and are indicative of intensive harvest activities and fire protection occurring in the last 130 years. A majority of the forested stands are between 70 and 110 years old which indicate that many of the stands were regenerated over a 40 year period from approximately 1890 until 1930 which corresponds to historical accounts of heavy logging activity. There is a period from about 1930 to 1970 (40 to 70 year age classes) where the amount of new stand regeneration declines rapidly indicating that harvest methods and amounts changed, and fire-induced mineral exposure and subsequent regeneration were not as prevalent. Within the past 20 years, an increase in the amount of regeneration harvesting has occurred as can be seen by the upward trend in acres in the 1 to 20 year age classes.

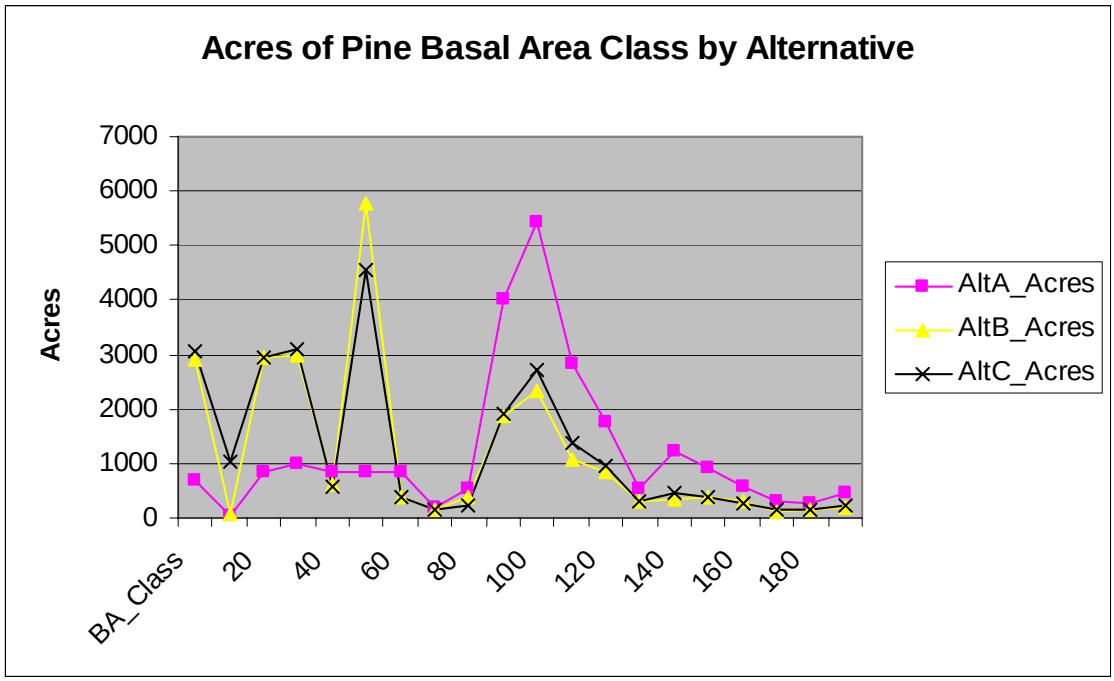
Stocking Levels

Desired Forest Plan stocking describes ranges of tree densities and sizes. Stands with low stocking levels generally can be brought up to the desired level with natural or artificial regeneration, or by allowing the stand to grow. Low density stands are not considered a problem due to prolific natural regeneration. However, an increase in oak competition has been noted in

some less densely stocked pine stands. Stands with stocking above desired levels are prone to insect and disease, increased fire hazard, and relatively slow growth in the trees of concern, and will generally require thinning.

displays the existing condition (Alternative A) and the estimated results of proposed treatments by alternative on basal area distribution. The effects of these proposed changes are described under the effects analysis below, however this chart shows them together for comparison.

Figure 3-2. Acres of Pine Basal Area Class by Alternative



About 894 acres (3%) are less than 40 BA, 3,920 acres (16%) are 40 to 79 BA, 8,345 acres (34%) are between 80 and 120 BA, and about 11,189 acres (46%) are greater than 120 BA. The area shows little diversity in basal area distribution, with much of the area above desired stocking densities.

Regeneration

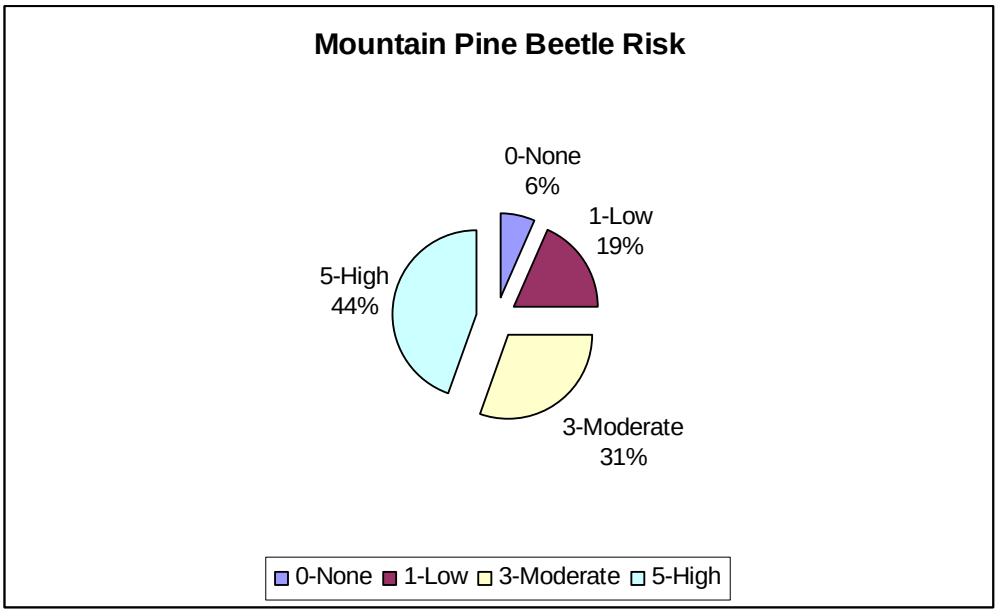
Pine regeneration is occurring in the project area where the crown canopy is open, where mineral soil has been exposed and where competition from grasses, forbs, and oak is low. In some areas, particularly where oak is established, regeneration is at moderate to low levels. Pine regeneration activities within the project area should be designed to reduce ground cover competition and expose mineral soil, increasing natural regeneration potential. The most common plant association in the area is ponderosa pine/bur oak, which does not yield adequate pine regeneration if the oak is well established. Past regeneration harvests in adjacent areas have resulted in fully stocked stands of pine when the soil was disturbed in conjunction with site preparation.

Insects & Disease

Current timber losses from insect and disease are at endemic levels. The primary insect and disease concern in the Black Hills is the mountain pine beetle, which has become increasingly prevalent across the Forest in recent years. Mountain pine beetle populations are currently at endemic levels; however, risk ratings (Schmid et al 1994) show much of the pine is at moderate

or high risk for infestation. The risk ratings use 120 BA as the high risk threshold as established by Schmid and Mata (1992), but recent studies indicate the threshold may be lower (Schmid and Mata 2005).

Figure 3-3. Current Mountain Pine Beetle Risk



The Mountain Pine Beetle hazard (calculated from stand exam data) is a concern as 75% of the area is at high or moderate risk. The hazard rating does not indicate the probability of infestation but instead refers to the chance of losses within a stand if an infestation occurs within the area. If an infestation occurs within a stand with a high hazard rating, then it is expected to experience higher overall losses than a stand with a lower hazard rating.

In addition to mountain pine beetles, several other insects and diseases are known to exist in the Citadel project area. Red turpentine beetles typically attack trees weakened by drought, fire, other insects or logging damage. However, red turpentine beetle activity is low and is not likely to increase. Western gall rust (*Peridermium harknessii*) has been observed in the area. Most of the galls were observed on the limbs and not on the boles of the ponderosa pine. The result is reduced growth of the pine stands to a certain extent but should not be considered a significant threat to the merchantability of the stands in the area. Armillaria root disease (*Armillaria ostoyae*) is another important disease in the Black Hills that causes tree mortality by killing the cambium, which effectively girdles the tree and causes decay of the sapwood and heartwood. Armillaria centers can vary in size from a few trees to a patch of 1,000 acres. There is little evidence of Armillaria centers in the project area and it is considered a minor problem. 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 becomes overmature. Mortality will increase and merchantable volume will decrease due to red rot disease in overmature pine. Diplodia tip blight (*Sphaeropsis sapinea*) is a fungus that attacks ponderosa pine needles and cones. It can reduce growth and kill trees over time. However, it has occurred at very low levels in the project area. Harvesting and pre-commercial thinning activities have occurred in some stands in the project area. Slash buildup from these activities has the potential to favor a buildup of insects, especially the pine engraver or ips beetle (*Ips pini*). Where pre-commercial thinning has occurred within the area, no major infestation has occurred and additional activities can be considered a minimal risk.

The western pine tip moth (*Rhyacionia bushnelli*) and the southwestern pine tip moth (*Rhyacionia neomexicana*) can both be found in the Black Hills. Both moths attack small trees (less than 10' tall) and are not considered serious pests, especially in the Citadel project area.

Other insects and diseases that could affect the tree species of the Citadel project area either occur infrequently or have not been observed.

Environmental Consequences

Most of the treatments and cutting methods proposed in the alternatives are described and illustrated in section II-31 "Methods to Achieve or Influence Vegetative Diversity" of the Black Hills National Forest Final Environmental Impact Statement (USDA-Forest Service 1996b). Some combinations of treatments are proposed that are not listed specifically, but the actions and effects described for the individual treatments allow for an understanding of the kinds of impacts to be expected.

Alternative A (No Action)

Direct and Indirect Effects on Silviculture/Timber

Under this alternative, no timber management activities would take place other than ongoing activities such as firewood gathering, right-of-way clearing, Christmas tree cutting, and activities approved under other environmental analyses.

The effects of deferring treatment in the project area would be an increase in standing timber volume as the size of the existing trees increases with growth; a reduction of diameter growth due to age and overstocking (trees will continue to grow, but at a slower rate due to competition); an increasing risk of mountain pine beetle infestations; and an increased risk of a large wildfire.

Structural stage imbalances would persist and be exacerbated by the lack of regenerated stands. The age class distribution within stands would likely show increases in older stands over time, but would also reflect changes due to unpredictable natural processes such as insect infestations and wildfire. Long-term effects would be an increase in mortality due to competition between pine and an increase in merchantable defect due to disease. In addition, long term sustainability of the timber resource would be in jeopardy since few acres are currently young and available to grow into the next generation of mature forest.

The risk of a stand replacing wildfire would be higher without treatment. Crown fires would cause complete mortality in many stands. The effect of such a high severity 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.

The overstocked stands of pine pose a high risk of loss by mountain pine beetle. This risk would increase over time as trees grow and stocking levels continue to increase. The likelihood of a widespread epidemic level infestation of mountain pine beetle would increase over the next three decades. Without disturbance, all of the currently low risk stands would grow into moderate risk and the moderate risk stands become high risk stands within 30 years (USDA-Forest Service

1996b). Other insects and diseases are expected to remain at current levels barring natural disasters.

As pine stands increase in density 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 developed with open canopies shed their snow as wind shakes them and are less susceptible to snow buildup. Snow damage is more likely to occur under Alternative A than under either of the action alternatives.

Plant species composition and diversity would decrease. Pine is encroaching into hardwood and meadow areas and overtaking small openings in the forest canopy. As the canopy closes, aspen, oak and other hardwoods would diminish in numbers until natural disturbances once again open up the canopy. Within many sites, forbs and grasses in the understory would be shaded out, reducing quality of other resources such as wildlife habitat, range, recreation and scenic integrity.

Alternatives B and C

Direct and Indirect Effects on Silviculture/Timber

Structural Stage

Alternative B proposes vegetation and fuels treatments on 13,035 acres of forested land within the project area, and Alternative C proposes treatment on a total of 17,780 acres. These harvest treatments are consistent with the exceptions provided in part m2 of the National Forest Management Act (NFMA) (see Appendix B), and include the following: pre-commercial thinning, commercial thinning, liberation harvests, clearcuts, group selection harvests, meadow retention and restoration treatments, and hardwood restoration and retention harvests which are designed to meet other than timber objectives. These treatments are proposed to meet the Forest Plan multiple-use and National Fire Plan objectives stated earlier in this analysis. Treatments will result in changes in the composition of structural stages as displayed in the table below.

Table 3-9. Resulting Structural Stages by Action Alternative and Management Area.

Management Area and Forest-Wide Objectives	Structural Stage	Alternative B	Alternative C
4.1 (5%)	1	0%	0%
4.1 (5%)	2	3%	3%
4.1 (10%)	3A	0%	0%
4.1 (15%)	3B	0%	0%
4.1 (5%)	3C	4%	4%
4.1 (25%)	4A	22%	19%
4.1 (25%)	4B	38%	29%
4.1 (5%)	4C	27%	27%
4.1 (5%)	5	6%	17%
5.1 (5%)	1	0%	0%
5.1 (5%)	2	6%	7%
5.1 (10%)	3A	0%	0%
5.1 (15%)	3B	3%	3%
5.1 (5%)	3C	13%	15%

5.1 (25%)	4A	26%	27%
5.1 (25%)	4B	50%	46%
5.1 (5%)	4C	2%	3%
5.1 (5%)	5	0%	0%
5.4 (5%)	1	1%	1%
5.4 (5%)	2	14%	14%
5.4 (10%)	3A	3%	3%
5.4 (15%)	3B	0%	0%
5.4 (5%)	3C	0%	0%
5.4 (25%)	4A	34%	34%
5.4 (25%)	4B	36%	35%
5.4 (5%)	4C	5%	6%
5.4 (5%)	5	7%	7%
5.6 (5%)	1	1%	1%
5.6 (5%)	2	15%	14%
5.6 (10%)	3A	4%	4%
5.6 (15%)	3B	1%	1%
5.6 (5%)	3C	1%	1%
5.6 (25%)	4A	30%	39%
5.6 (25%)	4B	40%	30%
5.6 (5%)	4C	4%	5%
5.6 (5%)	5	4%	5%

Alternatives B and C both redistribute the structural stage acres out of the overabundant 4B and 4C categories into Structural Stage 2, which is currently lacking. Alternative C does this to a greater degree than Alternative B. Although it appears that neither alternative creates much Structural Stage 3, this stage may be under reported in both the current and resulting acres. The sapling/pole stage ranges from 1” dbh to 9” dbh, so it is easily overshadowed in the basal area-based structural stage classification. Past experience indicates the forest is not lacking in trees 1” to 9”; however, the data does show that there are relatively few pure stands of this structural stage. The rules used for estimating resulting structural stage may also under represent the created Structure Stage 3 (Blaine Cook, personal correspondence). It was assumed that all overstory removal treatments resulted in Structural Stage 2. While this is a conservative estimate, it is likely that some areas would remain in the sapling/pole stage.

Plant Species Composition

Plant species composition would increase under both Alternatives B and C. The amount of hardwood and meadow acreage would increase slightly with the largest increase in plant species composition occurring in the pine understory. As the pine is thinned out and prescribed burning occurs, grasses, forbs, and inclusions of hardwoods would increase. Because Alternative B treats fewer acres than Alternative C, it would result in less species diversity. Both action alternatives provide more diversity than Alternative A.

Age Class Distribution

Age class distribution would improve under both Alternatives B and C. Alternative B would remove the overstory on 2,435 acres, while Alternative C would do so on 2,134 acres. Also, Alternative B proposes shelterwood seed cuts on 914 acres, and Alternative C proposes this treatment for 604 acres. Shelterwood seed cuts should establish regeneration under the reserve trees, providing future young stands. Currently, young stands are noticeably few across the landscape, so an increase in acreage would be beneficial. Thinning and prescribed burning may remove some younger pine but generally the distribution would not change significantly due to these understory treatments.

Stocking Levels
Stocking levels are measured in basal area distribution. Stocking levels would decrease under both Alternatives B and C, but both alternatives would provide adequately stocked pine stands for future management (see Figure 3-2 above). Under Alternative B, stocking levels would decrease where thinning and prescribed burning occurs. Decreased stocking levels would increase diameter growth of individual trees, increase plant species composition in the understory, reduce the risk to stands from insects and disease, and improve the general vigor of the stands treated. The use of commercial treatments in this alternative provides the opportunity in commercial-size stands to reduce stocking levels and, as a result, this alternative moves more of the area toward desired Forest Plan stocking levels than Alternative C.

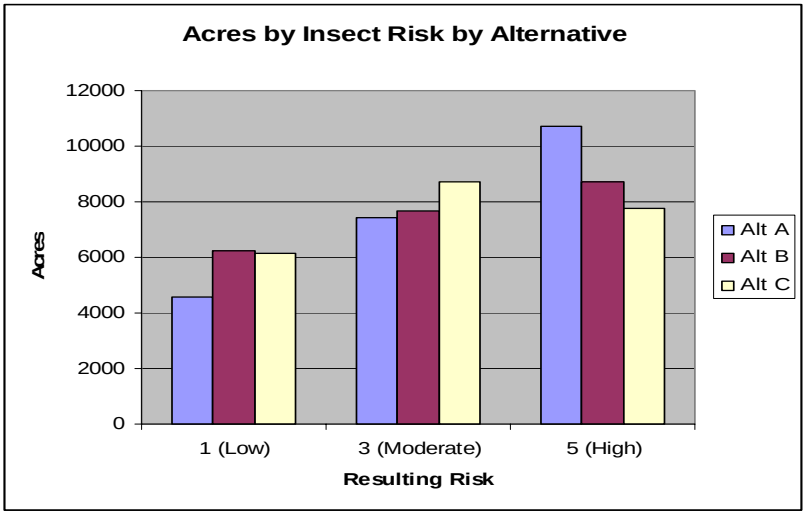
Alternative C was designed to reduce crown fire and mountain pine beetle risk and increase forage within large portions of the project area by increasing the spacing between trees. The lower basal areas and associated reduced bulk density of crown fuels reduce the potential for high severity wildfires and increases forage. Total yield would be lower over time than for Alternative B, which would leave more basal area. The reduction in yield is because the trees would not fully occupy the stand.

Regeneration
The natural regeneration of pine and other native species is expected to occur at sufficient levels following treatments under both Alternative B and C. However, because Alternative C proposes a greater level of prescribed burning than Alternative B, it is likely to result in enhanced regeneration. Prescribed burning may adversely affect existing seedlings, but by exposing mineral soils it helps establish new seedlings and improved growing conditions for grasses and forbs.

Insects & Disease
Current losses from insect and disease are at an endemic level. Treatments proposed under Alternatives B and C would lower the current risk of mountain pine beetle infestation. Risk reduction is likely to be greater under Alternative C because of its more extensive treatments, its greater reduction of basal area within pine stands, and the resulting structural stage composition.

Slash buildup from treatments, if not treated properly, could encourage Ips Beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices of lopping, scattering, and burning of slash piles within a year of treatment has reduced Ips infestation to less than a few trees per acre. Additional fuel treatments for fire risk reduction would also reduce the probability of insect infestations. Scattering slash facilitates the rapid drying of fuels, which reduces conditions favorable for Ips buildup. Other insects and diseases affecting both pine and other species of trees in the project area that are present are having minimal impact on the area and would probably continue to have a low impact under either action alternative.

Figure 3-4. Mountain Pine Beetle Risk by Alternative



CUMULATIVE EFFECTS

Past Activities and Their Effects on Silviculture/Timber

The cumulative effects area for the silviculture resource is defined as the project area. The time period used for analysis is 15 years, the expected duration of activities proposed under the action alternatives.

Much of the area has experienced vegetative treatments within the past 20 years. Commercial harvests and pre-commercial thinning from the late 1970s through the early 1990s have taken place within the project area. 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.

The effect of past treatments has been an increase in the volume and quality of merchantable volume and a decrease in the amount of insect infestation and disease. There has been an increase in individual tree growth as a result of releasing the remaining trees from competition for light, water and nutrients. Trees have developed larger diameters due to a reduction of competition. Commercial thinning reduced the stocking levels in some overstocked stands; however, not all stands were treated in the past and growth has occurred, so many stands are currently overstocked. A reduction of the risk of pine beetle infestation in the pine stands is a result of a reduction in basal area, but risk is now increasing due to growth. Some stands were regenerated, resulting in seedlings. 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.

Past treatments have led to the forest conditions that we see today. The effects of these treatments are reflected in the existing condition as described under Alternative A.

Present and Reasonably Foreseeable Activities and Effects on Silviculture/Timber

The Griggs Fuel Management project is ongoing in the northeastern corner of the Citadel project area. This project involves treating a total of approximately 3,400 acres with pre-commercial thins, broadcast burns, mulcing, piling, or fuel break construction. KV (post-sale) activities continue in the Crow, Maurice, Rimrock, Seventy, and Tollgate timber sale areas. These activities were analyzed under previous decision documents and were developed to maintain the productivity of the area. Private land comprises

about 12 percent of the project area (4,082 acres). Approximately half of the private land is forested, and so little harvest has occurred on this land that any effects related to it are not measurable.

Anticipated future silvicultural activities, not connected to this analysis, which are reasonably expected to occur within the Citadel project area include:

- Within the planning area, several closed timber sales would have ongoing sale area improvement activities. This analysis incorporated and considered the KV treatments and associated effects.
- Firewood gathering and Christmas tree cutting by permit would 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.

Activities likely to occur on land within the Project area other than National Forest System land:

- Development of primary residences is likely to occur in Section 30 of R2E T6N. Access road building and land clearing has begun.
- With an increasing interest from landowners to manage their forested land for profit and fire protection, more acres may be treated within the next decade. However, lower timber prices may cause landowners to defer treatments until they can get a better price for their timber.
- Treatments on private land for fire risk reduction would contribute to a reduction of risk from high intensity wildfire and mountain pine beetle infestation.

Cumulative Effects of the Alternatives

The level of silvicultural treatment likely to occur in the project area (aside from the treatments proposed as part of this project) is minimal, and the effects to forest resources associated with these treatments are expected to be minimal.

Alternative A, the No Action Alternative, would not contribute any additional beneficial effects in the project area. Alternatives B and C would change environmental conditions to move towards those desired conditions specified in the Forest Plan. As described above, the treatments would lead to direct and indirect effects that include a decreased mountain pine beetle risk, reduced risk of catastrophic wildfire, increased growth rates and improved overall quality on retained trees in treated areas, increased forage and shrub presence and growth, and some improvement in the structural stage and age class distributions. Negative effects of the treatments include removal of some trees so they won't be available for harvest in the future, temporary increase in fuel loadings following pre-commercial thinning, and possibility of increased oak competition. The action alternatives are expected to have a minimal cumulative effect over the direct and indirect effects that would result from implementation.

3.4.2 Fire and Fuels

Fire has been a primary factor in shaping the composition and structure of the ecological processes of the Black Hills National Forest. Historically, fires occurred infrequently (every 10 to 30 years) and were low in severity. Ponderosa pine evolved to co-exist and flourish with fire, particularly frequent, low-intensity underburns. The thick bark of large trees enables them to resist fire damage. In the past, periodic low-intensity fires consumed small seedlings, pruned

lower branches from large trees, and consumed concentrations of woody fuels on the forest floor. The result was a mosaic of conditions. When large crown fires did occur, they probably did not completely consume all trees within a landscape, but left sources of seed for the eventual re-colonization of the burned areas (Sheppard and Battaglia 2002).

Across much of the Black Hills, frequent, low-intensity fire appears to have been the historic norm, but climate cycles periodically altered the fire regime. Evidence indicates that if a somewhat wetter period (perhaps a few years of much wetter than average precipitation) caused an interval between fires to extend longer than usual, the accumulation of fuels and increased stand density would persist until the next dry cycle. Then a larger, more intense, stand-replacing fire was likely to burn though the area. This fire would be outside the norm of regular, low-intensity surface fires (Brown 2003).

In the last five years, stand replacing fires have burned an average of 35,000 acres per year (Scott and Reinhardt 2001). This is due in large part to increased forest density and accumulations of forest litter resulting from decades of fire exclusion. It is likely that the Black Hills fire ecosystem is now operating more closely to a mixed severity fire regime.

Affected Environment

As illustrated in Table 3-10, much more of the landscape is forested as compared to estimated conditions in 1875.

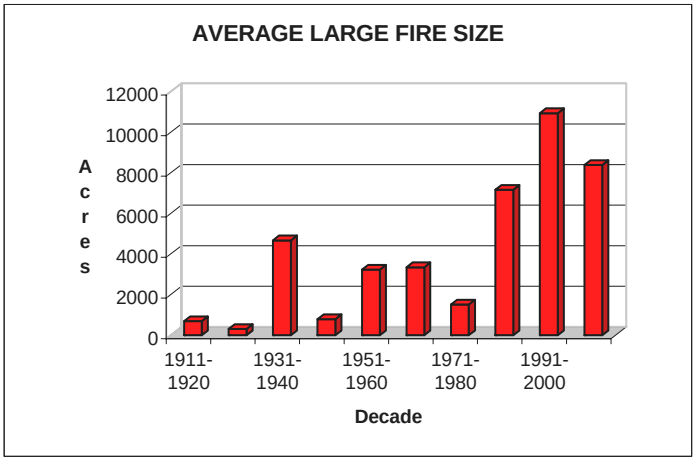
Table 3-10. Forest Structure 1875-2000

Percent of the Black Hills National Forest with:				
Year	**Trees >9”**	**5-9” in Diameter**	**Trees < 5”**	**Meadows/Seedlings**
1875	20.0%	40.0%	0.0%	40.0%
1953	48.9%	19.7%	17.9%	13.5%
1973	63.8%	22.0%	13.9%	0.3%
2000	69.8%	21.8%	2.3%	6.1%

In recent years there has been a dramatic increase in the amount of private land development in the Black Hills area. This influx of people complicates fire suppression and the use of prescribed fire or prescribed natural fire to meet management objectives.

The number of fires on the Black Hills National Forest has remained fairly constant over the past 30 years at 65 to 130 starts per year. In recent years, however, some of these fires have burned large areas. Of the fires that reach at least 300 acres in size, average fire size has increased from under 1,000 acres in the early 1900s to over 8,000 acres in recent years.

Figure 3-5. Average Large Fire Size



Between 1900 and 1980, fires at least 300 acres in size burned about 150,000 acres. Since 1980, large fires (>300 acres) have burned nearly 240,000 acres.

Historical data, personal accounts, on-site evidence, and aerial photographs indicate that wildfires have occurred throughout the Citadel project area. Data suggests that historic fire intervals ranged from about 3 to 41 years, depending on location. Fire scar data shows that the Iron Creek Fire burned approximately 30,400 acres inside and around the project area in 1899. Fire scar data also shows that the Boundary 2 Fire burned approximately 1,390 acres along the Wyoming/South Dakota border but a definite date is not known. Recently, the Beaver Fire of 2001 burned 50 acres and the Crow Peak Fire of 2003 burned 15 acres. Both of these fires were entirely within the Citadel project area.

Past and Present Vegetation Management

From 1997-2005, four different timber sales were active in the project area. During this period, harvest was conducted on a total of 2,328 acres. The Griggs Fuel Management project is also active within the project area. The Griggs plan calls for 43 acres of mulching, 1,170 acres of thinning, 500 acres of prescribed burning, and 326 acres of fuel break construction to reduce hazardous fuels and create defensible space near WUI areas in the northeastern section of the Citadel project area.

Fuel Profile and Fuel Models

Ponderosa pine is the dominant vegetation with large areas of hardwoods and upland meadows interspersed across the project area. Approximately 7 percent of the project area is comprised of quaking aspen, and three percent is bur oak. The remaining cover types consist of paper birch, grass, and white spruce.

The following table displays the different fuel models within the Citadel project area. Fuel models provide a means of categorizing fuel properties so information about fuels can be used in mathematical fire behavior models (Anderson 1982).

Table 3-11. Fuel Models in the Citadel Project Area

Stand Type	Fuel Model(s)	Comments
Ponderosa Pine	2, 9	In some ponderosa pine (PIPO) stands, usually south facing slopes, grass is

(homogeneous)		the primary understory component, representing Fuel Model (FM) 2. Homogeneous PIPO, FM9, in Citadel is usually closed canopy product other than log (POL) size trees that restrict understory growth; primary understory fuel is pine timber litter.
Ponderosa Pine (with oak, ironwood, or birch understory)	6, 8, 9	PIPO with hardwood understory is prevalent throughout northern half of project area. For short time periods in the fall prior to leaf drop, the dead foliage on the oak and ironwood represent FM6. During autumn, stands represent FM8 with significant broadleaf and needle layer that is loosely compacted. These stands typically represent FM9 in spring and summer after leaves/needles have been compacted by snow.
Quaking Aspen	8, 9	Found scattered throughout project area sometimes in large pockets, probably the result of the larger historic fires (Iron Creek) that occurred at the turn of the century. FM8 in fall, FM9 in spring. Some aspen stands have well established conifer understory which can contribute to erratic fire behavior. These stands typically do not contribute much to fire behavior.
Paper Birch	8, 9	Generally found in cool moist draws and on north faces which inherently limit fire behavior. FM8 in fall, FM9 in spring. These stands contribute very little to fire behavior and are usually used to aid control of a wildfire and sometimes as safety zones.
White Spruce	8, 10	Generally occurring in narrow stringer valleys between pine stands mostly in the southern portion of the project area. Typical spruce growth habits and fire regime allow for FM10 fuel loadings in some areas.
Grass	1	Livestock grazing limits height of grass (fuelbed depth) and amount of material available to fire. Cow dung will burn and can cause spotting problems in high wind. FM1 is usually located in valleys and transitions into the other fuel models
Previously harvested areas	10	Past harvest brush disposal was usually lop to 18” and scatter. Most needles have fallen off of slash, most 1, 10, 100 hour fuels are close to ground surface. Stumps and 1000 + hour fuels are beginning to rot but are still solid enough to affect fire severity.

Surface Fuels

In 2004, photo series data collected during common stand exams for the Citadel project area indicated that surface fuel loads of material less than 3 inches in size ranges from less than 1 ton per acre to as much as 32 tons per acre. The majority of the project area, approximately 12,000 acres, has 3 to 6 tons of fuel loading per acre.

Surface fuel loading can be used to determine the fireline intensity of a fire. Fireline intensity is a specific measurement of the amount of heat released per second by a 1 foot wide portion of the flaming front of a fire. Fireline intensity is a function of fuel type, fuel load, fuel moisture, slope, temperature, and wind. It indicates 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.

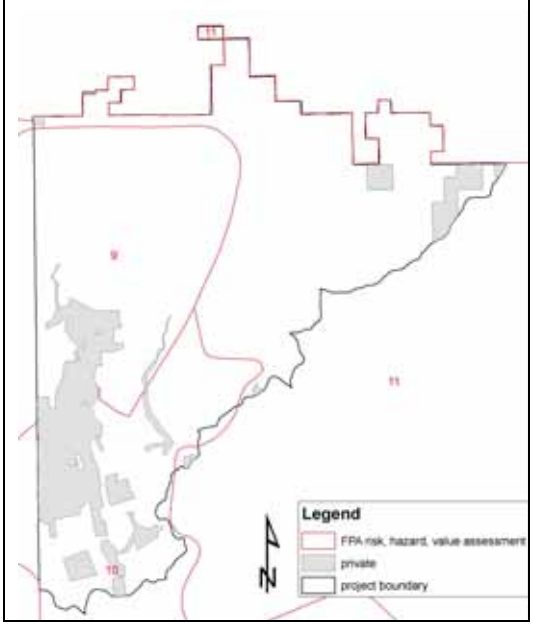
The 1997 Wildfire Prevention and Analysis Plan (also called Fire Protection Assessment), which identifies wildfire protection measures, divides the Forest into compartments that are given ratings based on the risk, hazards, and values in each compartment. Risk is the probability of wildfire ignition; hazard is the potential (based on topography and fuels) for a “large” fire to develop from an ignition source; and values are areas where loss or destruction from a wildfire would be unacceptable. Based on the evaluation of the risks, hazards, and values, a compartment is given an overall rating of low, moderate, or high. A high rating in any of the three categories gives a compartment an overall rating of high. The Citadel project area lies in 3 different Fire Protection Assessment (FPA) compartments:

Compartment 9 (Seventy Flats) is rated moderate risk, high hazard, and moderate value. The overall rating of this compartment is "high."

Compartment 10 (Little Spearfish) is rated moderate risk, moderate hazard, and moderate value. The overall rating of this compartment is "moderate".

Compartment 11 (Spearfish Canyon) is rated high risk, high hazard, and high value. The overall rating of this compartment is "high".

Figure 3-6. FPA Compartments



Forest Plan Guideline 4110 uses FPA compartments to outline acceptable fireline intensities in compartments with High, Moderate, or Low ratings. Fuels in compartments with:

- High ratings will be treated so the potential fireline intensity does not exceed 200 Btu/ft/sec during 90th percentile weather conditions,
- Moderate ratings will be treated so the potential fireline intensity does not exceed 300 Btu/ft/sec during 90th percentile weather conditions,
- Low ratings will be treated so the potential fireline intensity does not exceed 400 Btu/ft/sec during 90th percentile weather conditions.

Ladder Fuels

Typically, the smaller sapling and pole sized conifer trees make up the majority of ladder fuels in conifer stands. A significant feature affecting the type and potential severity of wildfire is the amount of deciduous vegetation below the overstory canopy within the analysis area. Bur oak, aspen, birch, and ironwood also occur within the analysis area. Of the 28,135 National Forest acres, 3,585 acres are typed as one or a mix of deciduous species. Where these scattered deciduous stands would affect potential fire behavior is mostly on northerly aspects. A wildfire burning in an adjacent conifer stand would likely decrease in rate of spread and fireline intensity upon entering the hardwoods. The ridge tops and southerly aspects would likely be the locations where wildfire would make short runs and potentially produce crown fire.

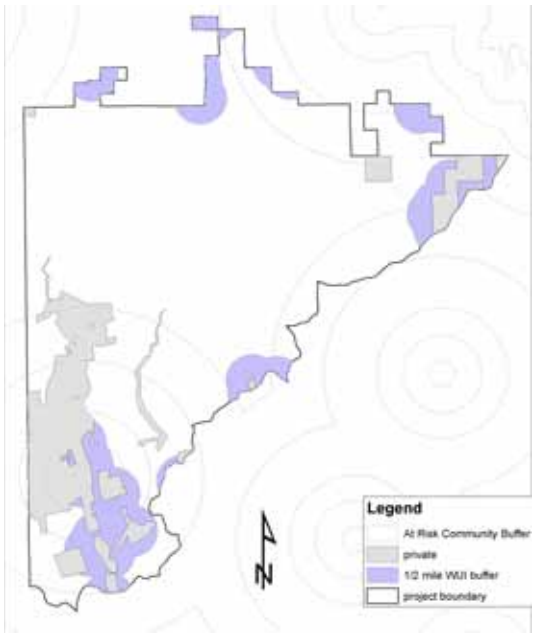
Fire Hazard Ratings Within and Outside of the WUI

The 2001 National Fire Plan (NFP) outlines a comprehensive approach to the management of wildland fire, hazardous fuels, and ecosystem restoration on Federal, State, and private lands. Goals of the NFP are to prevent loss of life, reduce firefighter injuries, and lessen damage to communities and the environment from severe, unplanned, and unwanted fires. The NFP emphasizes directing funding for fuel reduction activities toward communities that have a Community Wildfire Protection Plan in place and toward wildland urban interface areas (WUIs) with high risk reduction potential. The WUI is generally described as the zone where structures

and other human developments meet and/or intermingle with undeveloped wildland or vegetative fuels.

In addition, a list of At Risk Communities (ARC) was published in the Federal Register in August 2001. This list outlines the WUI communities in the vicinity of Federal lands that are at high risk from wildfire. The list was developed so that land managers could identify priority areas that would benefit from hazard reduction activity. Three ARCs of South Dakota are located near the Citadel project area: Spearfish, Maurice, and Potato Creek.

Figure 3-7. Half-mile Buffers and 3 Mile ARC Boundaries



In 2005, Lawrence County compiled a Community Wildfire Protection Plan (CWPP). The Lawrence County CWPP states that within 1/2 mile of all inhabited structures in Lawrence County hazardous fuels should be reduced to the point where a high intensity crown fire will not be supported. This should be done by providing conifer canopy separation, removing ladder fuels, and reducing dead and down fuel. The Lawrence County CWPP also recommends that areas within 3 miles of ARCs be managed in such a way that will minimize the chances of a crown fire from threatening the community (Mattox 2005).

Overall, the Citadel project area is one of the least inhabited portions of the Northern Hills District; however, WUI is present within the project area. The project area is approximately 2 miles southwest of Spearfish with the northern boundary of the project area abutting private property and state land. The Aspen Hills and the Mountain Plains II subdivisions are located in the northeast corner of the project area. A new subdivision is currently being constructed in Township 6N, Range 2E, Section 30. The largest proportion of non-NFS lands is in the Tinton Mining District. Currently there are 41 inhabited structures within the project area and an undetermined number of associated outbuildings. Around the 41 inhabitable structures are approximately 6,568 acres of federal land. The buffers of the three ARCs also overlap the Citadel project area (see Figure 3-6).

Forest Plan objectives direct Black Hills National Forest land managers to strive to achieve a moderate-to-low fire hazard rating in 50 to 75 percent of National Forest System lands within the WUI. The objective for most lands outside the WUI is to achieve a moderate-to-low fire hazard rating for 50 percent of the area (unless the Management Area calls for different management objectives). Movement toward these objectives is determined through analysis of the forest structural stages that are likely to result through implementation of the alternatives.

The table below displays existing crown fire hazard ratings for NFS lands in the Citadel project area both within and outside the WUI. Approximately 24 percent of the acres within the WUI have a low-to-moderate hazard rating and 24 percent of the NFS lands outside of the WUI have a low-to-moderate rating. Currently, 76 percent of the stands within and outside of the WUI are rated at high and very high.

Table 3-12. Existing Crown Fire Hazard on NSF Lands in the Citadel Project Area

Hazard Rating	WUI Acres (% of WUI)	Non-WUI Acres (% of WUI)	Total Acres (% of Total Acres)
Low	938 (14%)	3,147 (15%)	4,085 (15%)
Moderate	614 (10%)	1,853 (9%)	2,467 (9%)
High	1,856 (28%)	4,378 (20%)	6,234 (22%)
Very High	3,160 (48%)	12,189 (57%)	15,349 (54%)
Total Acres	**6,568**	**21,567**	**28,135**

Environmental Consequences

The area to be analyzed for determining direct and indirect effects of proposed fuel treatments is all lands located within and adjacent to the Citadel project area. Cumulative effects are also analyzed for all lands within or adjacent to the project area.

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Under the no action alternative, no vegetation management treatments would be implemented. Ecosystem trends and processes would continue as they have. 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. This alternative would minimize disturbance from forest management activities in the short-term, but could result in more significant effects to people and the environment from wildfire and related suppression activities in the long-term.

Fire hazard ratings would initially remain the same, but would 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. The likelihood of a surface fire transitioning to a crown fire would increase. Crown fire may be sustained once initiated. Fire suppression activities would continue, but could become more difficult and dangerous as the complexity of the forest structure increases.

Unchecked growth of conifers in hardwood stands could eventually convert these natural firebreaks into stands which area unable to alter the direction and rate of fire spread. Over time, conifer encroachment would eventually convert hardwood stands from 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.

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 likely increase. Firefighters would be required to take more aggressive actions such as utilizing mechanized equipment and 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.

Alternatives B and C

Direct and Indirect Effects

Alternatives B and C would both alter existing wildland fuels in the project area through vegetative treatments. Alternative B includes vegetative treatments for 3,445 acres in the wildland urban interface and 9,590 acres outside the wildland urban interface. As a result, fire hazard risk ratings would move toward those desired conditions specified in the Forest Plan: 36 percent of the NFS lands within the WUI would have a low-to-moderate hazard rating and 42 percent of the NFS lands outside of the WUI would have a low-to-moderate rating.

Alternative C includes vegetative treatments for 5,311 acres in the wildland urban interface and 12,469 acres outside the wildland urban interface. As a result, fire hazard risk ratings would move toward those desired conditions specified in the Forest Plan: 43 percent of the NFS lands within the WUI would have a low-to-moderate hazard rating and 46 percent of the NFS lands outside of the WUI would have a low-to-moderate rating.

Alternative C would generate the greatest improvement in fire hazard ratings over the existing condition both within and outside of the WUI, and would produce greater improvements in the fire hazard ratings than those found under Alternative B. Improvements in fire hazard rating under both alternatives could enhance fire suppression efforts by reducing the number of acres susceptible to crown fire.

Table 3-13. Alternatives B and C Crown Fire Hazard

Hazard Rating	Alternative B		Alternative C	
	WUI Acres (% of WUI)	Non-WUI Acres (% of WUI)	WUI Acres (% of WUI)	Non-WUI Acres (% of WUI)
Low	953 (15%)	3,218 (15%)	1,066 (16%)	3,248 (15%)
Moderate	1,363 (21%)	5,844 (27%)	1,777 (27%)	6,707 (31%)
High	2,450 (37%)	4,768 (22%)	1,902 (29%)	4,151 (19%)
Very High	1,802 (27%)	7,737 (36%)	1,823 (28%)	7,461 (35%)
Total Acres	**6,568**	**21,567**	**6,568**	**21,567**
Treated Acres	**3,445**	**9,590**	**5,311**	**12,469**

Vegetative treatments have direct and indirect effects on stand structure and fire behavior. Canopy base height, canopy bulk density, and canopy continuity are key characteristics of forest structure that affect the initiation and propagation of crown fire (Graham et al 2004). Overstory or crown thinning reduces crowding in the overstory by selectively harvesting some of the mature trees in the stand. Removing the crowns of mature trees from a stand reduces the canopy bulk density of the stand (reduces fuels available to a crown fire) and creates openings in the canopy (reduces canopy continuity) that can help slow a crown fire, keep a crown fire from developing, or divert a crown fire back to the ground.

During timber harvest, the crown material and other non-merchantable material can either be left in the woods (lopped and scattered) or can be brought to a central location (whole tree yarding). Whole tree yarding typically leaves approximately 25 percent of the total activity created fuels in

the unit. This is accomplished by yarding the entire tree, bole, branches, and foliage from the unit and piling unmerchantable material and slash at the landing. Whole tree yarding would be utilized in commercially harvested units where feasible to limit the amount of surface fuels that are added to the stand. The objective of this treatment is to remove as much activity fuel as possible off-site and into landing piles, where it will be later treated through routine pile burning activities. The result is a stand that is more resistant to loss from wildland fire. Areas where skidding is required for long distances would not utilize this brush disposal technique. Also, within overstory removal cutting units where minimizing residual stand damage is necessary, this harvesting technique would not be used.

Mechanically masticating or manually felling mid-story vegetation reduces the likelihood of a surface fire ascending from the forest floor to the overstory canopy by raising the canopy base height of a stand. Small diameter thinning mimics mortality caused by inter-tree competition or surface fires and concentrates site growth potential on dominant, vigorous trees (Graham et al 1999). Manually or mechanically thinning mid-story vegetation has the ability to more precisely create desired stand structure than does prescribed fire (Graham et al 2004). Used alone, manual or mechanical thinning that focuses on understory tree regeneration and shrubs can be effective in reducing the vertical fuel continuity that aids crown fire initiation (Graham et al 2004). In areas where manual felling is used, all cut material would be piled and then burned when sufficient snow cover exists to reduce the risk of fire escaping into the stand.

Mechanically masticating surface fuels reduces wildfire rates of spread and flame lengths by compacting and rearranging existing fuel loads. Compacting existing fuels brings the fuel into closer contact with the surface of the ground reducing the amount of air space that is between the fuel particles. The lack of air surrounding each fuel particle restricts combustion creating less intense fire. Rearranging existing fuel loads is beneficial because it separates fuel particles and scatters jackpots of fuel, providing less fuel per unit area to a fire. Mechanical mastication does not eliminate fuels, it only redistributes them vertically and horizontally. Additionally, mechanical mastication fragments the woody material on the forest floor creating more surface area for weather and microbes to decompose the material into nutrients for use by the remaining vegetation.

Aspen, birch, and oak stands can act as natural fuel breaks during weather conditions when conifer stands would readily carry fire. These deciduous stands can slow and even stop the advance of a surface or crown fire because the stands tend to be found in cool draws, are heavily shaded, and have foliage that is not easily ignited. With a lack of disturbance, pine and spruce can encroach into a deciduous stand and eventually replace the deciduous species in the overstory. Commercially removing and manually felling conifers in hardwood stands slows the encroachment of the conifers into these stands, improving the ability of the deciduous stands to act as natural fuelbreaks.

Prescribed fire would be utilized to reduce surface fuel loading and to reduce the density of small-diameter conifers. Prescribed fire is an effective tool that can be used to alter potential fire behavior by reducing the loading of fine fuels, duff, large woody fuels, rotten material, and live surface fuels (shrubs, seedlings) all of which compose the fuel and energy available to a surface fire (Graham et al 2004). Prescribed fire also reduces the horizontal continuity of surface fuels which limits surface fire intensity and reduces the potential of spot fire ignition (Graham et al 2004). As a prescribed fire burns over an area, burned fuels settle closer to the ground reducing the fuelbed depth which slows the combustion rate of the remaining fuels (Graham et al 2004). The lower branches of the overstory can be scorched and killed during a prescribed fire, effectively raising the canopy base height of the stand (Graham et al 2004).

In forested stands that have developed without regular disturbance a combination of mechanical harvest/thinning and prescribed fire is the most effective technique for altering the fuels matrix (Graham et al 2004). Initially treating a stand with mechanical harvest or thinning reduces canopy continuity and ladder fuels allowing for prescribed fire to be safely used as a follow-up treatment to consume surface fuels. Alternative B proposes a combination of vegetative treatments and prescribed burning on 8,107 acres within the project area. Alternative C proposes this combination of treatments on 9,007 acres.

Limited control lines would be utilized to burn units identified in Alternative B. However, specific control line locations can not be predicted at this time due to the isolated nature of some of the units. As prescribed fire is generally planned to follow commercial treatments under this alternative, it is likely that there would be opportunity to use skid trails and logging roads prior to their rehabilitation/closure. All control line locations would be reviewed by staff specialists prior to implementation. Under Alternative C, existing roads would be used for control lines in the majority of the burn units. The use of road-to-road containment would allow for larger burn blocks, minimizing the need for large amounts of new control line. However, it is likely that two miles of dozer line, three miles of hand line, and three miles of wet or black line would be needed to meet prescribed fire objectives in those areas that do not have roads or natural barriers for control. Any control lines created for the burns would be rehabilitated after the burn is completed.

Cumulative Effects

The cumulative effects area used for this analysis is defined as the project area and all adjacent WUI and ARC areas. The time period used for analysis is 15 years, the expected duration of activities proposed under the action alternatives.
The effects of the treatments under Alternatives B and C, in combination with effects of past actions and reasonably foreseeable future action in the project area are likely to result in cumulative impacts on the fire hazard rating within and outside of the WUI in the project area. From 1997-2005, four different timber sales were active in the project area, and harvest occurred on 2,328 acres). The Griggs Fuel Management Project is also active within the project area. Under the Griggs project, 43 acres of mulching, 1,170 acres of thinning, 500 acres of prescribed burning, and 326 acres of fuel break construction will reduce hazardous fuels and create defensible space near WUI areas in the northeastern section of the Citadel project area. 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 additive effects on fire hazard.

The overall effect of treatments will be to reduce fire hazard ratings in the project area. However, continued development of private land in the project area will lead to additional acres of WUI and the need to treat forested lands to bring fire hazard ratings in line with Forest Plan objectives.

3.4.3 Range

Affected Environment

Rangeland is defined in the Region 2 Rangeland Analysis and Management Training Guide as “land producing or capable of producing native forage for grazing and browsing animals and

lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. It includes all grasslands, forblands, shrublands, and those forested lands which can continually or periodically, naturally or through management, support an understory of herbaceous or shrubby vegetation that provides forage for grazing or browsing animals" (USDA-Forest Service 1996c).

The Citadel project area overlaps five grazing allotments on the Northern Hills Ranger District (NH) and three on the Bearlodge (BL) Ranger District (see Table 3-14). These allotments cover an estimated 86,350 acres of NFS land. All of the allotments use a deferred rotation grazing system.

The grazing season generally begins in mid-June and ends depending on pasture conditions, usually between September 15 and October 20. Pasture rotation schedules are revised on an annual basis during winter meetings with the permittees. The timing of use for each pasture may vary annually. Livestock numbers or length of season can be adjusted on an annual basis to adapt to climatic conditions. Forage utilization monitoring is done periodically during the grazing season to ensure Forest Plan Standards are met.

Grazing is currently authorized under permit as described below.

Table 3-14. Grazing Allotments and Permits

Allotment	District	Pastures	Number and Type of Permits	Livestock Numbers (cow/calf pairs)	Season of Use
Bear Ridge	NH	2	2 Term	98	JUN 16 to SEP 20
Higgins Gulch	NH	2	5 Term	206	JUN 16 to SEP 20
Tollgate	NH	2	2 Term	288	JUN 16 to SEP 20
Pettigrew	NH	2	1 Term	324	JUN 16 to SEP 20
Cement Ridge	NH	2	1 Term	115	JUN 16 to SEP 20
Sand Creek	BL	2	3 Term	375	JUN 16 to SEP 20
Stearns Park*	BL	7	2 Term	357	JUN 16 to OCT 5
Willow Springs*	BL	7	2 Term	369	JUN 16 to SEP 30

*The Stearns Park and Willow Springs allotments are run together under one permittee as a seven-pasture deferred rotation. The total permitted livestock number is 726 cow/calf pairs.

Environmental Consequences

Impacts to the rangeland resources in the Citadel project area related primarily to changes in forage production. Road construction, closure, and decommissioning would impact the use of available forage for livestock as well as access to range improvements necessary for proper livestock management.

No changes in current grazing management are proposed under the Citadel project. Livestock grazing would be expected to continue with current permitted numbers unless modified in Annual Operating Plans or by other NEPA decisions, and no structural range improvements are proposed in any of the alternatives.

Alternative A (No Action)

Direct and Indirect Effects

Under the No Action alternative, there would be few effects on the range resource and no effects on current allotment management. Available primary forage would remain at the current level. Secondary forage may gradually decrease. Shading from the timber overstory would limit growth of forage species.

Alternatives B and C

Direct and Indirect Effects

The action alternatives would have limited effects on the range resource. Vegetation and fuel treatments could increase and improve the browse and forage component. Potential short-term effects resulting from removal of timber overstory include provision of additional secondary forage to livestock and elk.

Any change in current allotment management resulting from implementation of the action alternatives is likely to be minimal. The allotments on which prescribed fire is proposed are on a deferred rotation grazing system. The Forest Service would coordinate burn projects and rotation and season of use by livestock to ensure adequate regrowth of forage species following burning and prior to allowing livestock to graze in the area again.

Cumulative Effects

The cumulative effects analysis area for the range resource is the total area of the affected grazing allotments including Bear Ridge, Higgins Gulch, Tollgate, Pettigrew, Cement Ridge, Sand Creek, Stearns Park and Willow Springs, both within and outside the Citadel project area. This is a total of about 86,350 acres of NFS land. Previous and foreseeable timber harvest has created and will continue to create transitory range, improving livestock distribution and forage availability. This reduces the time livestock spend on primary range. Most harvested areas have typically regenerated quickly, so the value of these areas as transitory range has been of short duration. Fire suppression has allowed forest cover to expand, negatively affecting forage availability.

Under the action alternatives, creation of transitory range would have a positive cumulative effect on those allotments by reducing the time livestock spend in riparian areas. Prescribed burning proposed under all action alternatives would work against the cumulative effect of fire suppression by killing small trees and setting back succession, though it is expected to have limited effects on overstory canopy.

All of the effects discussed would be limited in intensity and duration as far as their impacts to the rangeland resources. Any negative impacts would be minimal and are directly related to livestock management in the short term as they are impacted by treatment activities.

3.4.4 Botany

Affected Environment

The Citadel project area contains a variety of plant habitats. The entire project area itself is the north-facing flank of the South Dakota Black Hills. The highest elevations are in the southern part

of the project area and they decrease to the north. Pure and mixed stands of birch (*Betula papyrifera*) and aspen (*Populus tremuloides*) with beaked hazelnut (*Corylus cornuta*) are common on north-facing slopes throughout the project area. Dry ponderosa pine (*Pinus ponderosa*) stands are common throughout. Ponderosa pine often mixes with bur oak (*Quercus macrocarpa*) or ironwood (*Ostrya virginiana*) in the northern part of the project area. In the southern part of the project area, Black Hills spruce becomes common in drainage bottoms and north-facing slopes. The percentage of pine and spruce in hardwoods (e.g., birch, aspen, oak and hazelnut) depends on moisture levels and aspect. Open grass and sedge meadows are occasionally found in draw bottoms and along perennial waters.

The project area contains two Botanical Areas: Bear/Beaver Gulches and Higgins Gulch. These areas would not be affected by this project because no treatments or new roads are proposed under either action alternative. The project area does not contain any Research Natural Areas or montane grasslands recommended for conservation in the Survey of Black Hills Montane Grasslands (Marriott 2000).

No plant species that have been listed by the U.S. Fish and Wildlife Service as threatened, endangered, or proposed for listing as threatened or endangered occur in any South Dakota county in the Black Hills National Forest. However, recent surveys conducted in the project area have identified the occurrence of four plant species listed by the U.S. Forest Service, Region 2, as sensitive. The surveys also identified areas that are suitable for supporting at least six of the listed Sensitive plant species. Suitable habitat for Sensitive plant species is defined by the habitat category types moist forested communities and riparian communities. It is estimated that 9 percent of the project area is suitable Sensitive plant habitat. A brief description of each of the Sensitive plants for which the project area contains suitable habitat is provided below. The Botany Biological Evaluation, located in the project record, includes more detailed information about these and other species.

Table 3-15 summarizes the occurrence of and suitable habitat for R2 Sensitive plant species within the project area.

Table 3-15. R2 Sensitive Plant Species Known to Occur/With Suitable Habitat in the Project Area.

Scientific Name	Common Name	Known Occurrence In Project Area?	Suitable Habitat in Project Area?
Botrychium campestre	prairie moonwort, Iowa moonwort	No	Unknown
Botrychium lineare	narrowleaf grapefern; slender moonwort	No	Unknown
Botrychium multifidum	leathery grapefern	No	Yes
Carex alopecoidea	foxtail sedge	Yes	Yes
Cypripedium parviflorum	yellow lady's slipper	Yes	Yes
Epipactis gigantea	giant helleborine	No	No
Lycopodium complanatum	trailing clubmoss	No	Yes
Platanthera orbiculata	large round-leaf orchid	Yes	Yes
Salix candida	sage willow	No	No
Salix serissima	autumn willow	No	No
Sanguinaria canadensis	bloodroot	No	No
Viburnum opulus var. *americanum*	highbush cranberry	Yes	Yes
Viola selkirkii	great-spurred violet	No	No

R2 Sensitive Species Known to Exist in Project Area

Carex alopecoidea (foxtail sedge)

Carex alopecoidea is widely distributed from eastern to central Canada, the northeastern United States, the Great Lakes region south to Tennessee, and west to North Dakota and the Black Hills of South Dakota and Wyoming (USDA-Forest Service 2005c). Over 3,600 clumps of *Carex alopecoidea* have been counted on the Black Hills National Forest since 2001 from 29 different sites. The number of individuals at the sites ranges from one to over 800 (USDA-Forest Service 2005c).

The majority of currently known Black Hills occurrences have been documented along the upper headwaters of low-gradient perennial streams, with the majority of the occurrences associated with old beaver dams and ponds (little or no ongoing beaver activity) where flooding and disturbance have created wet to moist meadow habitat conditions. Black Hills *Carex alopecoidea* sites are most often open, with little to no canopy cover and are located at elevations between 4,100 and 6,400 feet. Documentation for the majority of the sites indicates that *Carex alopecoidea* individuals occur primarily in the transitional areas between saturated soils and the immediately adjacent mesic upland areas, and individuals are often found on the downstream side of old beaver dams (USDA-Forest Service 2005c).

Within the Citadel project area, there are approximately 5 reaches of stream, ranging from a 0.5 miles to 2 miles each that are known to support *Carex alopecoidea*. Individuals per site range from approximately 50 to 270.

Cypripedium parviflorum (yellow lady's slipper)

In North America, *Cypripedium parviflorum* occurs from Alaska to Newfoundland, south to Washington, Arizona, New Mexico, Kansas, Mississippi, and Georgia. Occurrences have been located on three of the Black Hills National Forest Ranger Districts (Bearlodge, Northern Hills and Mystic). Currently known locations in the Black Hills indicate that the species is associated with mesic conditions on limestone rock outcrop areas, often on north-facing slopes, and on mesic to saturated conditions in and adjacent to riparian areas. *Cypripedium parviflorum* is often associated with hardwoods, conifer-deciduous communities, deciduous communities and conifer, mostly *Picea glauca* (white spruce) communities (USDA-Forest Service 2005c).

Within the Citadel project area, there are approximately 12 discrete occurrences of *Cypripedium parviflorum*. Individuals per site range from approximately 1 to 43.

Platanthera orbiculata (large round-leaved orchid)

Platanthera orbiculata (large round-leaved orchid) is endemic to the boreal regions of northern North America from Newfoundland to southern Alaska, with a more southern distribution in the eastern United States into the Appalachians and Great Lakes. In the Black Hills, it primarily occurs as disjunct occurrences in remnant boreal/hardwood forest in the Bearlodge Mountains of Wyoming and the northwestern limestone plateau and Black Elk Wilderness in South Dakota.

Platanthera orbiculata is relatively secure in the Black Hills based on the large number of occurrences (31) distributed in three geographically separated regions on Forest-administered land, each within a different geological type: Bearlodge Mountains, northwestern Black Hills (contains the largest cluster of sites), and Black Elk Wilderness. In the Black Hills, scattered occurrences are located in sheltered, north-facing, forested slopes in damp humus-rich soil at elevations from 4,300 to 6,000 feet. This species is often associated with dense understory

vegetation in mid to late-successional paper birch/hazelnut forest, often with an overstory component of white spruce. Historically in the Black Hills, periodic fires likely maintained the successional paper birch/hazelnut forests where *Platanthera orbiculata* occurs. Within appropriate habitat, the sparse and patchy distribution of this species may be due to its specialized interactions with mycorrhizal fungi and insect pollinators and other micro-habitat conditions (USDA-Forest Service 2005c).

Within the Citadel project area, there are approximately 14 occurrences of *Platanthera orbiculata*. Individuals per site range from 1 to 115.

Viburnum opulus var. *americanum* (highbush cranberry)

Viburnum opulus var. *americanum* (highbush cranberry) is a widespread species with disjunct occurrences in the Black Hills in South Dakota and Wyoming. It is widely distributed across north central North America; in Canada from Newfoundland to southern British Columbia; and in the United States from Maine to Washington, extending southward to Kentucky, Missouri and Nebraska (USDA-Forest Service 2005c). Occurrences are widely dispersed across the Forest Currently known occurrences are distributed over a wide elevational range from 3,800 to 5,700 feet and within 10 sixth level watersheds on Forest lands.

On Forest lands *Viburnum opulus* var. *americanum* is primarily associated with moist but well-drained sites and grows in dense shrub thickets and in deciduous woodlands with tree canopy covers ranging from zero to 90 percent (some areas have a limited number of conifer species). The majority of the reports document the species to be associated with dry to moist soil conditions, often in and adjacent to upper watershed ephemeral draws and on gentle to steep wooded hillslopes, with most of the shrubs occurring on northern aspects (USDA-Forest Service 2005c).

Within the Citadel project area, there are approximately 18 patches of *Viburnum opulus* var. *americanum*. Individuals per site range from approximately 1 to 50.

R2 Sensitive Species with Suitable Habitat, No Known Occurrences

The Citadel project area also contains suitable habitat for two additional Sensitive plant species, though no instances of these plants were identified on Natioanl Forest System land in the project area: *Botrychium multifidum* and *Lycopodium complanatum.* In the Black Hills, the primary habitat for these species is riparian communities or moist forested communities usually with a birch or spruce component

R2 Sensitive Species with Undefined Suitable Habitat

There are two Sensitive plant species for which suitable habitat has yet to be defined: Botrychium campestre (prairie moonwort or Iowa moonwort) and Botrychium lineare (narrowleaf grapefern or slender moonwort). There are no known occurrences of these species in the project area.

Black Hills National Forest Plant Species of Local Concern

The Black Hills National Forest has identified plant species that may have declining trends in only a portion of Region 2 of the Forest Service or that are important components of diversity in a local area (FSM 2600, Chapter 20, Supplement No. r2_bh_2600-2005-1). These species are referred to as Species of Local Concern.

Two Plant Species of Local Concern (SOLC) are known to occur in the Citadel project area: *Lycopodium annotinum* (stiff clubmoss) and *Polystichum lonchitis* (northern hollyfern). The primary habitat for both of these species is moist forested communities. Suitable habitat for four additional botanical SOLC exists within the project area as well. Moist forested communities are also capable of supporting *Listeria convallarioides* (broadlipped twayblade). Riparian communities are capable of supporting *Gentiana affinis* (pleated gentian), *Petasites satittatus* (arrowleaf sweet coltsfoot), and *Salix lucida* (shining willow).

Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects

There would be no direct effects to known occurrences of or suitable habitat for Sensitive plants or plant Species of Local Concern 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 habitat and protect biodiversity in the short-term (next 20 years), although over time there may be indirect effects to suitable habitat (e.g., change in species composition due to succession, lack of disturbance, or changes resulting from disturbances such as wildfires).

Cumulative Effects

The cumulative effects area for Sensitive plants and plant SOLC is the suitable plant habitat within the project area. The cumulative effects analysis for species persistence is bounded in time as the next 50 years, as described in the Phase II FEIS. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (USDA-Forest Service 2005c).

Soil disturbance, introduction of invasive species, and changes in microsite moisture and hydrologic regimes can negatively affect Sensitive and plant SOLC as well as their suitable habitat. 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 decreased suitability of many of these habitats for Sensitive plant species.

Under Alternative A, negative effects from disturbance would not occur. The absence of treatments under Alternative A could contribute to negative cumulative effects for 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 suitable habitat. This could create more intense wildfire conditions and increase the risk of fire spreading into suitable habitat. In some cases, increased fuel loading could potentially cause a reduction in available water to Sensitive plant species habitats.

Under Alternative A, travel management would remain the same as now. No new roads, reconstructed roads, or decommissioned roads are proposed. Therefore, negative cumulative effects resulting from new or reconstructed roads would not occur. In addition, beneficial effects from decommissioning roads would not occur.

Determinations

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.

Alternatives B and C

Although these two alternatives have differences in objectives, types of treatments, and acres to be treated, the types of effects to occurrences of and habitat for Sensitive plants and Species of Local Concern are anticipated to be similar. For this reason the anticipated effects of both action alternatives on these categories of plants and habitats are discussed together.

Direct and Indirect Effects

Vegetation Treatments and Fuels Treatments
Mechanical vegetation treatments have the potential to directly affect Sensitive plants and plant Species of Local Concern or suitable habitat (moist forested and riparian communities) for these species. Potential effects include trampling of individual plants, ground disturbance and soil compaction resulting from use of heavy equipment. Because the action alternatives do not allow for mechanical treatment within suitable habitat, direct effects are likely to be minimal and comparable between the alternatives.

Prescribed fire is a proposed treatment that may occur adjacent to or surrounding known Sensitive plant occurrences and/or their suitable habitat in both action alternatives. There are 363 acres of suitable plant habitat that occur within or adjacent to proposed prescribed burn units in Alternative B and 764 acres in Alternative C. The suitable habitat within proposed prescribed burn treatments in Alternative B has 11 known occurrences of Sensitive plants and the suitable habitat within proposed prescribed burn treatments in Alternative C has 18 known occurrences of Sensitive plants.

The intensity and severity of a fire as it burns through vegetation is determined by three environmental factors: weather, topography, and fuels. One aspect of weather that affects fire behavior is the addition and subtraction of moisture in vegetation and down woody material through relative humidity and precipitation. Topography, especially the direction a slope faces, or the aspect of the slope, also affects fire behavior; south and west facing slopes tend to be hot and dry while north and east facing slopes tend to be cooler and moister. Fuels (wildland vegetation and down woody material) create different types of fire behavior based in part on fuel moisture and fuel temperature.

The areas of suitable plant habitat within the Citadel 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, suitable 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) and fall (mid-September-January) to take advantage of moderate daytime temperatures and low night time temperatures, higher relative humidity's, increased chance of precipitation, lower fuel temperatures and higher fuel moisture content. Additionally, risk to Sensitive plants and their habitat is further reduced because these burns would most likely occur when plants are dormant (that time period between plant quiescence in late fall and green up in early spring).

By utilizing moderate weather conditions and by taking advantage of an ecosystem's inability to carry fire, it is possible to contain a prescribed fire without constructing soil disturbing control line (i.e. handline or dozerline). Instead, two other control techniques, wet lining and black lining, can be used in addition to these natural fuel breaks, to contain the prescribed fire.

Black lining can be used where suitable plant habitat occurs within or adjacent to a burn unit. During implementation the ignition crews will not ignite within the suitable habitat, but will ignite adjacent to these areas. Because suitable plant habitat typically does not carry fire, the fire that is ignited adjacent to the habitat will move away from the habitat as it burns into fuels that are more receptive to fire (timber litter) creating a "black" unburnable area adjacent to the habitat. Though suitable plant habitat does not typically carry a fire, some low intensity creeping of the fire into the habitat (including locations of known occurrences) can be expected prior to the fire extinguishing itself in the moist fuels.

Wet lining can be used in conjunction with black lining to further minimize impacts to sensitive areas. In areas where fire engines or hose lays can be used, personnel will precede the ignition team to pre-treat vegetation in the suitable habitat by wetting the vegetation with water making it resistant to fire.

Prescribed burn blocks are only proposed in Alternative C. Proposed prescribed burn blocks will be contained primarily by existing roads. However, three miles of wet line or black line will be used where fire containment is needed adjacent to or within suitable plant habitat. At the time of burn plan preparation, a botanist will be consulted on the location and type of line to be used in an area to further minimize impacts to the suitable plant habitat. Prior to implementation of the burn, the suitable habitat will be delineated on the ground by the botanist. There are 3 segments of wet line or black line that may be used adjacent to or within suitable habitat:

1 & 2. North and west of Crow Peak there are 2.8 miles of wet line or black line proposed. 1.1 miles is along Crow Creek (control line G) and .05 miles are along an unnamed drainage north of Crow Peak (control line H). The suitable habitat, with no known occurrences, in these sites is described as birch/ironwood/hazelnut on the low slopes and grass/*Carex* riparian in areas where the intermittent surface water is present.

3. Approximately .06 miles of wet line or black line (control line L) will occur in suitable habitat in a northwest facing slope along Bear Gulch, .75 miles northwest of Beartown Hill. This site is described as being a botanically diverse site with spruce and birch, although there are no known Sensitive plant occurrences.

Activities associated with prescribed fire treatments, under both action alternatives, may result in direct impacts to habitat and/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.

A potential indirect effect that is hard to predict and quantify 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 1996b). It is possible that an increase in available moisture could occur and that increase would improve or expand suitable R2 Sensitive plant habitat.

Vegetation and fuels treatments have the potential to indirectly affect suitable habitat and individual plants through the introduction of noxious weeds in nearby areas. Noxious weeds have the potential to outcompete desired plant species, and spray from herbicides used to help control weeds can also have negative effects on Sensitive plants. However, implementation of Standards and Guidelines in the Forest Plan and the Black Hills National Forest Noxious Weed Management Plan would help mitigate this effect.

Meadow Enhancement and Hardwood Enhancement Treatments
In Alternative C there are 10 units proposed for commercial hardwood enhancement treatments, non-commercial hardwood enhancement treatments, and non-commercial meadow enhancement treatments adjacent to 6 *occurrences* of *Carex alopecoidea*. In Alternative B, one of these treatment units is next to one occurrence of *Carex alopecoidea*. Currently, information gaps exist in understanding *Carex alopecoidea's* habitat preferences, therefore, at this time, these occurrences will be avoided so that site conditions (i.e. canopy cover) will be maintained.

There are three units of commercial hardwood enhancement treatments in Alternative C and two of these same units in Alternative B, which are adjacent to *suitable habitat* (although this habitat is not currently known to be occupied by Sensitive plants). Through design criteria, these sites would be avoided.

Commercial hardwood enhancements would involve removal of pine trees >9" dbh. with the goal of maintaining the hardwood and meadow communities by reducing competition by ponderosa pine. Whole tree logging is the preferred method. For non-commercial hardwood and meadow enhancements (both non-mechanized treatments), small unmerchantable trees (generally < 9"dbh) would be removed from hardwood and meadow areas and within a 30 foot buffer of these areas. Cut materials would be lopped and scattered to maintain nutrients on site. The goals of this treatment are to eliminate encroaching pine from hardwood and meadow areas and maintain habitat diversity.

Indirect effects to occurrences of *Carex alopecoidea, Cypripedium parviflorum, Platanthera orbiculata,* or *Viburnum americanum* var. *americanum* and suitable Sensitive plant habitat under Alternatives B and C include the potential 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 Phase II of the Black Hills National Forest Land and Resource Management Plan and the Black Hills National Forest Noxious Weed Management Plan will help reduce indirect effects on Sensitive plant occurrences and suitable 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 plants.

Transportation System
Road construction has the potential to directly and indirectly affect plants and their habitat. Construction of roads can degrade habitat, and heavy equipment can crush individual plants. In

addition, roads act as corridors for the dispersal of invasive weeds. Alternatives B and C include construction of four segments of new road (totalling 0.28 miles) through suitable habitat. Effects of road construction are expected to be minimal because no known occurrences of Sensitive plants or plant SOLC are within this habitat. A botanist would work with the road engineer to determine the best placement of these roads considering habitat and feasibility. Degredation of riparian areas and moist soils is further reduced through protective measures associated with Forest Service Manual 2509.25 - Watershed Conservation Practices Handbook. Adherence to Forest Plan Standards and Guidelines and the Noxious Weed Management Plan would help minimize the invasion and spread of noxious weeds.

In October 2004, a closure order was issued for Botanical Areas (closure order #082-2004). The order prohibited use of motorized vehicles off Forest System Roads within specified areas. Approximately 6.2 miles of new road construction is proposed under both action alternatives. These roads are within the botanical area closure boundary, but not within the Botanical Areas themselves (3.4 miles in the Higgins Gulch Botanical area closure boundary and 2.8 miles in Bear/Beaver Gulches Botanical area closure boundary). These roads will be closed following completion of project activities. However, the potential exists for unauthorized off-road motorized vehicle use in the Botanical Area closure area. Once roads are created it is often difficult to effectively enforce closures. Potential indirect effects include trampling or uprooting individual plants and degradation of associated habitat (e.g., soil compaction, baring mineral soil, litter removal).

A possible beneficial indirect effect under Alternatives B and C could result from the decommissioning of 31 miles of roads. Allowing the land to be free of disturbances caused by motorized travel in these areas has the potential to improve plant habitat over the long-term by allowing vegetation to reestablish and shade and moisture levels to increase as a result of increased canopy cover. Decommissioning roads would have a beneficial effect to all plant communities and “eventually, obliterated roads would be expected to function like undisturbed areas” (USDA-Forest Service 1997). In both action alternatives, approximately 9.2 miles would be decommissioned in suitable plant habitat and approximately 2.4 miles in botanical areas.

Cumulative Effects

The cumulative effects area for the 6 R2 Sensitive plant species analyzed in this section, 4 species with known occurrences and 2 species with suitable habitat but no known occurrences in the project area, is suitable 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 FEIS associated with the amendment to the Forest Plan. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (USDA-Forest Service 2005c).

Soil disturbance, introduction of invasive species, increased fuel loading, and changes in micro site moisture and hydrologic regimes can negatively affect Sensitive 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 plant species.

Implementation of Alternative B or C could contribute to the spread of invasive species and noxious weeds resulting from soil disturbing activities in the proximity of Sensitive plant species. These activities include mechanical treatments associated with logging, fuel reduction practices, and commercial hardwood enhancements, prescribed burning, and road building and road reconditioning. 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 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.

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 suitable 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 and fire-sensitive species are more likely to be maintained (USDA-Forest Service 2005c).

Determinations

Alternatives B and C 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. The project area was surveyed for Sensitive plants and suitable habitat, and the alternatives were designed so that suitable habitat would generally be avoided.

Viability determinations for Sensitive plant species were made at the Forest level in the Phase II FEIS. These determinations assume that conservation measures (objectives and protective standards and guidelines) will be applied and implemented as written. Standards and guidelines are being followed for both action alternatives in the Citadel project area.

Comparison of Magnitude of Effects for Alternatives B and C

Table 3-16. Comparison of Action Alternatives

	Action Alternative		**Anticipated Differences, Relating to Botanical Resources, Between Action Alternatives**
	B	**C**	
Acres treated-- vegetation treatments (other than prescribed fire)	12,190	12,578	Essentially the same, no anticipated difference There is the potential for both more negative and positive direct and indirect effects (e.g. burning plants,
Acres treated-- prescribed fire	8,952	14,209	
Number of acres of suitable habitat within all RIS units proposed for treatment	660	977	

With effective design criteria, number of acres of suitable habitat within all RIS units proposed for treatment	0	0	reducing adjacent fuels loading, increasing weed infestations) in Alternative C.
Number of acres of overlap with suitable habitat and vegetation treatments	593	604	
With effective design criteria, number of acres of overlap with suitable habitat and vegetation treatments	0	0	
Number of acres of overlap with suitable habitat and prescribed fire	363	764	
With effective design criteria, number of acres of overlap with suitable habitat and prescribed fire	0	0	
Number of acres of overlap with known occurrences and prescribed fire	11	18	
With effective design criteria, number of acres of overlap with known occurrences and prescribed fire	0	0	
Miles of wet line or black line adjacent to/within suitable habitat	0	1.2	
Miles of new road construction in project area	18	17	No anticipated difference
Miles of road reconstruction in project area	35	35	No difference
Miles of new roads across suitable habitat	0.28	0.28	No difference
Miles of new roads in Botanical Areas	0	0	No difference
Miles of new roads in Botanical Area closure boundaries	6.2	6.2	No difference
Roads decommissioned in project area	31	31	No difference

3.4.5 Noxious and Invasive Weeds

Affected Environment

It is estimated that 80 percent of the lands administered by the Black Hills National Forest are infested with varying populations of noxious weeds. Known weed species found in the project area are displayed in Table 3-17.

Table 3-17. Noxious Weeds

Scientific Name	Common Name	Acres
Cirsium arvense	Canada thistle	50
Tanacetum vulgare	Common tansy	7
Cynoglossum officinale	Houndstongue	21
Verbascum thapsus	Common mullein	36
Carduus nutans	Musk thistle	51

Scientific Name	Common Name	Acres
Hypericum perforatum	St. Johnswort	22
Linaria vulgaris	Yellow toadflax	1
TOTAL		**188**

Soil-disturbing activities associated with timber sales typically encourage the establishment and spread of noxious weeds. Left untreated, these weeds often 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 most susceptible to infestation. A review of timber sales indicates that we can expect up to 3.5 percent of the total acres in a timber sale to be infested by noxious weeds. Known weed infestations occur in areas proposed for activities.

Environmental Consequences

Any time ground disturbance occurs noxious weeds have the potential to spread from existing infestations or for new species to colonize. Many noxious weeds out-compete native and other desirable species because they are early successional species, can produce chemicals that inhibit the growth of other species, grow rapidly and 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).

Alternative B proposes approximately 12,190 acres of vegetation treatment and 845 acres of prescribed fire of which it is estimated that 211 acres may experience moderate to high fire intensity. In addition, this project proposes the construction, reconstruction and maintenance of approximately 109 miles of roads and approximately 7.7 miles of prescribed fire control lines.

Alternative C proposes approximately 12,578 acres of vegetation treatment and 5,202 acres of prescribed fire of which it is estimated that 1,252 acres may experience moderate to high fire intensity. In addition, this project proposes the construction, reconstruction and maintenance of approximately 108 miles of roads and prescribed fire control lines will be road to road containment unless prescribed otherwise by the fuels specialist.

Along each road proposed for construction, reconstruction or pre-use maintenance, approximately five feet on either side of the running surface is capable of supporting noxious weeds until revegetated. Of the total miles worked, it is estimated that approximately 10% will actually become infested with weeds.

Alternative A (No Action)

Direct and Indirect Effects

Mature stands of timber are common in the project area, creating large contiguous areas of similar structure. This creates the potential for wildfire and beetle infestation. Both could play a role in noxious weed spread. An increase in downed timber from beetle kill would increase the potential for wildfires to spread and burn with increased intensity, creating large areas of bare ground on which weeds could become established and outcompete 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 would hamper 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 outcompete noxious weeds in areas where infestations already exist. As a result, these infestations would be likely to increase.

Inventory and treatment of noxious weeds would continue. Roads and trails would continue to be avenues for spread of noxious weeds. Off-roading by recreational vehicles would continue to promote the spread of noxious weeds by providing a means of transport. Seeds collect in wheel-wells and grills of ATVs and other off-road vehicles and are dispersed as machines travel. In areas where resource damage has occurred and bare soil is exposed, opportunities exist for the establishment of new infestations.

Alternatives B and C

Direct and Indirect Effects

Noxious weed infestations are expected to increase under both action alternatives. Commercial and non-commercial timber harvest activities as well as mechanical fuel reduction activities often provide mechanisms for the introduction, establishment, and spread of noxious weeds. Anywhere there has been some form of soil disturbance, the potential for the establishment of noxious weeds is high. The potential is even higher when there are existing populations in or near the area of disturbance. This increases exponentially with the movement of equipment in and out of these areas. Roads create a network of corridors through which seed dispersal occurs.

The following formula was used to estimate potential additional infestation due to the action alternatives (USDA-Forest Service 1996b). A ten-year review of timber sales estimated that between 2.0% and 3.5% of the acres in a timber sale are likely to develop weed infestations. For the purpose of this analysis, 3.0% of all treatment activities except prescribed fire were used. New road construction and reconstruction would result in approximately 0.12 acres of new weed infestation per mile of road (USDA-Forest Service 1996b). Alternative A would not result in any new acres of weed infestation. Alternative B would likely lead to approximately 379 acres of new infestation. Alternative C would likely lead to approximately 390 acres of new infestation.

Additional acres may be infested as a result of prescribed fire. Dozer lines, hand lines, staging areas, and areas burned so that mineral soil is exposed are susceptible to weed infestation. At this time there is not a formula to estimate acres infested. Too many variables, such as soil temperature, fire intensity, and time of year, play into the effects prescribed fire has on noxious weeds. While beneficial to forest health, fire can also be conducive to the spread of noxious weeds. Broadcast burning is proposed to be low-intensity, but there would probably be pockets of higher intensity fire (estimated to occur on about seven percent of the burned acres) that could result in exposure of mineral soil and loss of understory herbaceous species. The loss of existing grasses and forbs provides an opportunity for weeds to become established. Many noxious weed species are very competitive and may prevent re-establishment of desirable grasses and forbs. Seeding of these areas would be required. Pre-treatment of weed infestations prior to prescribed fire implementation is important to reducing the risk of spread. Again, movement of equipment needed during fire operations can contribute to the spread of weeds. There is a risk of new species being introduced to the area when equipment is brought in from out of the local area. It should be noted that fire managers plan to use existing roads as control lines wherever possible, which should considerably reduce the need to construct lines on previously undisturbed ground.

Funding would be required to control and monitor noxious weeds. This funding would most likely originate from timber receipts obtained from this project and made available for sale area improvements under the Knutson-Vandenburg (KV) Act. Currently the average cost per acre to

treat through conventional herbicide application is $190.44. Monitoring would be required as well, at a cost of $11.32 per acre. Usually KV plans run for three to five years. Table 3-18 and Table 3-19 show the costs of weed treatment and monitoring by alternative for a total of five years. Inflation was not considered in the cost. This analysis assumes a 20% reduction in acres each year.

Table 3-18. Cost Comparison for Weed Treatment and Monitoring

Alternative	Year 1	Year 2	Year 3	Year 4	Year 5	Total
B	$107,979	$86,383	$69,107	$55,286	$44,229	$362,984
C	$110,074	$88,059	$70,447	$56,357	$45,086	$370,023

Table 3-19. Cost Comparison for Monitoring by Alternative

Alternative	Year 1	Year 2	Year 3	Year 4	Year 5	Total
B	$6,418	$5,134	$4,107	$3,286	$2,629	$21,574
C	$6,543	$5,234	$4,187	$3,350	$2,680	$21,994

Actual costs for all alternatives are likely to be somewhat higher due to prescribed fire.

Travel management plays a role in the spread of noxious weeds. Roads and trails provide avenues and corridors through which noxious weeds can spread. Off-road vehicle use increases the risk of spread as well as the rate of spread for many weed species. Resource damage that results from extensive use by off-road vehicles can result in areas of bare ground that provide opportunities for new infestations to become established. Even in winter, off-road vehicle use has the potential to spread weed seeds. Snowmobiles can pick up seeds if seed heads are above the snow. Proposed actions may increase the likelihood of motorized off-road travel due to expansion of the road system and removal of vegetation allowing access to new areas.

Alternative C may have a slightly higher potential to increase noxious weed infestations due to the largest proposed area of mechanical treatment and the most road construction.

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.

Cumulative Effects

The cumulative effects analysis area for noxious weeds is the project area plus private land inholdings. The time period used for analysis is 15 years, the expected duration of activities proposed under the action alternatives.

Previous and foreseeable activities such as timber harvest, off-road vehicle use, road construction and maintenance, and livestock concentration around water sources 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 water developments. Activities and effects on private land appear to be much the same as those on NFS lands.

Noxious weeds have been and will 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 cost. 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.

All action alternatives are likely to add to 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. With the level of treatment proposed and probable resulting ground disturbance, however, 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.

3.4.6 Wildlife

This section summarizes the Wildlife Specialist Report and Biological Evaluation/Biological Assessment (BE/BA) for wildlife, which are located in the project file. The full reports contain detailed data and descriptions of habitat associations for threatened and endangered wildlife species, Region 2 Sensitive Species, Management Indicator Species, Black Hills National Forest Species of Local Concern, and migratory birds. The information that follows includes a discussion of habitat components and each category of wildlife species covered in the Wildlife Specialist Report and BE/BA. Because the analysis covers so many species, the description of the affected environment and environmental consequences are grouped together by species to facilitate comprehension.

HABITAT COMPONENTS

Affected Environment & Environmental Consequences

The Forest Plan specifies objectives, standards, and guidelines that apply Forest-wide to guide planning and implementation of resource management activities in various habitat types. A brief analysis by habitat community follows.

Hardwood Communities

The project area contains 3,585 acres (13% of project area) of stands typed as hardwoods. These include oak, aspen and paper birch. Numerous drainages and stands typed as ponderosa pine also support aspen and oak communities, and many stands are mixed with scattered white spruce. Some hardwood stands have undergone pine removal; others need pine removed to reduce competition with ponderosa pine. Under Alternative A (the no action alternative), pine would likely continue to encroach on hardwood stands and, through time, decrease the amount and integrity of hardwood stands in the area. Alternatives B and C would increase and enhance hardwood stands by removing pine from 135 acres and 787 acres of aspen stands respectively.

Meadow/Grassland Communities

The project area contains 365 acres (1.3% of project area) in natural openings, meadows and prairie. Grasslands and meadows provide unique habitats not found elsewhere within the forested ecosystem. Many of these meadows are being encroached upon by adjacent ponderosa pine, and

in some cases bur oak and aspen. In the absence of treatment or natural disturbance, meadow habitat will eventually disappear. Ponderosa pine has also encroached upon riparian meadow habitat. This encroachment is decreasing the quantity of riparian grassland habitat. Under Alternatives A and B, pine would likely continue to encroach into meadows and through time, decrease their amount and integrity. Alternative C would increase and enhance meadows by removing encroaching conifers from 106 acres of meadow habitat.

Snags and Down Logs

The Phase II Amendment FEIS determined that future snags would be provided through the diversity of structural stages across the Forest through structural stage objectives. At the project level, snag standards 2301 and 2305 would be met for all alternatives. That is, all existing snags would be left standing except those cut for safety reasons and during construction of roads, skid trails, log landings, and firelines. Under Alternatives B and C, prescribed burning (845 acres or 5,202 acres, respectively) is expected to create more snags than are lost, but most of these snags would likely be in smaller size classes. However, under Alternative C, the proposed burning of the Crow Peak area could create snags of all sizes because there would be no treatment before burning, the area has very steep slopes and it would intentionally be allowed to burn hotter than other prescribed burn areas beneath harvested stands.

Late Succession Forest

The project area contains 1,299 acres classified as Structural Stage 5 (late succession or old growth). This represents approximately 4.6% of the ponderosa pine stands in the project area. There are also 6,403 acres classified as 4C (mature with >70% canopy cover). These stands exhibit some late successional characteristics. Prescribed understory burning of late successional forest would occur to allow for nutrients to cycle back into the soils while preventing a loss of canopy cover (no changes in structural stages are anticipated). Alternative A (the no action alternative) meets late succession structural stage objectives.

In Alternative B, the following management areas will not meet ponderosa pine structural stage 4C and 5 (late succession) targets at the project level (5% of each): MA 5.1 (with a 38 acre reduction of 4C- moving existing structural stage conditions in the project are from 11% to 2%) and MA 5.6 (with a 2,489 acre reduction of 4C-moving existing condition in the project area from 28% to 4%; and with a 110 acre reduction of 5-moving existing conditions in the project area from 5% to 4%). However, it should be noted that Forest-wide Management Areas 5.1 and 5.6 exceed Forest Plan Objectives for Structural Stage 4C. Therefore a reduction of 4C at the project level would not be moving the Forest away from 4C Structural Stage objectives. It should also be noted that there is currently a Forest-wide deficit of Structural Stage 5 and under this alternative 297 acres of Structural Stage 5 in the project area would be lost, moving the Forest away from the Structural Stage 5 objectives. Under this alternative 822 acres of 4C and 301 acres of 5 would be prescribed burned.

Alternative C does not meet 4C targets at the project level (5% 4C). This alternative would reduce 4C by 38 acres in MA 5.1 (moving existing conditions in the project area from 11% to 3%). However, it should be noted that Forest-wide, Management Area 5.1 exceeds Forest Plan Objectives for Structural Stage 4C. Therefore a reduction of 4C at the project level would not be moving the Forest away from 4C Structural Stage objectives. Under this alternative 138 acres of 4C would be prescribed burned; no old growth would be harvested.

Riparian/Aquatic Communities

The main stream channels of Bear Gulch and Beaver Creek flow in a northerly direction into Redwater Creek (also referred to as Redwater River) and Crow Creek, respectively. The drainages of Higgins Gulch, Johnston Gulch, and Fish Hatchery Gulch flow into Spearfish Creek. Both Crow Creek and Spearfish Creek eventually flow into Redwater Creek (the 5th level Watershed) north of Spearfish. The entire length of these streams may not be perennial, as stream flows may go underground when crossing the loss zone associated with the Madison and Minnelusa limestone outcrops. The approximate loss zone thresholds for Bear Gulch, Beaver Gulch, Higgins Gulch and Spearfish Creek are 4 cubic feet per second (cfs), 9 cfs, 0 cfs and 23 cfs, respectively (Cater et al 2002).

Loss of beaver, past livestock over-utilization, illegal and legal motorized traffic, flooding events, and road development have all contributed to degradation in these streams' character and health. Ponderosa pine has encroached on riparian habitat as well. This encroachment is decreasing the quantity of riparian grassland habitat, as well as riparian shrubland habitat. The amount of willow throughout the project area is minor and scattered throughout many of the drainages.

THREATENED & ENDANGERED SPECIES

Bald Eagle (*Haliaeetus leucocephalus*)—Affected Environment & Environmental Consequences

Bald eagles are closely associated with water and are rarely seen far from aquatic environments. Between 1998 and 2005 bald eagles were observed on the Black Hills National Forest 308 times. Observances ranged from 19 in 2005 to 69 observances recorded in 2000. The presence of bald eagles is determined more by the availability of carrion than any other factor. Wintering bald eagles have been documented in the project area. However, optimal habitat is lacking due to the absence of large, fish supporting streams. No roost trees have been documented in the project area. Potential effects are extremely low because of the dispersed use of this area by wintering eagles.

Populations of wintering eagles will likely continue to be well supported in and around the Black Hills and within the Citadel project area. Its primary winter food source of deer carrion will continue to be available as deer numbers increase. Habitat conditions for deer across the Black Hills are likely to remain stable or increase, and management activities proposed for the project area will enhance deer habitat and may further increase deer numbers, benefiting the eagle.

Direct and Indirect Effects

Alternative A would result in no direct impacts because no new activities would occur.
Under Alternatives B and C, migrating and foraging birds may avoid the project area in the short term (over the next 10 years), during timber harvest and burn activities. There would be no long-term effects on bald eagles resulting from the action alternatives since no nesting territories or roosting sites are in the analysis area.

Cumulative Effects

Human disturbance associated with roads and trails in the area may contribute to the cumulative effects to bald eagles. However, most disturbances associated with these activities occur in the

spring, summer and fall. Therefore the cumulative effects from these disturbances to migrating and wintering eagles would not likely occur or would be minimal, causing eagles to temporarily avoid the area. In addition, the Citadel project area contains seasonal (winter) or year-round vehicle closures in the northern half of the project area although some snowmobile use is allowed.

Determination for Bald Eagles

Alternative A proposes no new activity and would therefore have no effect on the bald eagle. Likewise, Alternatives B and C would have no effect on the bald eagle due to the absence of eagles in the area during breeding periods, lack of roosting sites and mobility during winter. Since it was determined that the alternatives would have no effect on bald eagles, no consultation with the U.S. Fish and Wildlife Service was conducted for the Citadel project.

REGION 2 SENSITIVE SPECIES

A total of six wildlife species listed on Region 2's Sensitive Species list have been recorded in the Citadel project area. In addition, the project area contains ten sensitive wildlife species. The discussion of R2 Sensitive Species that follows is tiered to the Phase II Amendment FEIS, Appendix C (Biological Assessment/Biological Evaluation). Detailed information on these species is incorporated here by reference.

Table 3-20. Region 2 Sensitive Species in the Citadel Project Area

Scientific Name	Common Name	Species Recorded	Potential Suitable Habitat
Accipiter gentilis	Northern goshawk	X	X
Martes americana	American marten	X	X
Picoides arcticus	Black-backed woodpecker	X	X
Rana pipiens	Northern leopard frog	X	X
Storeria occipitomaculata pahasapae	Black Hills redbelly snake	X	X
Oreohelix strygos	Cooper's Mountainsnail	X	X
Picoides tridactylus	American three-toed woodpecker		X
Otus flammeolus	Flammulated owl		X
Pelcotus townsendii	Townsend's big eared bat		X
Myotis thysandodes pahasapensis	Fringed myotis		X

Northern Goshawk—Affected Environment

Goshawks are known to occur in all Black Hills counties but are considered a rare to uncommon resident (South Dakota Ornithologists Union 1991, Peterson 1990). There are approximately 31 known goshawk territories on the Northern Hills Ranger District. In 2005, 23 (41%) of all the Black Hills National Forest's territories were found active out of the 56 which were monitored (USDA-Forest Service 2005b).

Goshawks generally occur in mature or old growth aspen, conifer, or mixed forests. Nesting habitat is most often dense, mature ponderosa pine (SS 4C or 5) in the Black Hills although denser SS 4B is also used in some cases. Fledgling habitat includes Structural Stages 3B, 3C, 4B, 4C, or 5. Preferred nest sites in the Black Hills are mature ponderosa pine stands with greater than 60 percent canopy closure (Structural Stages 5, 4C and upper 4B). Foraging habitat is more dependent upon prey species and includes a variety of habitat types and structural stages. Food

items in the Black Hills include red squirrels, least chipmunks, rabbits, robins, juncos, northern flying squirrels, mice and turkeys (Erickson 1987).

There are three northern goshawk territories identified in the Citadel project area. None of these territories have been confirmed as successfully reproducing young, but apparently they are attractive to the species and there is the possibility that unrecorded reproduction is occurring within them. The Citadel project will follow applicable Forest Plan Standards (Standard 3108 and 3111) as they pertain to goshawks.

Northern Goshawk—Environmental Consequences

Direct Effects

Alternative A would have no direct effects on the northern goshawk because no new activities would occur. Alternatives B and C could cause a loss of an unknown active nest during harvest or prescribed burn operations; however, project design and Forest Plan direction provide protection for any newly found nests and the surrounding habitat (Standard 3115).

Indirect Effects

Alternative A would both increase and decrease nesting habitat. Stands that are maturing with little understory development would grow in the tree canopy and provide optimal nesting habitat, while other stands with developing understories would eventually become too dense to be suitable nesting habitat. Loss of open areas through time would decrease the diversity of foraging habitat.

Alternatives B and C were designed to maintain or enhance the stands value for goshawk (Standard 3108). Appropriate nest stands were chosen within each of the territories as currently suitable goshawk nest stands and replacement nest stands (Structural Stages 5, 4C and upper 4B). Each was identified and incorporated within the project design. Alternatives B and C propose understory treatments in the chosen nest stands, but avoid overstory treatments. This would maintain and enhance the stands' value for goshawk by reducing the risk of canopy cover reduction due to fire and insects/disease (Standard 3108). Outside of the nest stands, large pine would be harvested which may decrease potential nesting habitat, and through time increase the diversity of foraging habitats. Proposed treatments may have beneficial impacts to the goshawk by increasing habitat diversity. Timing restrictions found in Standard 3111 would be applied to reduce impacts to the goshawk, including prescribed burning, line construction and road traffic.

Cumulative Effects

Past timber sales, within and adjacent to the project area, have reduced nesting habitat by removing large trees and decreasing mature tree density. However, removal of trees has also helped some stands mature faster and has provided diversity as well as potential future nesting habitat. Future timber harvests in the area would likely decrease potential nesting habitat as would the Citadel project in the short-term. Livestock overgrazing may negatively impact habitat for goshawk prey populations associated with riparian areas. Grazing may aid prey detection for the goshawk. Nest disturbance and possible abandonment increases due to present and future timber and grazing management activities.

Use and expansion of roads may negatively impact nesting and foraging habitat. Recreational use of the area adds to the potential for nest abandonment. There are three areas (Crow Peak, Bear/Beaver Gulch and Higgins Gulch) that have year-long off-road closures that reduce disturbance of the goshawk. The action alternatives would require 17-18 miles of new temporary road and 35 miles of road reconstruction. This could cause disturbance to the goshawks during implementation, but timing restrictions would apply (Standard 3111) in known territories. Once the project is completed, several miles of classified roads would be closed and 31 miles of unclassified would be decommissioned. Potentially these closures would enhance habitat for the goshawk in unknown territories. Past fuel wood harvest, which removed snags, most likely had a negative impact on goshawk prey, and consequently goshawks themselves.

Prescribed burning would likely improve nesting habitat by reducing the understory in mature stands and foraging habitat by providing a variety of habitats for a greater diversity of prey species. Fire exclusion over the last 100 years has resulted in a denser, pine-dominated landscape, which has decreased both nesting and foraging habitat. The action alternatives have the opportunity to reverse some of these effects.

American Marten—Affected Environment

Martens tend to select for moist-site tree species that grow in stands characterized by living branches on the lower boles of trees, abundant course woody debris and lengthy fire return intervals (Buskirk 2002). Martens generally avoid habitats that lack overhead cover and are intolerant of habitat types lacking at least 30% canopy cover. Large snags or hollow logs are required for denning. Their diet is mainly composed of small mammals and birds, but is supplemented by berries and nuts.

Marten historically occurred within the Black Hills, but were thought to be trapped out by 1930. They were re-introduced in the northern Black Hills between 1980 and 1981 and have been sighted frequently near the re-introduction sites. One marten has been observed within the project area in a coniferous riparian area with spruce, pine, birch and aspen. The Citadel project area does not contain a high-quality habitat patch, but does contain potentially suitable habitat mapped by Fecske (2003).

American Marten—Environmental Consequences

Direct Effects

Alternative A would have no direct effects on marten because no new activities would occur. The action alternatives may affect the species because they would thin the forest structure and remove dead and downed woody debris preferred by martens. Alternatives B and C do not propose any treatments within a spruce dominated forest, the primary habitat type for this species. The entire project area contains only 41 acres of white spruce dominated forest but smaller stringers of spruce can be found along riparian areas, also not proposed for treatment. Some of the ponderosa pine stands proposed for treatment near spruce stands have a white spruce component, particularly in the drainages and north aspects. Furthermore, they contain large amounts of coarse woody debris (CWD), preferred by martens. Direct effects are unlikely due to the mobility of the species. However, direct effects may occur if natal or maternal den sites are removed during project activities and young of the year are still in these dens. Martens tend to give birth in stands with high tree density and large diameter snags and CWD, and in association with red squirrel cash sites. Natal dens tend to be in tree boles above the forest floor, whereas maternal dens tend

to be closer to the forest floor. No information is available on natal or maternal dens of martens in the Black Hills, but den sites could represent an important habitat need of martens (Buskirk 2002).

Indirect Effects

Under Alternative A, the density of ponderosa pine trees would likely increase, as would the risk of losing these forested stands to fire and disease/insects. Vegetation management actions under Alternatives B and C that reduce ponderosa pine stands and CWD may make the habitat less suitable for martens. Removing dead and down CWD and burning the lower limbs of spruce would reduce the amount of ground cover necessary to provide subnivean space (pockets beneath the snow which are used by small mammals) during the winter. Removing standing dead trees may reduce habitat for red squirrels, a primary prey species for the marten. Both mechanical harvesting followed by prescribed burning and prescribed burning alone would reduce the amounts of CWD. The amount of CWD located beneath the few stands of white spruce is unlikely to change with the action alternatives.

Cumulative Effects

Past timber harvest and subsequent slash cleanup may have negatively affected characteristics of marten habitat such as spruce, dense stands, and down woody debris. Conversely, fire suppression has probably allowed spruce stands to persist and expand. Continued fire suppression elsewhere on the forest may add to the cumulative effect of increasing spruce acreage and potential habitat. Harvesting denser stands of ponderosa pine would have the cumulative effect of reducing or preventing pine stands from becoming dispersal corridors.

The Citadel project area does not contain critical white spruce habitat, but surrounding project areas do, such as the Hop Creek project area to the southeast. The Forest Plan standard is to maintain canopy closure of at least 50 percent in areas identified as important connectivity corridors for marten (Standard 3215). In addition, spruce stands are not proposed for treatment in the neighboring Hop Creek project area currently planned for implementation in FY 2008. No known present or proposed actions on private or NFS lands would reduce white spruce, the preferred marten habitat.

Prescribed fire would decrease marten habitat in the short term by reducing CWD. And future prescribed burns to decrease surface fuels and maintain open forest conditions would decrease habitat. Fire exclusion over the last 100 years has resulted in a denser, pine-dominated landscape, which may have increased both denning and foraging habitat.

Black-backed Woodpecker—Affected Environment

Black-backed woodpeckers are associated with montane coniferous forests (Bent 1939, Terres 1987). They excavate cavities and forage on wood-boring insects in areas with concentrations of dead and decaying trees and logs. Literature suggests a strong tie to insect infestations, post-fire conditions, and snag habitats for nesting, foraging and roosting. Habitats created by fire and insects are temporary and episodic. Black-backed woodpeckers have evolved with these conditions, and are known to have population irruptions (growths) that coincide with the events (USDA-Forest Service 2005b). The amount of time that black-backs fully exploit these habitats is variable, but population declines are expected relatively quickly after initial irruptions. The decline in the black-backed woodpecker population only three years after the 2000 Jasper Fire is consistent with observations in other parts of the bird's range (USDA-Forest Service 2005b).

District personnel located several black-backed woodpeckers within the project area. The only sizeable fire within the Citadel Project area which may be providing some habitat for the black-backed woodpecker is the Beaver Fire (50 acres) of 2001. It is located in the north-central portion of the project area. Other smaller fires throughout the project area could also be providing individual fire-burned snags; beetle infested trees are also present.

Black-backed Woodpecker—Environmental Consequences

Direct Effects

Alternative A would have no direct effects because no new activities are proposed.Alternatives B and C have the potential to result in loss of nests if occupied nest trees are cut for safety reasons during timber harvest.

Indirect Effects

Under the No Action Alternative, development of dense stands would increase risk of mountain pine beetle infestation in the absence of management or natural disturbance. These conditions and development of ladder fuels would increase the risk of stand-replacing wildfire. Both beetle infestations and stand-replacing fire would create black-backed woodpecker habitat. The no-action alternative affects the black-backed woodpecker least because it would conserve existing habitat while allowing for natural succession to make the stands more susceptible to beetle infestation and fire risk, both factors that create optimum habitat.

The proposed action alternatives include timber harvest prescriptions that would result in loss of large trees and reduction in stand density. Thinning treatments would promote the development of larger-diameter trees, which may eventually provide large-diameter snags. Dense, large diameter pine stands (Structural Stages 4C and 5) totaling 7,702 acres exist in the project area. Approximately 3,718 acres are proposed for treatment in Alternative B (46% reduction) and 4,193 acres in Alternative C (54% reduction).

The reduction in dense habitat is not likely to affect viability in the project area because black-backs are more influenced by large beetle outbreaks and stand replacing fire, neither of which has recently occurred in the project area. Snag density within the stand seems to be an important characteristic. All snags except those deemed safety hazards would be maintained.

Cumulative Effects

Fire exclusion has resulted in a more pine-dominated, continuously forested landscape. Timber harvest over the years has probably resulted in fewer large-diameter trees, less mortality, and more trees overall. Alternative A would continue this trend, though susceptibility to insect infestations and stand-replacing fire would increase with stand density and stagnation. These events would increase habitat for black-backed woodpeckers.

Fire suppression would continue under all alternatives, and the type of prescribed burns proposed under Alternatives B and C would not likely result in the type of post-fire conditions (high tree mortality providing foraging habitat and potential new snags) most suitable as black-backed woodpecker habitat. Snag retention and replacement measures included in these alternatives would help assure a long-term supply of snags. In the absence of large fire or beetle events, the project area’s suitability for this species would change little under any alternative.

The number of roads and the amount of off-road travel that occurs presents a negative impact to black-backed woodpeckers, at least partially due to increased disturbance of nesting birds (Expert Interview Summary 2000). Approximately 18 miles of road construction and 35 miles of road improvement would be necessary to access stands for Alternative B and C treatments. Off-road motorized travel would remain prohibited in the project area, but main system routes currently open to vehicle traffic would remain open. All newly constructed roads would be closed following the completion of management activities. In addition, 31 miles of non-NFS roads would be decommissioned.

Natural disturbances of insect epidemics, wildfires and wind events may benefit these woodpecker species (Anderson 2002). Alternative A could lead to natural insect epidemics and a higher possibility of large wildfires.

Northern Leopard Frog—Affected Environment

Suitable habitat for the northern leopard frog includes beaver ponds, stock ponds, streams, marshy areas and other permanent water sources with aquatic vegetation and good water quality. Breeding habitat is limited to permanent water sources greater than 6 inches deep, that do not freeze solid (Baxter and Stone 1985). After maturing, sub-adult frogs migrate to suitable feeding sites that are usually adjacent uplands. These dispersal movements may be along riparian corridors or upslope areas. Adult frogs are highly mobile, moving up to two miles from water (Smith 2003). During summer, adults prefer grassy areas, swampy areas, and wet meadows surrounding pools and marshes with 100 percent vegetative ground cover; heavily grazed areas are avoided. Winter habitat is lakes and stream bottoms where they dig themselves into mud and leaves. Eggs are attached to submerged vegetation or laid on the bottom.

Northern leopard frogs were found to be common at most suitable sites in the northern Black Hills of South Dakota by Smith (2003). At the moment there seems to be little evidence of serious problems in the Black Hills. The most important local considerations would be pollution from cattle, input of pesticides into streams and breeding ponds, mining, and runoff from roadways (including sedimentation) (Smith 2003). On the other hand, the creation of small stock ponds has increased the availability of breeding sites and habitat for frogs. There is one known location of northern leopard frog in the Citadel project area (USDA-Forest Service 2007).

Northern Leopard Frog—Environment Consequences

Direct Effects

Alternative A would have no direct effects because no new activities would occur. Alternatives B and C have the potential to cause mortality of frogs at unknown frog locations through the use of heavy equipment, falling of trees and prescribed burning if activities are located within riparian areas or the surrounding uplands of breeding grounds. Because timber treatments do not focus upon riparian areas, most, if not all, sites would be avoided.

Indirect Effects

Alternative A could indirectly affect leopard frog suitable habitat through continued encroachment of ponderosa pine into riparian areas. Increased density of pine would reduce the amount of suitable habitat available. With Alternatives B and C, habitat disturbance or loss may

occur from temporary road construction and sedimentation in riparian areas. Prescribed burning in riparian habitat may cause short-term (1 year) loss of habitat by reducing grass cover. It could also reduce cover in the surrounding uplands. The most important variables appear to be herbaceous cover, downed wood, and litter depth. Amphibians better tolerate habitats that provide cover because this allows them to avoid desiccation (Smith 2003).

Cumulative Effects

Alternative A would continue the trend of pine encroachment into riparian areas while Alternatives B and C are expected to help reverse this trend. Historical loss of beaver from the riparian system has decreased habitat for the leopard frog. Livestock grazing has reduced habitat for this species in some areas by over utilization of some riparian areas, bank and stream trampling, decreases in water quality and water consumption. The introduction of predatory fishes has negative impacts on leopard frogs (Smith 2003). The project is not likely to add to these cumulative effects.

Black Hills Redbelly Snake—Affected Environment

The range of redbelly snake is limited to the Black Hills of western South Dakota and northeastern Wyoming. The Black Hills redbelly snake is rarely seen in the Black Hills, possibly because of its secretive habits. Localized populations of varying densities may be found in the Black Hills.

Habitat use by redbelly snakes is poorly understood and in the Black Hills area has not been fully studied (Smith and Stephens 2003). Redbelly snakes are known to occur in wet meadows, woodlands, and forest-meadow edge habitats within the Black Hills (Smith and Stephens 2003). They generally hide in and under ground litter, understory vegetation, rocks, coarse woody debris and abandoned ant mounds. They are typically associated with mesic habitats with abundant ground cover. The red-bellied snake has been recorded at two different locations in the Citadel project area (USDA- Forest Service 2007). These locations are not hibernacula sites.

Black Hills Redbelly Snake—Environmental Consequences

Direct Effects

No direct effects would result from Alternative A because no management activities are planned. Direct impacts of timber harvest under Alternatives B and C on Black Hills redbelly snakes may include the disturbance of habitat in localized mesic sites (e.g., streams, springs, ponds, wet meadows and any other wet area) and soil compaction by machinery. Machinery used to clear the way for timber removal may remove snake hiding shelters such as rocks, downed woody debris and tree stumps (Smith and Stephens 2003). Mortality caused by prescribed fires is a risk. Because timber treatments do not focus upon riparian areas most, if not all, sites would be avoided.

Indirect Effects

Redbelly snake habitat could be impacted by wildfires, which there would be a higher risk of under Alternative A. The prey of the redbelly snakes (e.g. slugs, snails, earthworms and insect larvae) could be affected by the soil compaction caused by timber machinery under Alternatives B and C (Smith and Stephens 2003). Subjecting management areas to prescribed fires

periodically would probably help to return the Black Hills to their historic habitat and may help to conserve and potentially expand mesic habitats (Smith and Stephens 2003). Prescribed burning and hardwood enhancement projects would likely enhance the aspen component throughout the project area. No barriers would be created between riparian areas and potential hibernacula such as rock outcrops.

Cumulative Effects

The most serious threat to Black Hills redbelly snake populations may be habitat loss. Current land practices, including fire suppression, construction of roads or failure to decommission roads in or near mesic habitats, and the abundance of beaver, currently thought to be at low abundance relative to historic levels, all favor the reduction of mesic habitats (Parrish et al 1997, Smith and Stephans 2003). The Citadel activities proposed would further reduce roads located in mesic sites at the completion of project activities and would avoid them in most cases during implementation. Livestock grazing has reduced habitat for this species from over utilization of some riparian areas, bank and stream trampling and water consumption.

Cooper's Mountain Snail—Affected Environment

Cooper's mountain snail is common in Spearfish Canyon and occurs elsewhere in scattered populations on the Forest (Frest and Johannes 2002). However, without additional evidence of historically occupied areas, valid trend data resulting from comparison with currently identified occupied sites is not obtainable (Federal Register 2006).

Forest-wide, one site thought to only contain dead Cooper's specimens is now known to support live specimens. Two sites where this species was rare may now be void of snails. One site thought to be void had a new population discovered within a short distance. Six previously unknown colonies, containing this species were discovered. No habitat losses were noted during 2003 for this species which is the most current information in the Black Hills (USDA-Forest Service 2004a and 2004b).

Cooper's mountain snail habitat consists of calcareous soils developed on the Pahasapa limestone, but also the Ordivician Whitewood formation in lower Spearfish Canyon. Most habitats are lowland wooded areas and talus slopes, generally, but not always, north or east facing slopes. Habitat in the Black Hills is in the ponderosa pine community, partially closed canopy, with a common secondary deciduous tree component of birch, aspen, or ironwood (Frest and Johannes 2002). Typical habitats include partially closed canopy forests with a deciduous tree and shrub component. Riparian woodlands also are occupied, often in areas with adjacent steep rocky slope bases (Federal Register 2006). The species is able to withstand a relatively high proportion of spruce or pine needles in the duff, and may occur at sites with relatively less vegetative cover and thin litter than other Black Hills land snail species (Frest and Johannes 2002).

There are seven sites where Cooper's mountain snails have been located within a proposed treatment unit in the Citadel project area. Treatments are not proposed within the riparian area, except for prescribed fire, but are proposed in the surrounding uplands. In addition there are other snail locations in the project area, but no treatments are proposed nearby (Frest and Johannes 1993, 2000 and 2002) (USDA-Forest Service 2007).

Cooper's Mountain Snail—Environmental Consequences

Direct Effects

Alternative A would have no direct effects because no new activities would occur. Management activities from Alternatives B and C may impact individuals in occupied habitat where the snail has not currently been documented. This species depends on microhabitat conditions that any action affecting the amount of litter, soil moisture, or temperature would negatively impact; compaction of soil from heavy equipment could potentially crush snails (Anderson 2005). Because treatments do not focus upon riparian areas, most, if not all, sites would be avoided, but even harvesting timber near a snail colony could potentially lower the moisture levels, so a buffer area is probably required (Anderson 2005). Forest Plan Standard 3103 would be used to help reduce impacts to known snail colonies by avoiding these sites.

Indirect Effects

The increased fire hazard under Alternative A could potentially result in a wildfire burning across a snail area and negatively impacting individuals while also drying out the site, at least temporarily, and making it unsuitable. Alternative A does not include any road decommissioning, meaning that more roads would exist across the project area to act as barriers to snail movement.

Suitable habitat may be altered by treatments in Alternatives B and C. Some areas would become drier due to logging and burning, decreasing snail habitat. Activities that damage springs or otherwise change the moisture regime at a site can affect the amount of soil moisture available to the snails. This may affect the population size or distribution of a colony (Anderson 2005). Projects that create new roads or bare paths would essentially create new barriers for the snails, as do existing roads.

Cumulative Effects

Logging, grazing, road construction and maintenance, prescribed burning, recreation, wildfire, and drought have all negatively impacted snails. Unknown snail colonies may be impacted over time. The activities proposed with the Citadel action alternatives include logging, road construction, road maintenance and prescribed burning. Known snail locations would be avoided by these activities. The Forest Plan Phase II Amendment has dictated that all known snail colonies would be protected from adverse effects of management (Standard 3103).

American Three-toed Woodpecker—Affected Environment

The Forest monitors this species through the Rocky Mountain Bird Observatory. Other woodpecker studies have been conducted in the Black Hills in the past by the South Dakota School of Mines and Technology, the University of Wyoming, and the Forest Service Rocky Mountain Research Station. RMBO observed 12 three-toed woodpeckers in 2001, 26 in 2002, 44 in 2003, 35 in 2004, 44 in 2005 (Panjabi 2003, 2004, 2005, Beason et al 2006). Three-toed woodpecker observations have steadily increased since the Monitoring Birds of the Black Hills program began in 2001. Most observations were in spruce habitats and this species has thus far not appeared in monitored burned areas (i.e. ponderosa pine).

In the Black Hills, American three-toed woodpecker occurs almost exclusively in mature stands of white spruce, where it is generally found in low abundance. They apparently do not exploit burned ponderosa pine forest. Its preference for spruce forests likely extends even to burned areas

(Beason et al 2006). The Black Hills has large numbers of ponderosa pine, spruce, and aspen, so these trees are potentially being used locally. The birds utilize trees with some heart rot, which softens the tree for excavation. Several studies have examined specific characteristics of nest trees used by three-toed woodpeckers. Important attributes of nest trees appear to include diameter at breast height (dbh), height of nest tree, and height of actual nest.

Three-toed woodpeckers control insects that are harmful to forests and especially important during insect outbreaks. Prey includes mostly bark beetles and other wood boring insects and larvae, but also other insects including caterpillars and ants (Wiggins 2004). Wood-boring insects in the Black Hills that are candidates for woodpecker food include *Coleoptera* and *Hymenoptera* species. Wood boring and bark beetles are extremely important food sources for three-toed woodpeckers.

District personnel have not observed American three-toed woodpeckers within the project area. There are 41 acres of spruce dominated forest within the project area (0.1%) which is the preferred habitat for this species.

American Three-toed Woodpecker—Environmental Consequences

Direct Effects

No direct effects would occur under Alternative A because no management activities are proposed. Alternatives B and C could result in mortality of three-toed woodpeckers during timber and prescribed burning operations, but it is highly unlikely this species is present within stands proposed for treatment. The mobility of adult birds would also reduce this risk. Spruce forests would not be thinned. Understory burning is not likely to impact spruce.

Indirect Effects

Potential for beetle infestations or large wildfires would be higher under Alternative A, which has the potential to create additional snags that could be used as foraging habitat. Like Alternative A, Alternatives B and C would also maintain the current amount of white spruce forest. However, prescribed burning could potentially could burn individual trees. The resulting snags would provide foraging habitat for this species, which would be beneficial for several years.

Cumulative Effects

There are approximately 25,000 acres of white spruce across the forest. Habitat of this type is likely to remain unless unique circumstances occur (e.g. spruce removal due to WUI concerns or aspen enhancement). In 1995, there were 21,737 acres of spruce and in 1899 spruce acreage was estimated at 15,000 (USDA-Forest Service 1996b). This indicates a long-term increase in spruce. Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills (USDA-Forest Service 2005b), consequently increasing the amount of available habitat for the American three-toed woodpecker.

Flammulated Owl—Affected Environment

Documented breeding range includes southern British Columbia, Washington, Cascade and Sierra Nevada mountain ranges, forests of Nevada, New Mexico and Colorado, and recently found in forests of Idaho and Montana. Residency of this species in the Black Hills is questionable, and

reproduction has never been observed here. One unverified report of a flammulated owl was made in the southern Black Hills during the early 1990's (Tallman et al 2002). The species was not reported again until 2002, but this time the location was in the northern Hills. RMBO surveyors confirmed the second report through nighttime non-protocol surveys. The SDGFP contracted biologists during 2003 through 2005 to monitor owls at the 2002 location, and to inventory flammulated owls in other potentially suitable habitat. The contractors did not detect any flammulated owls at any location. The mixed results could mean flammulated owls occur here in very low density within very specific habitat types, or only during migration or transient periods.

This migratory species is a secondary cavity nester that breeds in ponderosa pine forests and utilizes abandoned woodpecker holes (USDA-Forest Service 2005c). They are often associated with old-growth forests of mixed conifers (USDA-Forest Service 2005c). In Colorado, nesting flammulated owls showed a preference for old trees and stands of ponderosa pine and Douglas-fir, often choosing areas dominated by older forests (Linkhart et al 1998). They prefer open, mature forests with low shrub cover in western New Mexico and research found that silvicultural practices of thinning doghair and controlled burning would benefit this owl species (McCallum and Gehlbach, 1988). The flammulated owl is almost entirely insectivorous and feeds primarily on moths, beetles, and crickets. Flammulated owls often nest in northern flicker (*Colaptes auratus*) or other woodpecker holes (Hayward and Verner 1994). Nesting generally occurs mid-May to early June, and ends by late July.

There are no records of flammulated owls within the Citadel project area. None were recorded on the Black Hills in 2005 (USDA-Forest Service 2006).

Flammulated Owl—Environment Consequences

Direct Effects

Alternative A would have no direct effects because no new activities would occur. Based on recent sightings and the availability of suitable habitat, individuals could occur in or near the project area and could be affected by the reduction of mature trees and snags in Alternatives B and C. This species' preference for mature, mixed conifer forested areas would be reduced with both of the action alternatives.

Indirect Effects

Increased risk of beetle infestation and high intensity wildfire has the potential to reduce the amount of suitable flammulated owl habitat available in the project area. Alternative A would result in a higher density of roads than either action alternative, creating a higher potential for human disturbance.

Under Alternatives B and C individuals could be affected by the reduction of mature trees and snags. This species prefers mature, mixed conifer forested areas. These areas would be reduced with both of the action alternatives. Loss of mature ponderosa pine forests may represent the greatest threat to this species in Region 2 (USDA-Forest Service 2005c). The reduction of understory shrubs and trees could improve the foraging habitat for this species. At present, there is no information suggesting that flammulated owls are established or breeding in the Black Hills.

Cumulative Effects

Open pine habitats have decreased in and adjacent to the project area over the last 100 years due to fire suppression. Alternative A would continue this trend. Risk of catastrophic fire and mountain pine beetle activity would likely increase under Alternative A. Timber harvesting that has created large diameter trees has likely benefited this species, while the loss of snags may decrease potential nesting opportunities. Past fuelwood harvesting, if snags were removed, negatively impacted habitat. The action alternatives would create a more open, mature forest cover in many areas. Snags would be protected (Standards 2301, 2305) but some nesting areas could be removed.

Bats—Affected Environment

The fringed myotis and Townsend's big-eared bat may use the project area as foraging, maternity roost, hibernacula and/or roosting habitat. There is one confirmed location of hibernacula/maturity roost for Townsend's big-eared bat in the project area, though others are likely (Tigner 2007).

Fringed myotis occupies a variety of habitats including mid-elevation desert, grass and woodland habitats, and is found at higher elevations in spruce-fir habitat and in mixed timber of ponderosa pine, white spruce and aspen (Schmidt 2003a, Keinath 2004). It is limited to caves and mine shafts with cool temperatures and high humidity within a variety of vegetative types. Numerous crevices and fractures are needed for roost sites. Tree cavities are used for maternity roosts and may occasionally be used for daytime roosting. This species is a colonial rooster. It feeds mainly on small moths high in the forest canopy and on or near the ground near thick or thorny vegetation. It may occasionally glean insects from leaves (Barbour and Davis 1969). Factors that affect this species are human disturbance of roosting and hibernation sites, low reproductive rate and habitat loss. Disturbance by humans, especially in hibernacula and maternity roosts, can be a threat to survival of this species (Barbour and Davis 1969, Higgins et al 2000).

The Townsend's big eared bat has been recorded in all South Dakota counties of the Black Hills (Schmidt 2003b). Habitat for the Townsend's big eared bat consists of forest edge, shrub-steppe grasslands, pinyon-juniper, arid country, deciduous, and mixed coniferous forest. Hibernacula and maternity roosts are usually caves, rock crevices, buildings and occasionally mine shafts. They roost in caves, mine shafts, rock outcrops, lava tubes and old buildings. Caves with high humidity, cool temperatures, and numerous crevices and fractures are preferred. Tree cavities may occasionally be used for daytime roosting. This species is sensitive to disturbance in and around maternity roost sites and hibernacula, especially during the winter due to critical energy loss. They feed mainly on moths high in the forest canopy and occasionally glean insects from leaves.

Bats—Environmental Consequences

Direct and Indirect Effects

Alternative A would have no direct effects because no new activities would occur. Individual mortality may result from Alternatives B and C. Potential loss of occupied daytime roost trees may negatively impact individuals, if the snag is determined to be a safety hazard and removed. Risk is low because of their mobility and because they primarily roost in caves and rock crevices.

Both Alternatives B and C would maintain mature forested stands although canopy covers would be reduced. Although Townsend's big-eared bat forages in a variety of habitat types, its flight and echolocation style makes it well suited to forage among the canopies and along the edges of mature forested stands. This species typically does not use large clear-cuts or regenerating stands in early seral stages (Gruver and Keinath 2006).

Indirect Effects

Under Alternative A, cave or mine exploration could indirectly affect bats. No bat gates would be installed under this alternative. In addition, the lack of thinning treatments would lead to an increased chance of a large wildfire or mountain pine beetle infestation occurring in the project area. Either of these disturbances could benefit bats by diversifying stand structure, and consequently bat habitat, and by through an increased insect population for the bats to prey upon. Conversely, in the absence of a wildfire, the forest is expected to grow denser, which is unfavorable to bats. No day roost trees would be lost through timber harvest, but could be consumed by a wildfire occurring due to the lack of fuel treatments.

Proposed treatments in Alternatives B and C may have beneficial impacts to this bat as a result of increased prey species such as insect populations after prescribed fires (Cerovski 2002) and logging and thinning (Dykstra et al 1999). Silvicultural treatments of timber harvest and prescribed burning that benefit riparian habitat would benefit bat insect prey, and thus bat foraging habitat. In addition, the action alternatives could reduce disturbance to bats. Funds generated by the timber sale may be used to construct bat gates at 1-3 sites to protect bats from human disturbance during critical times of the year.

Cumulative Effects

Past timber sales and fuelwood gathering have reduced snags and decreased potential roost sites. The action alternatives could also reduce snag amounts and potential roost sites. Additional decreases in pine cover in Alternatives B and C would largely benefit bat habitat by improving riparian and foraging habitat. Alteration of water flow or persistence can impact bat distributions (Keinath 2004). Cattle grazing may affect foraging habitat for bats by reducing riparian vegetation through grazing (Bock et al 1992). Recreational use of mines and caves throughout the Black Hills has gradually been reduced through the use of bat gates during critical times for bats. The funds generated by the action alternatives would allow the installation of bat gates to protect bat habitat and offset some of the impacts of snag and roost tree loss in the Citadel project area. Education of the public has also played an important role in protecting these sites. Mining activities, which originally created some of the sites, no longer occur.

Population Viability Determination Summary for R2 Sensitive Species

Alternative A would have no impact on the viability of any of the populations of R2 Sensitive Species described above. Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. Population viability was evaluated in the Phase II Forest Plan Amendment FEIS. The Phase II Amendment FEIS (USDA-Forest Service 2005c) determined that there would be adequate habitat for maintaining viable populations of R2 Sensitive Species if Forest Plan standards are followed

at the project level. All alternatives in this project Forest Plan standards. For a more detailed discussion of population viability, refer to the Wildlife Specialist Report and Biological Evaluation/Biological Assessment (BE/BA) for wildlife prepared in conjunction with this project (located in the project record).

MANAGEMENT INDICATOR SPECIES

Management Indicator Species (MIS) or their habitats are representative of a variety of habitats and can indicate overall changes in the forest ecosystem. MIS were selected to evaluate the effects of Forest Plan implementation and natural change of the Forest to support species that rely on similar habitat needs (USDA-Forest Service 2005c). Table 3-21 below displays all the MIS and whether they or their habitat is present in the project area.

Table 3-21. Summary of Management Indicator Species and Habitat in the Citadel Project Area

Scientific Name	Common Name	Species Present?	Habitat Present?
Picoides arcticus	Black-backed Woodpecker	Yes	Yes
Certhia americana	Brown Creeper	Yes	Yes
Regulus satrapa	Golden-crowned Kinglet	Yes	Yes
Bonasa umbellus	Ruffed Grouse	Yes	Yes
Melospiza melodia	Song Sparrow	Yes	Yes
Odocoileus virginianus	White-tailed Deer	Yes	Yes
	Beaver	No	No
	Grasshopper Sparrows	No	No
	Mountain Suckers	No	No

Because beaver, grasshopper sparrows, and mountain suckers are not present in the project area and have no habitat within the project area, these species will be unaffected by the project. The following discussion of Management Indicator Species is tiered to the Phase II Amendment FEIS (USDA-Forest Service 2005c).

Black-backed Woodpecker

The black-backed woodpecker is highly associated with ponderosa pine forests that are recently burned (within 5 years) or have high bark beetle populations. Another important habitat for this species is mature or late successional forest (USDA-Forest Service 2005c). Black-backed woodpeckers excavate cavities and forage on wood-boring insects in areas with concentrations of dead and decaying trees and logs. They nest in hard snags or live trees with diameter of 9 to 18 inches (Anderson 2003). Habitats created by fire and insects are temporary and episodic. Black-backed woodpeckers have evolved with these conditions and population growth and decline often coincides with such events (USDA-Forest Service 2005c).

According to the 2005 Monitoring Report, a total of 88,648 acres of large (greater than 300 acres) wildfires had burned in the proceeding five years (2001-2005). Of this, 24,877 acres were in ponderosa pine, were stand replacing, and remain unsalvaged. This is approximately 2.5 times greater than the 10,000 acres called for under Objective 11-03 (USDA-Forest Service 2005c). It is difficult to determine Forest-wide habitat trend based on 3 preferred habitat types for the black-backed woodpecker; burned areas, bark beetle infestation, and availability of dense and late succession stands is difficult. Over the long-term (10-25 years), habitat for this species has

increased, but information from the past few years suggest that the habitat is stable to slightly decreasing (USDA-Forest Service 2005c).

The Forest monitors this species through the Rocky Mountain Bird Observatory (RMBO). Other woodpecker studies have been conducted in the Black Hills by the South Dakota School of Mines and Technology, the University of Wyoming, and the Forest Service Rocky Mountain Research Station. RMBO observed 24 black-backed woodpeckers in 2000, 134 in 2001, 75 in 2002, 57 in 2003, 68 in 2004, and 46 in 2005 (Panjabi 2001, 2003, 2004, and 2005, and Beason et al 2006). Due to the amount of new habitat availability and the number of birds observed, both the population trend and habitat trend appear to have been increasing for the black-backed woodpecker over the past several years (USDA-Forest Service 2004a and 2004b). There are 50 acres of recently burned (within the last 5 years) habitat and 7,612 acres structural stage 4C and 5 in the project area.

The only sizeable fire within the Citadel project area that may be providing burn habitat for the black-backed woodpecker is the 2001 Beaver Fire (approximately 50 acres). Smaller fires throughout the project area could also be providing individual fire-burned snags, and beetle infested trees are also scattered throughout the project area.

Direct and Indirect Effects

Alternative A would have no direct effects on black-backed woodpeckers because no actions are proposed. Alternatives B and C could result in loss of nests if occupied nest trees are cut for safety reasons during timber harvest. A loss of insect-infested trees and hazardous snags would reduce foraging habitat.

Under Alternative A, natural disturbances such as insect epidemics, wildfires and wind events may benefit black-backed woodpeckers (Anderson 2003). Development of dense stands of pine would increase risk of mountain pine beetle infestation in the absence of management. These conditions and development of ladder fuels would increase the risk of stand-replacing wildfire. These types of fires would create black-backed woodpecker habitat (Dixon and Saab 2000). Alternative A affects the black-backed woodpecker least in the short-term because it would conserve existing habitat. Long-term, through natural succession, stands may be more susceptible to beetle infestation and fire risk, both factors that create optimum habitat conditions for black-backed woodpeckers.

The black-back woodpecker is most influenced by large beetle outbreaks and stand replacing fires, neither of which has occurred recently in the project area. Snag density within the stand seems to be an important characteristic. Under all alternatives, all snags except those deemed safety hazards will be maintained (Standards 2301 and 2305).

Alternatives B and C include treatments that would result in decreases in the number of large trees, stand density, and snags. Thinning treatments may include removal of snags for safety reasons. Clearcut harvest has the greatest impact on snags because it removes trees that could become future snags. Over the long term, treatments would promote the development of larger-diameter trees, which may eventually provide large-diameter snags. There are approximately 7,612 acres of large diameter pine stands (Structural Stages 4C and 5) in the project area. Approximately 3,572 acres are proposed for treatment in Alternative B (47% reduction) and 4,007 acres in Alternative C (53% reduction).

Cumulative Effects

Fire exclusion has resulted in a more pine-dominated, continuously forested landscape. Timber harvest over the years has probably resulted in fewer large-diameter trees, less mortality, and more trees overall. Alternative A would continue this trend, though susceptibility to insect infestations and stand-replacing fire would increase with stand density and stagnation; these events would increase habitat for black-backed woodpeckers.

Fire suppression would continue under all alternatives, and the type of prescribed burns proposed would most likely not result in the type of post-fire conditions most suitable to black-backed woodpecker habitat. Snag retention included in these alternatives would help assure a long-term supply of snags. In the absence of large fire or beetle events, the project area's suitability for this species would change little under any alternative.

The number of roads and the amount of off-road travel that occurs presents a negative impact to black-backed woodpeckers, at least partially due to increased disturbance of nesting birds (Expert Interview Summary 2000). Approximately 18 miles of road construction and 35 miles of road improvement would be necessary to access stands for Alternative B and C treatments. Off-road motorized travel would remain prohibited in the project area, but main system routes currently open to vehicle traffic would remain open. All newly constructed roads would be closed following the completion of management activities. In addition, 32 miles of unclassified roads would be decommissioned.

Brown Creeper

The brown creeper is found in dense, mature and old growth coniferous forests in the summer and deciduous forests during the winter (Wiggins 2005, Kistler and Fager 1981). Within the Black Hills, brown creepers occur predominantly in old-growth stands, and demonstrate a preference for stands with large trees and large snags (Dykstra et al 1999). Optimal habitat within the project area is spruce and pine (Structural Stages 4B, 4C, and 5). There are 17,904 acres of optimal habitat and 41 acres of spruce within the project area. Recent forest-wide monitoring data suggests that brown creeper habitat capability on the forest has declined by one percent since 1995.

Four years of data collected by the Rocky Mountain Bird Observatory suggest the brown creeper is well distributed in low abundance throughout the Black Hills (Panjabi 2001, 2003, 2004, and 2005, Beason et al 2006). At least 90 percent of all brown-creeper observations in each of these years have occurred in white spruce and mature and late successional pine habitats (Structural Stages 4 and 5) (Panjabi 2001, 2003, 2004).

Direct and Indirect Effects

Alternative A would have no direct effects because no new activities would occur. Individual mortality may occur from Alternatives B and C if occupied snags or nest trees are removed from cutting units.

Alternative A would maintain 17,904 acres of preferred brown creeper habitat (spruce and late successional stands) which would increase through time in the absence of management activities. However, in the absence of management activities within the project area, fire hazard would increase which heightens the risk of brown creeper habitat being lost to a wildfire.

Under Alternatives B and C, habitat for this species would decrease to 13,374 and 12,555 acres respectively through the removal of commercial wood (larger than 9" dbh) in the proposed

cutting areas, which may negatively impact this species' habitat. A literature review (Hejl et al 1995) found that every study on the effects of timber harvesting in the Rocky Mountains suggested creepers are less abundant in harvested than unharvested forest types (Dykstra et al. 1999, Hutto and Young 1999, Wiggins 2005). Mannan and Meslow (1984) also suggested creepers occur more frequently in old growth than in managed stands (Wiggins 2005). To assure maintenance of viable brown creeper populations, managers need to maintain relatively large patches of uncut forest types across the landscape (Hutto and Young 1999). Prescribed burning may have beneficial impacts to this species as a result of increased insect populations after fires and increases in snag habitat (Wiggins 2005, Cerovski 2002). Silvicultural treatments aimed at reducing insects and disease may negatively impact prey species.

Cumulative Effects

Forest succession and fire suppression has generally maintained and enhanced habitat for the brown creeper. Management activities within and adjacent to the project area have decreased preferred habitat for this species. The current amount of snags within the project area and landscape-level structural stage guidelines should provide adequate habitat for creepers. Standards for snag protection would continue to be followed Forest wide as will Forest Plan Objective 238a.

Golden-crowned Kinglet

Golden-crowned kinglets breed almost exclusively in white spruce forests in the Black Hills (Beason et al 2006). They are uncommon in the Black Hills in winter, but are common spring and fall migrants (SDOU 1991). They usually nest high in evergreens, most often in the crown (NatureServe 2006). Spruce habitat is naturally patchy and of low abundance on the Black Hills. White spruce occurs at high elevations, on north aspects, and in cool canyon bottoms of the Forest where it forms nearly even-aged climax stands (USDA-Forest Service 1996b). Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills, generally at the expense of quaking aspen (Parrish et al 1996). According to the 2004 Monitoring Report, spruce habitat is found on 25,462 acres on the Forest (USDA-Forest Service 2005b). This exceeds Objective 239-LVD by 5,462 acres. There are 41 acres of spruce habitat in the project area.

Four years of data collected by the Rocky Mountain Bird Observatory suggest golden-crowned kinglets occur primarily in the northern half of the Black Hills and are moderately abundant in spruce habitat (Panjabi 2001, 2003, 2004, Beason et al 2006, USDA-Forest Service 2005c). Panjabi (2001, 2003, and 2004) and Beason et al (2006) reported breeding densities ranging from 18.5 to 72.36 birds/km^2 in white spruce habitat. Surveys suggest that kinglets may be increasing in the Black Hills, but the data are based on few routes and lack statistical significance (Sauer et al. 2003, Beason et al 2006). Several golden-crowned kinglets have been recorded in the project area (USDA-Forest Service 2007, Panjabi 2001, 2003, Beason et al 2006).

Direct and Indirect Effects

No direct effects to golden-crowned kinglets would occur under Alternative A because no management activities are proposed. Mortality of golden-crowned kinglets could occur during timber and prescribed burning operations proposed by Alternatives B and C but it is unlikely this species is present within stands proposed for treatment. The mobility of adult birds would also reduce this risk.

Alternative A could indirectly lead to a loss of spruce habitat due to increased fire hazard. It is more likely that spruce and available kinglet habitat would expand, because fire occurs in spruce relatively infrequently, and spruce has expanded across the forest over the past century. Alternatives B and C would maintain existing amounts of white spruce forest in the project area, though prescribed burning could potentially burn individual trees.

Cumulative Effects

There are approximately 25,000 acres of white spruce total on the forest. Habitat of this type is likely to remain except under unique circumstances (e.g. spruce removal for WUI concerns, aspen enhancement, etc.). In 1995, there were 21,737 acres of spruce and in 1899 it was estimated at 15,000 acres (USDA-Forest Service 1996b). This indicates a long-term increase in spruce. Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills (USDA-Forest Service 2005c). All alternatives of the Citadel project would continue to allow for a gradual increase in the spruce component.

Ruffed Grouse

In South Dakota, ruffed grouse are typically found in young-to-medium age aspen stands, other hardwood stands, and open pine forests (South Dakota Ornithologists Union 1991). Ruffed grouse are year-round residents of the Black Hills, and their presence roughly correlates to the distribution of aspen (Panjabi 2003). On the Forest, this species may require a variety of aspen structural stages to thrive, including late succession aspen for drumming logs and most other stages for buds and catkins in winter and spring (USDA-Forest Service 2005c). Ruffed grouse typically nest at the base of a tree, bush or stump and drumming areas and broods are usually found in areas with high density of woody stems and heavy ground cover (NatureServe 2006). There are 3,585 acres of hardwood habitat in the project area, including 2,055 acres of aspen.

Aspen abundance and distribution may limit ruffed grouse abundance and distribution in the Black Hills (USDA-Forest Service 2005c). Aspen stands have been replaced by pine and spruce in many areas, and may have declined since the pre-settlement era. Historic fire suppression has resulted in reduced vigor of existing aspen stands and inhibited aspen regeneration (Parrish et al 1996). Fire suppression has resulted in loss of some optimal habitat (South Dakota Ornithologists Union 1991). Stands dominated by aspen currently occupy approximately 46,172 acres on the Forest, and in 1995 they occupied 48,224 acres (USDA-Forest Service 2005c). This is a four percent (2,052 acres) decline.

Four years of data collected by the Rocky Mountain Bird Observatory suggest that ruffed grouse occurs widely throughout much of the northern Black Hills, although in low abundance (Panjabi 2001, 2003, 2004, Beason et al 2006).

Direct and Indirect Effects

There would be no direct effects under Alternative A because no management actions are proposed. Very few acres of hardwood would be removed through timber treatments under Alternatives B and C. Scattered aspen or oak may be removed when necessary for road construction, falling of neighboring trees, or hazard trees, but this amount is minor compared to what would remain. Ruffed grouse mortality could occur in these locations. Up to 53 miles of road construction or reconstruction would be required with the action alternatives.

Alternative A would potentially lead to a decrease in available ruffed grouse habitat because no hardwood restoration activities would occur. Over time, ponderosa would further encroach into hardwood stands, eventually overtaking some. The majority of the timber harvest treatments proposed in Alternatives B and C would be followed by prescribed burns which would likely promote aspen sprouting in the understory. Units which are heavily thinned or harvested may enhance aspen more than those that leave more dense pine overstory. The effect of treatments is dependent upon the site and the proximity to existing aspen stands. Young aspen stands are ideal habitat for ruffed grouse and could be created by some of the proposed treatments (Gullion 1989). There are 3,585 acres (13%) of hardwoods in the project area, 2,055 acres of which is aspen. Approximately 135 acres of hardwood enhancement is proposed under Alternative B and 787 acres under Alternative C. Additionally, approximately 106 acres of meadow enhancement would be completed with Alternative C. These activities would remove pine encroaching into aspen stands and maintain the stands as aspen, preserving ruffed grouse habitat for the long term. Once the project is complete, approximately 31 miles of unclassified roads would be decommissioned and several miles of classified roads closed under Alternatives B and C. Aspen regeneration could become established along some of these routes.

Cumulative Effects

The greatest impact to ruffed grouse has been loss of healthy aspen stands due to fire suppression and forest succession. This trend of forest succession and fire suppression has increased the pine cover and decreased aspen extent and vigor, negatively impacting grouse habitat. Approximately 63 percent (17,863 acres) of the project area is classified as mature ponderosa pine forest with canopy cover over 40% which typically does not have suitable conditions for aspen understory. Conversely, beneficial impacts to aspen habitat would result from past, current and future removal of commercial timber, thinning of pine and oak brush, as well as past and future wildfires and prescribed burns. Ruffed grouse populations may respond to increases in aspen habitat and the action alternatives of the Citadel project would promote this response.

Some hardwood stands have undergone pine removal in the past, particularly in Management Area 5.1. Many of these stands are now dominated by aspen in a variety of age classes. Design criteria for this project promote pockets of aspen within ponderosa pine dominated stands by allowing for the removal of conifers from within and up to 30 feet from the edge of aspen pockets in excess of ¼ acres when stands are to be commercially thinned.

Song Sparrow

Song sparrows are found exclusively in dense streamside vegetation in the Black Hills (Beason et al 2006). They occur mainly in streamside thickets, especially willows (Panjabi 2001). They are uncommon winter residents in the Black Hills (Tallman et al 2002). In the Black Hills, Panjabi (2001, 2003) found them in the highest density in riparian habitat. He also found them in white spruce adjacent to riparian stringers. They nest on the ground, among clumps of dead grasses or weeds; later in the season often 0.5-10 meters up in small conifer, thorny bush, willows, cattails, or cordgrass (NatureServe 2006).

Riparian areas account for approximately one percent of public and private land in the Black Hills and are typically located adjacent to streams and around natural springs, seeps, fens and reservoirs. The composition, structure, and pattern of riparian areas in the Black Hills have changed over the last 120 years due to a number of influences. More recent short term trends are

unknown. The latest estimate of the amount of riparian habitat on the Forest is approximately 64,000 acres. Of this acreage, about 12,000 acres have a shrub (willow) component (USDA-Forest Service 2005c).

Recent data collected by the Rocky Mountain Bird Observatory suggest that populations of song sparrows increased on the forest between 2002 and 2004 (Panjabi 2001, 2003, 2004, 2005, Beason et al 2006). It has also indicates that the song sparrow is found in fairly high densities in riparian habitats throughout the northern Black Hills (Beason et al 2006, USDA-Forest Service 2005c). Both foothill and montane riparian habitats showed increasing song sparrow densities between 2002 and 2005 (USDA-Forest Service 2005c).

Direct and Indirect Effects

Alternative A would not have direct effects on song sparrow populations or habitat because no management activities are proposed. Under Alternatives B and C, the riparian areas throughout the project area would be protected and avoided through BMPs and buffers created by the water influence zone (WIZ). Three stream crossings could cause direct mortality of song sparrow nests that are present when riparian vegetation (willows) is removed. This risk of mortality to song sparrow is very low. Associated prescribed burning may occur in riparian zones. Burning of willows during the nesting season is not likely to occur; adult mobility would likely avoid mortality.

Alternative A would indirectly affect song sparrows by not improving habitat conditions through vegetative treatments. Under Alternative A, fire hazard would increase over time, creating the potential for loss of some sparrow habitat to wildfire. Wildfires could also benefit sparrow habitat by reducing competition to willows, which are relatively fire resistant.

Prescribed burning proposed under Alternatives B and C has the potential for short-term (less than 3 year) negative impacts to riparian habitat by reducing riparian shrub cover (Dodd 2006). The proposed treatments in Alternatives B and C would have primarily beneficial impacts by enhancing riparian habitat through reductions in conifers and oak brush. Reducing pine would also lead to the development and expansion of stands of willow, aspen and birch near riparian areas, benefiting sparrow habitat (USDA-Forest Service 2005c). Effects from implementing this alternative are a slight increase in suitable riparian habitat across the Forest (Objectives 213, 214 and 238a). Decommissioning of unclassified roads located in riparian areas would benefit this species, along with riparian improvement projects.

Cumulative Effects

Some past commercial and noncommercial timber treatments have negatively impacted riparian habitat by reducing riparian shrub cover, destabilizing banks and accelerating erosion. Riparian habitat has been negatively impacted in some areas due to over utilization by livestock, bank and stream trampling, and water consumption. Past mineral withdrawal has negatively impacted stream habitat. Past human destruction of beaver dams has negatively impacted riparian habitat and likely reduced the amount of willow or other deciduous woody species found along riparian areas (USDA-Forest Service 2005c). Off-road motorized traffic has negatively impacted riparian habitat by increasing sedimentation and sloughing banks. Some of these types of activities would continue within the project area, but others would be reduced due to new Forest Plan Standards and Guidelines required by the Phase II Amendment. In addition, unclassified roads and several miles of roads located along riparian areas would be closed following the implementation of the Citadel action alternatives.

White-tailed Deer

White-tailed deer was selected as a MIS to evaluate the effects of Forest Plan implementation and natural change in the forest to support species that rely on a variety of forest conditions, including the occurrence of understory shrubs, to meet their needs (USDA-Forest Service 2005c). Important browse species in the Black Hills are bur oak, chokecherry, Oregon grape, serviceberry, sumac and snowberry. White-tailed deer live in every habitat type, including grasslands, mountains, deserts, tropical rainforests, swamps and urban settings (Higgins et al 2000). In the Black Hills, white-tailed deer inhabit a variety of forest types and structural stages. White-tailed deer in the Black Hills migrate between distinct summer and winter ranges. Hardwood stands are prominent both in white-tailed deer's selection of home ranges and their use of sites within these ranges (Stefanich 1995). Hardwood stands of aspen and birch are prominent features in white-tailed deer's selection of home ranges and their use of sites within these ranges (Stefanich 1995). Kennedy (1992) suggested aspen stands are highly selected during fawning. Spruce and aspen stands are used for summer thermal and hiding cover. Kennedy (1992) showed that aspen stands are highly selected during fawning season. During winter, deer move to winter ranges that include lower elevation forests that offer cover and browse and open habitats adjacent to wooded draws (Stefanich 1995). White-tailed deer occupy habitat throughout the project area and approximately 9,000 acres of the northern portion of the project area is within Management Area 5.4 (Big Game Winter Range Emphasis).

The Forest Service 2004 five-year evaluation report provides the most recent habitat trend assessments (1997 to 2002), using the HABCAP model. The summer index increased from 54% to 61%, and the winter index decreased slightly from 59% to 58%. Assuming these trends continue, it would appear that summer habitat conditions are undergoing a moderate increase and winter conditions are stable to slightly decreasing (USDA-Forest Service 2006). This assumption is reasonable to make because Forest management has not changed substantially between 2002 and 2007.

Deer populations in the state are monitored by SDGFP. Local population trend is considered stable but varies annually (SDGFP unpublished data). In the Black Hills, white-tailed deer are considered common to locally abundant. Forest Plan Objective 217 supports habitat for management of 60,000 white-tailed and mule deer combined in the Black Hills of South Dakota, which matches SDGFP population objectives. The white-tailed deer has increased 63 percent between 2000 and 2004 (USDA-Forest Service 2005c).

Direct and Indirect Effects

There would be no direct effects to white-tailed deer under Alternative A because no new management activities would occur. Alternatives B and C would directly affect white-tailed deer through disturbance related to management activities and removal of some cover during timber harvest, road construction and prescribed burning.

Under Alternative A, white-tailed deer foraging habitat is expected to decline. Fire suppression has caused widespread degradation of deer and elk habitat in the Black Hills (SAIC 2003). Deer typically thrive on seral vegetation and conversion of deciduous forest, such as aspen and bur oak, to ponderosa pine types has reduced diversity of forage available to deer (SAIC 2003). This alternative would not return fire to the ecosystem and would not promote the growth of seral vegetation, aspen, oak, Oregon grape and other desirable shrubs moving toward Guideline 4.5-4102.

Alternatives B and C would do both of these things. They would also create a diversity of forest structures within the pine types, provide additional forage in some stands through an increase in shrubs, and provide suitable cover in untreated stands. Different structural stage prescriptions in ponderosa pine offer different levels of habitat requirements for deer moving toward meeting Goal 5.4 – 201. Open forest conditions (Structural Stages 1, 2, 3A, and 4A) offer the best forage, including the best potential for understory shrubs. Structural Stages 3C, 4C, and 5 offer the best conditions for cover, including thermal cover (SAIC 2003). The action alternatives would result in a variety of structural stages providing year-round habitat for white-tailed deer (USDA-Forest Service 2005c).

Table 3-22. White-tailed Deer Forage and Summer Range

Forage & Habitat Indicators	Existing Condition (Alternative A)	Alternatives B & C	Change From Existing Condition
Forage in Ponderosa Pine Understory (SS1, 2, 3A, 4A)	5,742 acres	10,271 acres	+4,529 acres
Spring and Summer Habitat (Aspen and other hardwood)	3,575 acres	3,671 acres	+96 acres

Table 3-23. Acres of Thermal Cover by Management Area

Management Area	Existing Condition (Alternative A)	ALT B	ALT B Change from Existing Condition	ALT C	ALT C Change from Existing Condition
MA 3.1	1,432	1,432	no change	1,432	0
MA 3.32	175	175	no change	175	0
MA 4.1	565	336	-229	433	-132
MA 5.4	2,288	1,002	-1,286	1,103	-1,185

Spring and summer home ranges for white-tailed deer in the Northern Hills is found in both mature and immature aspen and other hardwood stands (Stefanich 1995). Currently, these can be found on approximately 2,055 acres of aspen and 1,520 acres of other hardwoods including birch and oak. Both of the action alternatives would increase aspen and other hardwood stand amounts to some degree (Objective 201).

The action alternatives could cause deer mortality through the increase of vehicles upon roads and prescribed burning. These alternatives would require approximately 53 miles of road reconstruction or construction. The current road density in the Citadel project area is 3.1 miles/square mile. At the completion of either of the action alternatives, the road density would be reduced to 1.2 miles/sq mile.

Cumulative Effects

White-tailed deer are migratory and move between distinct summer and winter ranges. They are impacted cumulatively by activities occurring within the Citadel project area, along their migratory routes and on lower elevation winter ranges. Winter ranges are primarily privately owned ranches located north of the project area. Habitat loss or degradation adds cumulatively to other impacts influencing white-tailed deer in the project area. Livestock grazing, fire suppression and forest succession have increased the amount of pine across the landscape and decreased meadows, riparian areas, and hardwood stands over the last 100 years. Roads within the area are used for multiple uses (e.g. ranching, allotment monitoring, weed control, recreational use, logging, etc.). Approximately 138.1 miles of Forest Service roads are currently present in the project area (3.1 miles/square mile). High road densities alter both human and animal behavior,

which contribute to animal displacement and stress (SAIC 2003). Deer are hunted within the project area, along traditional migratory routes and on winter ranges. Under the no action alternative, vegetation alterations are not permitted; therefore, there would be no cumulative impacts from timber harvest. However, loss of vegetative management on NFS lands could mean the area may become unproductive for current management of white-tailed deer and current road densities would remain. The action alternatives would alter vegetation structure, introduce fire back into the ecosystem and eventually reduce road densities.

SPECIES OF LOCAL CONCERN

Region 2 defines Species of Local Concern (SOLC) as species documented or suspected to be at risk at a local scale within Region 2, but that do not meet the criteria for regional Sensitive Species (SS) designation. SOLC need to be addressed during project design and effects to the species evaluated from alternatives considered. Forest Plan Objective 221 requires the Forest Service to conserve or enhance habitat for R2 SS and SOLC. Risk analyses are completed only for those species that occur, or whose habitat may be impacted by the project. The following discussion of Species of Local Concern is tiered to the Phase II Amendment FEIS (USDA-Forest Service 2005c). The following table shows the species that are included in the effects analysis for the Citadel project.

Table 3-24. Species of Local Concern Summary

Scientific Name	Common Name	Species Present?	Habitat Present?
Speyeria atlantis pahasapa	Atlantis Fritillary Butterfly	Yes	Yes
Buteo platypterus	Broad-winged Hawk	Yes	Yes
Accipiter cooperii	Cooper's Hawk	Yes	Yes
Zapus hudsonius campestris	Meadow Jumping Mouse	Yes	Yes
Glaucomys sabrinus	Northern Flying Squirrel	Yes	Yes
Aegolius acadicus	Northern Saw-whet Owl	Yes	Yes
Accipiter striatus	Sharp-shinned Hawk	Yes	Yes
Phycoides batesii	Tawny Crescent Butterfly	Yes	Yes
Mniotilta varia	Black-and-white Warbler	No	Yes
Sitta pygmaea	Pygmy Nuthatch	No	Yes
Myotix evotis	Long-eared Myotis	No	Yes
Myotis volans	Long-legged Myotis	No	Yes
Myotis septentrionalis	Northern Myotis	No	Yes
Myotis ciliolabrum	Small-footed Myotis	No	Yes

Broad-winged Hawk and Cooper's Hawk

The broad-winged hawk breeds in deciduous and coniferous forests from southern Canada and southward across the eastern United States (Bull and Ferrand 1977). They forage in mature and old-growth forests, along forest streams, roads, and openings (Stephens and Anderson 2003). In the Black Hills, the broad-winged hawk nests primarily in ponderosa pine in mixed pine and deciduous habitats, occasionally with a white spruce component. This hawk is considered rare in South Dakota (Peterson 1995). They have been documented on the Northern Hills District and there is a potential broad-winged hawk nest in the project area (USDA-Forest Service 2007).

The Cooper's hawk breeds in forested habitat across southern Canada and throughout the continental United States (Udvardy and Ferrand 1994). This bird is known to nest in riparian, conifer and aspen forests (Stephens and Anderson 2003b). The most common forest type in the Black Hills, ponderosa pine, is used for nesting, with moderate to high (60-90%) canopy closure

adjacent to openings (Structural Stages 4B, 4C and 5) (Stephens and Anderson 2003b). The Cooper's hawk forages across diverse habitats and preys on a variety of birds and mammals (Stephens and Anderson 2003b). They have been documented on the Northern Hills District (USDA-Forest Service 2007).

Direct and Indirect Effects

Alternative A would have no direct impact on broad-winged hawk and Cooper's hawk because no new activities would occur. Nesting habitat would likely increase with no active management. Foraging habitat would likely decrease as riparian corridors and open habitats are encroached upon. Additionally, young, dense stands would mature and the availability of diverse foraging habitats would decline. There are increased risks from wildfire and mountain pine beetle outbreaks with this alternative. Wildfire has the potential to eliminate habitat. Beetle outbreaks would also likely decrease suitable habitat. Continuing current travel management would likely negatively impact habitat security. Open road density is 3.1 miles of road/per square mile.

Table 3-25. Broad-winged Hawk and Cooper's Hawk Nesting Habitat by Alternative

Alternative	Nesting Habitat (SS 4B, 4C and 5)
A	17,863 acres
B	13,333 acres
C	12,514 acres

Management activities associated with Alternatives B and C have the potential to result in individual mortality for members of these species. Indirect impacts include nesting habitat loss for both species and preferred foraging habitat loss (approximately the same loss as nesting) for the broad-winged hawk or disturbance from logging, mechanical thinning, road construction and prescribed burning. Foraging habitat for Cooper's hawk would likely remain stable or increase with logging, thinning and prescribed burning, providing a variety of prey in diverse habitats. Initial road use would increase during project implementation. At the close of the project, potential negative impacts from off-road motorized traffic would be minimized, as use is restricted and open road densities are decreased.

Cumulative Effects

Past, current and future removal of mature timber has likely negatively impacted nesting habitat and foraging habitat for the broad-winged hawk and Cooper's hawk. Fire suppression has likely increased nesting and some foraging habitat. Mechanical thinning and prescribed fire have likely increased nesting and some foraging habitat by reducing understory competition and helping stands to mature faster. Foraging habitat has likely remained stable, as mature stands dominate the landscape and these birds will forage in a variety of habitats. Motorized traffic negatively impacts nesting habitat.

Northern Saw-whet Owl

Saw-whet owls occur from the southern boundary of Alaska, across most of Canada and into the northern United States, generally from Maine to Minnesota (Johnson and Anderson 2003). The Rocky Mountains, Cascade Range, Coastal Range, and Sierra Mountains all support year-round populations. In the Black Hills, seasonal migration between high and low elevation habitat is likely (Johnson and Anderson 2003). The saw-whet owl can be found in more dense coniferous forests and dense riparian woodlands. This owl nests in cavities of snags excavated by flickers, or

other large woodpeckers (Johnson and Anderson 2003). Nests tend to be in mature forests (Structural Stages 4C and 5), while dense sapling-pole sized stands are preferred for roosting (Johnson and Anderson 2003). This species preys on small mammals, particularly deer mice, and birds. They have been documented in the Northern Hills District (USDA-Forest Service 2007).

Direct and Indirect Effects

There would be no direct effects under Alternative A because no new activities would occur. Nesting habitat (i.e., mature, dense forest) would likely increase with no active management. Foraging habitat would likely remain stable, although riparian corridors and open habitats would decline. Additionally, young, dense stands would mature, and the availability of roosting habitats may decline. There are increased risks from catastrophic wildfire and mountain pine beetle outbreaks with this alternative. Wildfire has the potential to reduce habitat. Beetle outbreaks may reduce some dense forest habitat, but would also increase snags available for roosting. Not changing current travel management would likely negatively impact nesting habitat security. Open road density would remain at 3.1 miles of road per square mile.

Table 3-26. Changes in Nesting and Roosting Habitat

Alternative	Nesting habitat (acres) (SS 4C and 5)	Roosting habitat (acres) (SS 3B and 3C)
A	7,702	539
B	3,572	454
C	4,007	454

Direct impacts under both action alternatives include potential for individual mortality due to management activities. Indirect impacts include nesting habitat loss or disturbance from logging, mechanical thinning, road construction and prescribed burning. Foraging habitat would likely remain stable or increase with logging, thinning and prescribed burning providing a variety of prey in diverse habitats. Potential negative impacts to roost security from off-road motorized traffic would be reduced at the close of the project as use is restricted and open road densities are decreased. Riparian habitats would be protected from harvest treatments and aspen stands would be enhanced.

Some snags may be lost for safety reasons during logging operations and prescribed burning. Prescribed burning is expected to create more snags than are lost. However, most of these snags would likely be of a smaller size class. These alternatives decrease current road densities and decrease off-road access, which protects snags.

Cumulative Effects

Past, current and future removal of mature and immature timber has likely negatively impacted nesting and roosting habitat by removing trees and snags and opening the overstory. Fire suppression has likely increased nesting and roosting habitat. Mechanical thinning, prescribed fire, and wildfires have also opened up dense stands, reduced snags and decreased nesting and roosting habitat. Foraging habitat has likely remained stable, as these birds forage in a variety of habitats. Roads and fuelwood gathering (i.e. illegal cutting of snags) has and would likely continue to negatively impact habitat. Motorized traffic negatively impacts this species nesting habitat.

Sharp-shinned Hawk

The sharp-shinned hawk breeds from Alaska to Newfoundland, south throughout much of North America, Mexico, and into Central and South America wherever suitable habitat occurs (Stephens and Anderson 2003b). The species is considered partial to long-distance migration, with northern-most individuals wholly abandoning their breeding ranges and wintering in the southern United States. Other birds may remain on their breeding ranges throughout the winter. In the Black Hills they were suggested to be "probably fairly common" (Pettingill and Whitney 1965) although currently they seem to occur in very low densities (Panjabi 2003). They have been documented using spruce, pine and aspen cover types (Panjabi 2003). An association between nesting and young seral stages with dense canopies has been noted (Stephens and Anderson 2003b). They have been documented on the Northern Hills District (Panjabi 2005). Sharp-shinned hawks prey on small birds and mammals.

Direct and Indirect Effects

There would be no direct impacts because no new activities would occur. Indirectly, nesting habitat (i.e. dense young forest, structural stages 3B and 3C) would likely decrease without active management. Foraging habitat may decrease as well as prey associated with open habitats would decline. There are increased risks from wildfire and mountain pine beetle outbreaks with this alternative. Wildfire has the potential to reduce habitat. After a fire however, more nesting habitat would result. Beetle outbreaks would also likely decrease mature trees and, in time encourage more nesting habitat and more diverse foraging habitat. Continuing current travel management would likely negatively impact nesting and foraging habitat from motorized disturbance. Open road density would remain at 3.1 miles of road per square mile.

Table 3-27. Changes in Sharp-shinned Hawk Nesting Habitat

Alternative	Acres of Preferred Nesting Habitat
A	539
B	454
C	454

Direct impacts include potential for individual mortality (nest loss or abandonment) due to management activities proposed under Alternatives B and C. Indirect impacts include nesting habitat loss (approximately 85 acres) or disturbance from logging, mechanical thinning, road construction and prescribed burning. However, in time, other nesting habitat would be created and enhanced where mature trees are harvested leaving younger trees to become established and dominate stands. Foraging habitat would likely remain stable with logging and prescribed burning providing a variety of structural stages and cover types in which diverse prey species exist. Potential negative impacts from off-road motorized traffic would decrease compared to Alternative A, as use is restricted and open road density is decreased.

Cumulative Effects

Past, current and future removal of mature timber has likely positively impacted habitat by increasing young pine regeneration and enhancing nest stands. Fire suppression has likely increased nesting habitat. Mechanical thinning, prescribed fire, and wildfires have opened up dense stands and decreased nesting habitat. Foraging habitat has likely remained stable, as this bird forages in a variety of habitats. Motorized traffic has and will likely continue to negatively impact this species nesting and foraging habitat.

Pygmy Nuthatch

This species range includes southern interior British Columbia, northern Idaho, western Montana, central Wyoming, and southwestern South Dakota south to Baja California, Mexico, and western Texas. Pygmy nuthatches are cavity nesters generally associated with open, mature ponderosa pine forests (Ghalambor 2003, Scott 1979) with less than 70% canopy cover (Structural Stages 4A, 4B, and open 5) (Clark et al 1989). Degraff (1991) also noted that this species prefers more open park-like stands in lower and middle elevations. This species has demonstrated a dependence on snags and relatively large trees, is sensitive to forest alteration, and has shown declines when timber activities have removed snags (Ghalambor 2003). On the Black Hills, as elsewhere, identified limiting factors are thought to be the availability of snags for nesting sites and winter roosting habitat and the availability of productive foraging habitat (Ghalambor 2003). Estimates of local abundance are unavailable due to the scarcity of this species and its unpredictable distribution (Panjabi 2003).

Based on the literature in the West for this species, larger snags are preferred for nesting, and Clark et al (1989) recommended providing 3 to 5 large (over 19 inches dbh) snags per acre. Pygmy nuthatches have been known to utilize woodpecker holes. The nuthatch feeds on insects, ants, wasps, moths, beetles, grasshoppers, spiders, and pine seeds. This species is an uncommon resident in the Black Hills with a yearly fluctuating population; sighted more frequently in recent years, but of uncertain status in the northern hills (South Dakota Ornithologists Union 1991). This species has not been recorded in the project area.

Direct and Indirect Effects

There would be no direct impacts because no new activities would occur. Nesting and foraging habitat (open, mature forest) would decrease over time without active management. Snag habitat would likely increase. There are increased risks from wildfire and mountain pine beetle outbreaks with this alternative. Wildfire has the potential to reduce habitat. Beetle outbreaks would likely increase suitable habitat by creating snag habitat and thinning pine stands. Not changing current travel management may negatively impact snags and nesting habitat security.

Table 3-28. Changes in Pygmy Nuthatch Nesting Habitat

Alternative	Acres of Preferred Nesting Habitat (SS 4A, 4C and 5)
A	12,080
B	7,648
C	11,531

Direct impacts include potential for individual mortality due to management activities under Alternatives B and C. Indirect impacts are mostly beneficial from the removal of mature and immature conifers and brush from commercial logging, mechanical thinning and prescribed burning. Preferred nesting and foraging habitat in open pine sites would increase, provided large snags are retained. Prey species would likely increase (Cerovski 2002, Dykstra 1999). Mature trees that potentially become snags would decline in cutting units. Some snags may be lost to prescribed fire, but more snags are expected to be created though prescribed burning than are lost. Potential negative impacts (disturbance and illegal snag cutting) from off-road motorized traffic would be minimized, as use is restricted and open road densities are decreased.

Some snags may be lost through logging operations and prescribed burning for safety reasons. Prescribed burning is expected to create more snags than are lost. However, most of these snags would likely be of a smaller size class.

Cumulative Effects

Past, current and future removal of mature and immature timber has likely positively impacted nesting and foraging habitat by removing trees and opening the stand. Fire suppression has likely decreased nesting and foraging habitat. Mechanical thinning, prescribed fire, and wildfires have also opened up dense stands, and increased nesting and foraging habitat. Snags have declined due to past and current management activities, negatively impacting nesting and roosting habitat. Snags may further decline in harvest units if they are deemed a safety hazard. Prescribed burning would both consume and create snags. Roads and fuelwood gathering (i.e., illegal cutting of snags) has negatively impacted habitat.

Bats

The following bat species may use the project area for foraging, maternity roosts, hibernacula and/or roosting habitat and are analyzed together in this section: northern myotis, small-footed myotis, long-eared myotis and long-legged myotis. None of these species have been documented in the project area.

Northern Myotis: The northern myotis ranges across most of eastern North America. They have been documented across the Black Hills region (Higgins et al 2000, Cerovski et al 2004). The northern myotis is found in wooded riparian zones in badlands and prairies to higher elevation coniferous and deciduous woodlands (Schmidt 2003). Hibernacula for this species include mines and caves. Day roosts have been reported in buildings, under shingles, underneath bark, inside tree cavities, and in caves, mines and quarries. They have been documented using ponderosa pine snags as summer/maternity roosts in the Black Hills (Tigner and Dowd Stukel 2003). Moths and beetles make up most of this bat's diet (Schmidt 2003).

Small-footed myotis: The small-footed myotis ranges across much of western North America, from central Canada south to the central States of Mexico (Schmidt 2003a). The species is widespread but not abundant throughout the Black Hills region. It is found in a wide range of habitat types and is usually associated with rocky outcroppings within this broad range of habitat types (Schmidt 2003b). Hibernacula for this species include mines and caves. Maternity and summer roosts are usually associated with rock features. This species may use snags with loose bark as day roosts. Moths and beetles are primary prey items.

Long-eared myotis: The long-eared myotis ranges across much of montane western North America, from west central Canada; south to Baja California along the Pacific coast; along the western edges of the Dakotas; and most of Wyoming and Colorado to northwestern New Mexico and northeastern Arizona (Schmidt 2003b). This species is associated with coniferous montane habitats and has been reported foraging among trees and over woodland ponds. Hibernacula for this species include mines and caves, although they have not been documented hibernating in the Black Hills (Schmidt 2003c). Day and maternity roosts in the Hills are found in buildings, rock crevices, snags, under loose bark, and caves and mines. Limited data suggest they utilize ponderosa pine snags as day and maternity roosts in other regions. Moths and beetles are believed to be important prey items (Schmidt 2003c).

Long-legged myotis: The long-legged myotis is common across the western United States. Its range extends across much of western North America from southeastern Alaska into central Mexico (Schmidt 2003b). This species is considered to be the most common and widely distributed member of the genus *Myotis* and has been documented across the Black Hills region (Schmidt 2003d). This bat is primarily associated with montane forest. This species forages over meadows, ponds, streams, and open mesic habitats of the Black Hills. Hibernacula for this species include mines and caves. Day and maternity roosts have been documented in rock crevices,

buildings, under the bark of trees and in snags (Schmidt 2003d). Ponderosa pine snags are used as summer/maternity roosts in the Hills. Moths appear to comprise the majority of this species' diet, and it is known to feed on the spruce budworm moth (Schmidt 2003d).

Direct and Indirect Effects

Alternative A would have no direct impacts to these bat species because no new activities would occur. Indirect impacts include forest succession and fire suppression, which will limit foraging opportunities by creating dense forests and decreasing riparian areas so that they are not suitable foraging areas. Snag habitat would not be impacted. There are increased risks from wildfire and mountain pine beetle outbreaks with this alternative. The impacts of wildfire would be loss of roost trees and snags over large areas. However, snags would also be created by wildfire and beetle outbreaks. Beetle outbreaks would reduce live pine, increasing roost habitat and opening up the canopy to provide more suitable open foraging areas. Not changing current travel management would likely negatively impact bat roost habitat. Open road density would remain the same at 3.1 miles of road per square mile.

Management activities under Alternatives B and C have the potential to cause individual mortality for members of these bat species, though none have been identified in the project area. Indirect impacts include likely roosting habitat loss or disturbance from logging, thinning, road construction and prescribed burning; however, foraging habitat would likely increase with logging, thinning and prescribed burning. Insect prey numbers would likely increase after prescribed burns (Cerovski 2002). Potential negative impacts (e.g. illegal snag cutting) from off-road motorized traffic would be minimized, as use is restricted and open road densities are decreased. Alternatives B and C would generate funding to place three bat gates to protect bat colonies in mines and caves located in the project area. Some snags may be lost through logging operations and prescribed burning for safety reasons. Prescribed burning is expected to create more snags than are lost. However, most of these snags would likely be of a smaller size class. These alternatives would decrease current road densities and decrease off-road access, which would protect snags.

Cumulative Effects

Past, current and future removal of mature timber and loss of snags from past fuelwood gathering and logging operations has negatively impacted bat roosting habitat. Fire suppression has likely increased roosting habitat and decreased foraging habitat. Past, current and future removal of timber from logging, thinning and prescribed burns has increased foraging habitat and prey numbers (Cerovski 2002) for bats. Prescribed burning has been both beneficial by creating snags in some areas and detrimental by consuming established snags in other areas. Timber harvesting of mature trees and snags on adjacent private lands has also negatively impacted roost habitat, and enhanced foraging opportunities. Past human destruction of beaver dams has negatively impacted riparian habitat. Road construction and public access has likely negatively impacted roost habitat by providing a means to illegally remove snags.

Black-and-white Warbler

The black-and-white warbler breeds in mature deciduous forests of the eastern United States and throughout Canada. Overall, its populations are stable throughout North America (Sauer et al 2003). Habitat fragmentation is probably the main threat to this species. The Black Hills is at the edge of the black-and-white warbler's distribution in the United States. In the Black Hills, the

black-and white warbler uses mature aspen stands, bur oak woodlands and forested riparian areas (Panjabi 2005, Tallman et al 2002). Nests are placed on or near the ground and are well concealed at the base of a stump, log or rock (Kricher 1995). This species forages on insects and spiders. It is a rare breeder in the Black Hills, with breeding records confirmed in South Dakota but not in Wyoming (South Dakota Ornithologists Union 1991, Cerovski et al 2004).

Direct and Indirect Effects

There would be no direct impacts to the black-and-white warbler under Alternative A because no new activities would occur. Indirect impacts to warbler habitat include forest succession that favors pine and contributes to loss of aspen, riparian and oak woodland habitat. Warbler habitat would decline and become further fragmented. There would be increased risks from wildfire and mountain pine beetle outbreaks with this alternative. The impacts of wildfire would be short-term (less than 5 years) negative impacts and long-term (over 20 years) benefits to aspen, riparian and oak habitat. Likewise, beetle outbreaks would reduce pine and encourage hardwoods, increasing and benefiting warbler habitat.

Table 3-29. Changes in Habitat for Black-and-white Warbler

Alternative	Habitat Enhancements
A	0 acres
B	135 acres of hardwood enhancement, increase of 96 acres of aspen and birch
C	787 acres of hardwood enhancement, 106 acres of meadow enhancement and an increase of 165 acres of aspen and birch

Direct impacts that could result from Alternatives B and C include the potential for individual mortality due to management activities. Indirect impacts include potential habitat loss or disturbance that may occur from logging, thinning, prescribed burning and temporary road construction in mixed pine and aspen, riparian or oak habitat. The proposed treatments in this alternative would have mostly beneficial impacts by decreasing pine cover, increasing water available to aspen and birch habitat and encouraging the growth and expansion of aspen, riparian and oak habitats. Habitat enhancement projects are proposed for 231acres under Alternative B and 1,058 acres under Alternative C. Prescribed burning may have short-term (less than 1 year) negative impacts, but longer-term benefits to foraging habitat (Cerovski 2002). Potential negative impacts to nesting from off-road motorized traffic would be minimized, as use is restricted and open road densities decrease.

Cumulative Effects

The greatest impact to this species has been loss of healthy riparian areas and aspen stands due to fire suppression and forest succession which has increased the pine cover and decreased riparian habitat and aspen extent and vigor (USDA-Forest Service 2005c). Past, current and future removal of mature and immature timber has likely positively impacted nesting and foraging habitat by removing pine trees and encouraging hardwood and riparian development. Mechanical thinning, prescribed fire, and wildfires have caused reductions in pine trees and increased hardwood and riparian nesting and foraging habitat. Past livestock overgrazing has decreased riparian shrubs in some localized areas reducing habitat. Past human destruction of beaver dams has negatively impacted riparian habitat. Motorized traffic in riparian zones and oak and aspen woodlands has likely negatively impacted warbler nesting security habitat.

Meadow Jumping Mouse

The meadow jumping mouse occurs across portions of Alaska east through much of Canada and in the northern and eastern United States as far south as Georgia and Alabama (Higgins et al 2000). Within the continental United States, its western boundary extends to the eastern foothills of the Rocky Mountains (Higgins et al 2000). The Bearlodge jumping mouse is a separate subspecies that occurs in the Black Hills of northeastern Wyoming and is considered rare in the state (Cerovski et al 2004). The Bearlodge jumping mouse also occurs in western South Dakota and southeastern Montana. The meadow jumping mouse is associated with marshy areas and moist grasslands near streams, coniferous and deciduous forests, mixed shrublands and riparian shrublands (Cerovski et al 2004). It feeds on buds, grasses, seeds, fungi, leaves, fruit, and insects.

Meadow jumping mice tend to occur at relatively low abundance and it is uncertain whether current abundance is different than the past. Limits to abundance and distribution include reduction of understory shrubs, grasses, and forbs in low-to-mid elevation riparian areas (Cerovski et al 2004). Fragmentation of appropriate riparian habitat may limit this species' ability to disperse.

Direct and Indirect Effects

Alternative A would have no direct impact on meadow jumping mice because no new activities would occur. Species and structural diversity of habitats would decrease, negatively impacting this species. Pine encroachment also contributes to loss of willow, aspen, or cottonwood species. There would be increased risks from wildfire and mountain pine beetle outbreaks with this alternative. The impacts of wildfire would be short-term (less than 5 years) negative impacts and long-term (over 20 years) benefits to riparian habitat. Beetle outbreaks may enhance understory development of hardwoods, shrubs, forbs and grasses diversifying foraging habitat. Not changing current travel management would likely negatively impact riparian habitat.

Alternatives B and C have the potential to cause individual mortality due to management activities. Indirect impacts include potential habitat loss or disturbance that may occur from temporary road construction in riparian areas. Reducing pine would also lead to the development and expansion of hardwood stands and grasslands near riparian areas, benefiting mouse habitat. Pine removal is proposed for 106 acres within riparian areas in Alternative C. Prescribed burning and logging may have short-term (less than 2 year) negative impacts to riparian habitat by reducing hiding cover and increasing sedimentation. Potential negative impacts from off-road motorized traffic in riparian areas would be minimized, as use is restricted and open road densities decrease. The closure of several miles of classified roads along riparian areas could benefit this species.

Cumulative Effects

Some of the past and proposed treatments have and may again negatively impact riparian habitat by increasing sedimentation. Best Management Practices and WIZ protection measures would help prevent this from causing impacts. Riparian habitat has, and currently is, negatively impacted in some areas due to over utilization by livestock, bank and stream trampling and water consumption. Past mineral withdrawal has negatively impacted stream habitat. Off-road motorized traffic has negatively impacted riparian habitat by increasing sedimentation and sloughing banks.

Northern Flying Squirrel

This nocturnal mammal is a resident of the mountainous areas of the western United States and boreal forests of North America. Its range includes eastern Alaska, the montane western United States, most of Canada, and the northeastern United States (Burt and Grossenheider 1976). The northern flying squirrel in the Black Hills is an isolated population with the next nearest population located in western Wyoming (Clark and Stromberg 1987). Optimal northern flying squirrel habitat has been reported as cool, moist, mature forest with abundant standing and down snags. It is often most abundant near surface water (swamps and streams) (NatureServe 2006). Northern flying squirrels typically nest in tree cavities or abandoned woodpecker holes in winter and summer. They feed on lichens, fungi, conifer cones, fruit, buds, arthropods, bird eggs and nestling birds (Cerovski et al 2004).

There is a lack of specific data on habitat use by northern flying squirrels in the Black Hills. Turner (1974) noted that the highest densities are likely found in white spruce forests in moist canyons of the northern Black Hills. Duckwitz (2001) found flying squirrels in Wind Cave National Park in ponderosa pine types that had an open canopy allowing understory grasses to prosper. Open pine types may provide the “openness” necessary for gliding. Locations where flying squirrels were found in Wind Cave National Park did have large pines. Stands of dense dog hair pine were avoided (Duckwitz 2001). Anecdotal evidence suggests that Black Hills flying squirrels are habitat generalists and can be found in open pine habitat adjacent to more densely vegetated hardwood habitats (Krueger personal communication 2006). Northern flying squirrels have been located in the Citadel project area (USDA-Forest Service 2007).

Direct and Indirect Effects

Alternative A would have no direct effect on flying squirrels because no new activities would occur. Indirect impacts include forest succession and fire suppression creating dense forests, which is the preferred habitat. Increases in snag roosting habitat would be expected. There are increased risks from catastrophic wildfire and mountain pine beetle outbreaks with this alternative. The impacts of catastrophic wildfire would be loss of snags and preferred dense forest conditions to large areas. Foraging habitat would benefit from fire. Beetle outbreaks would reduce live pine, increasing snag habitat, but opening up the canopy may decrease preferred habitat. Not changing current travel management would likely negatively impact snag habitat by providing access for illegal snag cutting. Open road density would not change.

Table 3-30. Changes in Northern Flying Squirrel Nesting Habitat

Alternative	Acres of Preferred Nesting Habitat (Pine SS 4C and 5 and spruce).
A	7,743
B	3,613
C	4,048

Management activities proposed under Alternatives B and C could result in individual mortality to flying squirrels. Indirect impacts include likely roosting habitat loss or disturbance from logging, thinning, road construction and prescribed burning. Preferred dense forest habitat would decline, but the amount of white spruce habitat would remain the same (41 acres) and stands of pine adjacent to riparian areas would be avoided due to the WIZ buffers. Alternative C would not harvest in designated old growth stands. Alternative C would also create 8 openings (clear cuts) which flying squirrels avoid if too large (USDA-Forest Service 2005c). Prescribed burns would destroy some current snags and also create new snag habitat. Some benefits to foraging habitat would be realized. Potential negative impacts (e.g. illegal snag cutting) from off-road motorized traffic would be minimized, as use is restricted and open road densities are changed.

Cumulative Effects

Past, current, and future harvest of mature timber and the loss of snags from past fuelwood gathering and logging operations has negatively impacted preferred dense forest and roosting habitat. Fire suppression has likely increased preferred habitat. Prescribed burning has been both beneficial by creating snags in some areas and detrimental by consuming established snags in other areas. Road construction and public access has likely negatively impacted roosting habitat by providing a means to illegally remove snags.

Butterflies

The tawny crescent occurs in all counties encompassing the Black Hills (Ferris 1971, Marrone 2002). It is found in open meadows, stream bottoms, roads, trails, and riparian woodlands (Stefanich 2001). It is also found in mesic forest corridors across an ecotone between mixed-grass meadows or prairie grasslands at adjacent woodlands (Royer and Marrone 1992). Adults obtain nectar on a variety of forbs, including dogbane, leafy spurge and various composite flowers. Tawny crescent larvae appear dependent on asters as a food source, although the specific host species, and their relationship remain unclear (Stefanich 2001). This species has been located in the Citadel project area (Marrone 2005, USDA-Forest Service 2007).

The Altantis fritillary is an endemic butterfly of the Black Hills (NatureServe 2004). In general, it occurs in riparian areas adjacent to openings and moist meadows and in boreal forests (NatureServe 2006). Although adults are regarded as general nectarvores, feeding on a variety of flowers, larvae of this genus feed exclusively on violets (*Viola spp*.) (NatureServe 2004). This species has been located in the Citadel project area (Lovett 2006, USDA-Forest Service 2007)

Direct and Indirect Effects

Alternative A would have no direct effect on the tawny crescent or Atlantis fritillary because no new activities would occur. No habitat improvement would be conducted in meadows, hardwoods or riparian areas under this alternative. The pine forest would continue to encroach upon suitable habitats under this alternative.

Alternatives B does not include treatments at the four known locations of the Tawny crescent in the Citadel project area, so no direct effects are likely. Alternative C includes prescribed burning within two of the sites. Under Alternative C, individual mortality could occur from prescribed fire activities, but is not likely due to butterflies' mobility.

Management direction for riparian ecosystems, hardwood communities, grasslands, and meadows has the potential to impact these species. The Forest Plan contains numerous objectives, standards, and guidelines intended to maintain or enhance the quality of these areas (USDA-Forest Service 2005c).

The Atlantis fritillary has been found in five different locations in Citadel. Two of the five sites overlap areas proposed for timber harvest, pre-commercial thinning and prescribed burning in both action alternatives. Butterfly guidelines for prescribed burning and buffering of these sites would reduce direct effects on this species. The action alternatives provide habitat enhancement opportunities in meadows, hardwoods and riparian areas (see above description for Black-and-white warbler).

Road decommissioning would occur on 31 miles of unclassified road within the project area and could include reseeding with native plant species, which would benefit butterflies by providing additional native plant habitat.

Cumulative Effects

The loss of native plant species, particularly around water sources has caused a decline in habitat for butterfly species (Marrone 2005). Conifer encroachment into hardwoods, meadows and riparian areas has also reduced their habitat. Decades of fire suppression throughout the forest has contributed to this issue. Livestock overgrazing in such areas has potentially reduced necessary forbs for nectar and larvae food. However, moderate livestock grazing has the potential to benefit butterfly habitat by decreasing grass cover and encouraging forbs such as aster. Past human destruction of beaver dams has negatively impacted riparian habitat. Often roads are located in areas suitable for the Tawny crescent and Atlantis fritillary, causing a loss of vegetation.

MIGRATORY BIRDS

Migratory bird species of concern applicable to project-level conservation are identified by many sources including the Endangered Species Act, the Regional Forester's sensitive species list, the Black Hills National Forest MIS list, internal and public scoping efforts, the Wyoming Partners In Flight Plan (PIF), and the U.S. Fish and Wildlife Service's Birds of Conservation Concern (BCC) 2002 publication (U.S. Fish and Wildlife Service 2002).
The BCC 2002 publication partitions North America into 37 bird conservation regions (BCRs). The Black Hills is included in BCR 17 – Badlands and Prairies. Of the 24 bird species found in BCR 17, eleven are duplicated on the Regional Forester's Sensitive Species list, and have been addressed elsewhere in this document if they have potential to occur in the Black Hills. Nine of the other species are not expected to occur in the Black Hills due to lack of habitat. The four remaining species have documented occurrence on or near (within 1 mile) the Black Hills National Forest and are evaluated below for anticipated effects.

Golden Eagle (*Aquila chrysaetos*)

The golden eagle occurs throughout North America. The species is common in the plains of the western United States, Alaska and western Canada. It is a year-round resident of Wyoming and western South Dakota. This bird feeds primarily on small mammals, birds such as grouse and ducks, snakes, and carrion. Golden eagles inhabit open country, from barren areas to open coniferous forests, primarily in hilly or mountainous regions, but are also found in deserts and grasslands. It prefers to nest on cliff ledges, but will occasionally use trees for nesting. The golden eagle utilizes hilltops, cliff ledges and trees for roosting (DeGraff et al 1991).

Within the Black Hills, this eagle prefers to nest on sandstone and limestone cliffs (Pettingill and Whitney 1965). There have been numerous recorded observations of golden eagles on the Northern Hills District as well as recorded observations from the RMBO (USDA-Forest Service 2007, Panjabi 2005). This species has been documented within the Citadel project area (USDA-Forest Service 2007).

Environmental Consequences

Hunting success for this species may increase due to the creation of more open habitat with treatments proposed for the Citadel area. Additionally, reduced pine overstory in proposed cutting

areas would likely increase horizontal screening cover, which would benefit long-term (5-25 years) prey populations and survival and thus, eagle populations indirectly. Prescribed burning in forested areas, which would create more open habitat, may increase hunting opportunities. Enhanced habitat for prey species would benefit eagles. Potential nest trees may decrease in cutting units. However, nest trees are not limiting in the Black Hills. Nesting is primarily on cliffs in the Black Hills, yet nests are occasionally found in trees. Nesting habitat would be maintained by providing adequate numbers of trees across the project area.

Prairie Falcon (*Falco mexicanus*)

The prairie falcon occurs throughout southwestern Canada and the western United States. It is locally common throughout the plains, deserts, canyons, foothills and mountains in relatively arid regions (DeGraff et al 1991). It is a year-round resident of Wyoming and far western South Dakota. This bird nests on cliffs, from low outcrops (Tallman et al 2002) to tall vertical cliffs over 400 ft. (DeGraff et al 1991). The prairie falcon feeds on a variety of prey including ducks, prairie chickens, quail, pigeons, doves, small birds, prairie dogs, mice, ground squirrels, rabbits, grasshoppers, and lizards (DeGraff et al 1991). Hunting occurs in open areas.

Observations in the Black Hills are primarily along the perimeter of the forest, where high cliffs provide nest sites adjacent to open grasslands for hunting (Panjabi 2003). There have been observations of this species on the Northern Hills District (USDA-Forest Service 2007). Nesting falcons have been consistently observed on Sheep Nose Mountain, on the neighboring Bearlodge District approximately 17 miles northwest of the Citadel project area.

Environmental Consequences

Proposed projects in the Citadel area would create more open and diverse habitats, benefiting falcons and prey species. Initially, some cover would decrease in proposed treatment areas. Loss of cover for prey species would likely increase falcon hunting opportunities and success by making prey more vulnerable to detection over the short term, and increases in understory diversity and production would likely enhance prey species populations and survival over the long-term, thus benefiting the falcon.

Red Naped Sapsucker (*Sphyrapicus nuchalis*)

This species occurs from southern British Columbia and Saskatchewan south throughout the western United States. The red naped sapsucker is commonly found in deciduous and mixed deciduous-coniferous forests. In the Rocky Mountains, it occurs in pure aspen stands or mixed pine-aspen stands (DeGraff et al 1991).

It prefers to excavate cavities in aspen, but will also use birch, cottonwood, or ponderosa pine. It may use the same nest tree year after year, but excavates a new cavity each year (DeGraff et al 1991). In addition to foraging on cambium and sap, it will also consume insects, fruits, mast, and other seeds.

The red naped sapsucker occurs throughout much of the Black Hills, typically in low to moderate abundance, although it is most abundant in the northern Black Hills. The abundance and

distribution of this species is tied to the availability of hardwood stands, particularly aspen and birch (Panjabi 2003). They occur in greatest density in aspen stands (D=13.8 birds/km^2 in Panjabi 2001, and D=10.4 birds/km^2 in Panjabi 2003). They have been observed in hardwood stands of aspen and birch, and mixed pine-aspen stands across the Northern Hills District, as well as within the Citadel project area (Beason et al 2006, USDA-Forest Service 2007).

Environmental Consequences

Nest trees and nesting habitat for this species may be decreased by the removal of commercial wood (over 9" diameter at breast height) in the proposed cutting areas. However, this bird prefers to nest in aspen trees, which are unlikely to be affected by proposed activities. Silviculture treatments, which encourage aspen, would increase preferred habitat for this species. Harvesting timber and thinning the understory may increase foraging opportunities for this woodpecker by providing down woody material for insects. Prescribed burning may have beneficial impacts to this species as a result of enhancing and expanding aspen stands as well as increased insect populations invading dead and dying trees after fires (Cerovski 2002).

Black-billed Cuckoo (*Coccyzus erythropthalmus*)

The black-billed cuckoo breeds from Alberta and Montana east to Maritime Provinces, and south to northern Texas, Arkansas, and South Carolina. The birds winter in South America. This species favors areas of upland woods that provide a variety of trees, bushes and vines. Black-billed cuckoos also occur in brushy pastures, hedgerows, open woodlands, thickets, and along wooded roadsides. Preferred habitat includes low, dense, shrubby vegetation (DeGraff et al 1991). They will also inhabit open woods, avoiding extremely dense woods and high elevations (Haldeman 1980).

This species forages among leaves for food, which consists of caterpillars, especially tent caterpillars. The cuckoo will also eat insects and spiders, mollusks, and small wild fruits. The nest is well concealed by overhanging vegetation, usually in a shrub or low tree branch (DeGraff et al 1991). During 2001, a Rocky Mountain Bird Observatory technician observed two black-billed cuckoos on the Northern Hills District in South Dakota in the Black Hills (Panjabi 2003).

Environmental Consequences

Suitable habitat would likely increase with proposed treatments under the action alternatives. Pine removal and prescribed burning would encourage more diversity and production in the understory, benefiting this bird. Treatments such as prescribed fire may also increase prey abundance.

3.5 SOCIAL ENVIRONMENT

This section describes the affected environment and environmental consequences for each alternative to the Social Environment (Travel and Recreation Use, Scenery, Heritage, and Economics).

3.5.1 Travel and Recreation Use

Affected Environment

The Citadel project area provides abundant dispersed recreation opportunities and several miles of snowmobile trails. Popular hiking trails such as the Crow Peak trail and hiking/cross-country skiing trails such as Big Hill and Old Baldy are partially or wholly located within the project area. Peak tourism in the northern Black Hills typically occurs from July through September, with the highest use occurring in early August during the Sturgis Motorcycle Rally. A second peak in tourism occurs in late September during the fall leaf viewing period. Because of its proximity to Spearfish, Lead, Deadwood, Belle Fourche, Sturgis, and Rapid City, South Dakota, and Sundance, Newcastle, and Gillette, Wyoming, the project area is a popular recreation destination. The recreational uses of the area include: driving for pleasure including passenger cars, four wheel drive vehicles, ATV's and motorcycles, picnicking, snowmobile riding, hunting, fishing, horseback riding, hiking, mountain biking, berry picking, bird watching, and occasional dispersed camping.

Tourists also enjoy and use the Citadel project area, primarily to view scenery along the main road corridors that access the interior of the northern Black Hills. FSR 134 (Tinton Road), which traverses the eastern edge of the project area from north to south, is the largest and most heavily traveled route through the Citadel area. FSR 214 (Higgins Gulch Road), which accesses the Crow Peak trailhead, also experiences a significant amount of traffic. The primary access to the project area is Forest Service Roads (FSRs) 134, 214, 130, 131 and 222. These are all maintained gravel roads. There is no paved access in this project area.

The Forest Plan defines a Recreation Opportunity Spectrum (ROS) for each Management Area (MA). The following table displays the ROS associated with each of the Citadel MAs:

Table 3-31. Citadel Recreation Opportunity Spectrum

Management Area	Recreation Opportunity Spectrum
3.1	Semi Primitive Non-Motorized/ Roaded Natural
3.32	Semi Primitive Non-Motorized
4.1	Roaded Natural Non-motorized
5.1	Roaded Natural
5.4	Roaded Natural
5.6	Roaded Natural

ROS in Botanical Areas is either semi-primitive non-motorized or roaded natural, depending on the Botanical Area. In the Citadel project area, the Bear and Beaver Gulches Botanical Area is classified as semi-primitive non-motorized and the Higgins Gulch Botanical Area is classified as roaded natural.

A semi-primitive non-motorized area is characterized by a predominantly natural or natural-appearing environment of moderate to large size (determined by acreage). Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on site controls and restrictions may be present, but would be subtle. Motorized recreation use is not permitted, but local roads used for other resource management activities may

be present on a limited basis. Use of such roads is restricted to minimize impacts on recreational experience opportunities.

A roaded natural area is characterized by predominantly natural appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into the construction standards and design of facilities.

Roaded natural non-motorized areas are closed to motorized use yet have been heavily modified or are not large enough to be set aside as semi-primitive non-motorized. The expected recreation experience for these areas is similar to roaded natural areas with the absence of motorized use except occasionally for management activities (e.g. timber harvest, prescribed burning, etc.).

Developed Recreation

There are no developed Forest Service campgrounds in the Citadel project area. Iron Creek Lake lies just southeast of the project area boundary but is located on private property. Iron Creek Lake offers camping, fishing, canoeing and recreation residences owned by private individuals.

Dispersed Recreation

The total volume of dispersed recreation is difficult to quantify, but is thought to be moderate to high for the Citadel area. Dispersed recreation activities that occur in the area include driving for pleasure, ATV and motorcycle riding, snowmobiling, horseback riding, mountain biking, hiking, camping, fishing, hunting, wildlife viewing, Christmas tree cutting and firewood gathering. This is a popular area for ATV, dirt bike and four wheel drive vehicles because of its proximity to Spearfish, South Dakota. 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. Motorized travel restrictions are in place for several portions of the project area but are difficult to enforce.

Roads and Trails

Approximately 103 miles of National Forest System (NFS) roads exist in the project area with an additional 35 miles of unclassified roads. NFS roads are used by the public for ATV and automobile recreation and access to other recreation activities (e.g. snowmobile trails, hiking trails, fishing, hunting, etc.) and by the Forest Service for management activities.

There is a network of non-system or user-created roads and trails that have been developed over several decades. These roads and trails are typically used by individuals for recreational driving or to access favorite recreation areas that are not accessible via NFS roads or trails.

The Crow Peak hiking trail is 3.7 miles long and lies entirely within the project area boundary. This is a very popular hiking and mountain biking trail because of its easy access, proximity to Spearfish, South Dakota, and the panoramic views of the northern Black Hills and surrounding plains available from the summit.

The Old Baldy hiking trail is 6.4 miles long, with all but ¾ miles within the Citadel project area. The Old Baldy trailhead is located just outside the project area boundary. This is a moderately popular hiking and mountain biking trail.

The Big Hill trailhead is within the project area boundary but the 21 miles of hiking trails are mostly outside the project area. This trail system is moderately popular for hiking and mountain biking and popular for cross country skiing in the winter.

Tinton trail is an unofficial trail that is recognized by the Forest Service during permitted recreation events but is not part of the official trail system. Approximately 20 miles of this trail traverses the east side of the project area. This trail is maintained completely by volunteers. This route uses a combination of single-track trails, system roads and non-system roads.

Approximately 11 miles of Snowmobile Trail 3 and 1 mile of Snowmobile Trail 1 are within the project boundary. The Big Hill trail parking lot can be very busy in the winter months as it is used by both snowmobilers and cross country skiers. This is the primary access to the snowmobile trail system on the north side of the Northern Hills Ranger District. Snowmobile season begins December 15 and ends March 31 each year. Designated snowmobile trails are marked on the ground using carsonite posts with orange adhesive blazers and with aluminum orange blazers affixed to trees using aluminum nails. Trail 3 traverses south through the eastern third of the project area and then turns west near the southern end of the project area. It leaves Big Hill to the west following FSR 214.1F, turns south on 214, 214.1E, 130.1G, 633.1C, past Old Baldy Mountain and then west on 222 toward Cement Ridge. There are also several portions of Trail 3 that traverse unclassified roads. Trail 1 travels south out of the Big Hill parking lot along unclassified roads that parallel FSR 134. The majority of Trail 1 lies outside the project area boundary. A special order goes into effect from December 15th to March 31st each year prohibiting wheeled vehicles on the snowmobile trails.

Recreation Special Uses

There are three outfitters and guides permitted to guide big game and turkey hunting in the Citadel area. Their use is sporadic and could occur anywhere within the project area boundary during spring turkey hunting or fall big game hunting seasons. The level of use varies from year to year depending on the number of clients they have.

There are two outfitters and guides permitted to lead mountain biking or hiking trips on the Big Hill and Old Baldy trail systems.

There are two outfitters and guides permitted to conduct guided hiking on the Crow Peak hiking trail. These trips take place on or around the last weekend in June, the third weekend of July, and the third and fourth weekends in September.

There are several special use permits for recreation events:

- The Iron Creek Off-Road Triathlon takes place annually over the second weekend in July. They use portions of roads and trails from Iron Creek Lake to Old Baldy trails and back for running and biking.

- The Dakota 50 is a 50-mile mountain bike race that takes place over Labor Day weekend and uses the unofficial Tinton Trail.
- Tinton Time Trials is a mountain bike race that takes place the third or fourth weekend in June and uses the unofficial Tinton Trail.
- The Spirit of the Hills Wildlife Sanctuary in Spearfish, South Dakota, holds the Call of the Wild 4-mile foot race on the last weekend in September and it also uses the unofficial Tinton Trail and a small segment (<1/4 mile) of FSR 134.

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 National Forest System land 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.

In MAs 3.1, 3.2 and 4.1 no off-road motorized travel is allowed. In MAs 5.4 and 5.6 off road motorized travel may be restricted and in MA 5.1 off road motorized travel is allowed unless restricted by a project level decision. In all of the MAs except 5.1, on-road motorized travel may also be restricted by time of year or closed on the ground with gates or barricades.

Currently there are special orders in effect under 36 CFR 261.54(a) and 261.53(b) restricting motorized traffic to designated routes around Crow Peak (MA 3.22 and 4.1) and the Botanical Areas (MA 3.1). Under 36 CFR 261.54(a) seasonal restrictions are in effect for wildlife winter range (MA 5.4 and 5.6).

Approximately 35 miles of unclassified roads exist in the Citadel project area. Some of these roads were not planned or designed and consequently are located poorly (e.g. crossing or immediately adjacent to riparian areas or streams). Often they are sloped or graded poorly which has a detrimental effect on soils. Other unclassified roads were designed but taken off the NFS for various reasons in the past.

There is also an extensive system of user-created two track roads that exist in the Citadel area as described above. Off-road use can be divided into several motorized categories, including ATVs, four wheel drive passenger vehicles, and motorcycles. Sometimes habitats needed by sensitive plant and animal species are negatively impacted by unknowing off-road users.

There are approximately 11 miles of designated snowmobile routes in the project area, as described above.

The predominant recreational activities that users pursue within the project area include:

- Viewing scenery and wildlife: Both motorized and non-motorized users value this activity.

- Hunting: This is a seasonal activity that occurs throughout the area during the fall and spring months. Deer, elk and turkey are the primary game species in the area. Both motorized and non-motorized users value this opportunity.
- Fishing: Most popular along portions of Beaver Creek.
- Riding motorcycles, ATVs and 4x4s: Motorized users strongly value the opportunity to pursue this activity. This is evidenced by the presence of unclassified roads and user-created trails in the area and the frequency with which these vehicles are encountered in and near the area.
- Dispersed camping: Especially popular during big game hunting seasons.
- Mountain biking: Mostly on Crow Peak, Big Hill and Old Baldy trails.
- Hiking: On the Crow Peak, Big Hill and Old Baldy trails.
- Snowmobiling, cross-county skiing, and snowshoeing: Approximately 11 miles of designated snowmobile routes cross the project area. The Big Hill trails, just outside the project boundary, are groomed for cross-country skiing. Snowshoeing can occur anywhere in the project area when snow conditions permit.
- Miscellaneous activities: Includes berry picking, fuel wood gathering, Christmas tree cutting, and gold panning. Recreational gold panning is possible in some locations along Potato Creek and Beaver Creek on NFS land.

Along with the positive aspects of abundant dispersed and developed recreation opportunities, there are undesirable actions and negative effects on natural resources. These effects are tied to motorized access into the area. The better the access, the more likely these undesirable actions and negative effects are to occur. These actions appear to be committed by a small percentage of users, but can spoil the area and experience for others. Such actions include:

- Vandalism: Including shooting and destroying signs, damaging gates, and cutting fences.
- Damage to soil and water resources: Includes rutting and soil compaction from motorized use in wet areas, soil erosion from overuse, poorly located or unmaintained roads and motorized trails, stream bank damage, and sedimentation at unauthorized stream crossings.
- Increased spread of noxious weeds: Occurs along travel routes due to more users and a lack of public understanding of methods of spread and effects of infestation.
- Disturbance of wildlife: Due to noise and presence of motorized vehicles (varies according to species and time of year).

Currently, the Black Hills National Forest is undergoing a Forest-wide travel management analysis, which may affect motorized and non-motorized travelways. Travelways are expected to be designated by January 1, 2009. Numerous miles of two-tracks and unclassified roads in the project area were submitted to the travel management analysis team by motorized user groups for possible inclusion in the permitted travelways system. Designation of motorized trails is not proposed by the Citadel project, and any such designation would require separate NEPA analysis. Approximately 35 miles of the proposed travelway system are on National Forest System roads that are currently open and used for a variety of resource management and recreational activities. These roads include NFSRs 134.1, 661.1, 214.1, 214.1F, 130.1 626.1, 626.1F, 626.1G, 222.1, 222.2, and 101.1.

Environmental Consequences

Effects Common to All Alternatives

No developed recreation sites exist in the Citadel project area and none are proposed under any of the alternatives.

Snowmobile trails, the Crow Peak Trail, the Old Baldy Trail and the Big Hill Trailhead would not be affected by any of the alternatives.

Removal of hazard trees and general maintenance along designated trails would continue under all alternatives.

Any effects to dispersed recreation would be temporary in nature. As the name implies, dispersed recreation can occur anywhere throughout the project area. 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 roads 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. Current management would continue unless changed through the Forest-wide travel management analysis.

Under all alternatives, all areas of the Forest in the Citadel project area that are currently open to non-motorized uses would remain open. Likewise, the botanical areas, Bear/Beaver Gulches and Higgins Gulch, and the back-country non-motorized area surrounding Crow Peak would remain closed to off-road motorized use.

No changes in special use permits for outfitters/guides are anticipated under any alternative.

Comparison of Road Management

See the Citadel Transportation Report (Section 3.3.2) for a comparison of the alternatives showing proposed mileages of open and closed roads. The differences are discussed under each alternative along with the effects on motorized travel management.

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. User-created roads and trails would continue to be developed, 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 to current travel management and recreation opportunities in the Citadel 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 dispersed recreation management under Alternative A. The same dispersed recreation activities that are available in the Citadel project area currently would continue to be available under this alternative. Continued presence of unmanaged travelways has the potential to negatively affect the non-motorized dispersed recreation experience by expanding the area available for motorized vehicle use.

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 would reduce the quantity and quality of dispersed 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.

The public would continue to use the designated and unclassified roads and trails within the project area under Alternative A. Recreation-related damage to unclassified travelways is likely to continue, and there is little opportunity to maintain or repair these routes.

The use of two-track roads and user-created trails throughout the project area would continue to invite use and promote development of new unauthorized roads and trails. New and existing unauthorized roads and trails have the potential to draw more users to the area, which is likely to have a negative impact due to increased levels of erosion and vegetation damage.

Travel management would remain the same under Alternative A. No new closures or openings of new areas would occur.

New user-created roads would likely continue to be developed over time. The increase in additional trails would likely be small compared with the existing road system, but could grow by several miles per decade. This would increase the overall road density in the area.

Cumulative Effects

The cumulative effects analysis area for the Citadel project is the project area plus a two-mile buffer around it. 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. The time period considered for analysis is 10 years, the expected duration of project activities.

Although there are no developed recreation sites in the Citadel project area, the Iron Creek Lake campground, on private property, lies southeast and adjacent to the project area. Effects of activities within the project area could conceivably overlap with impacts from other sources occurring in this campground. Under Alternative A, no thinning of ponderosa pine would occur, creating the likelihood the mountain pine beetle infestations would increase. Beetle killed trees are less aesthetically pleasing than healthy trees because they display red needles the year after mortality. It is possible that large patches of beetle killed trees would occur within sight of Iron Creek Lake and reduce the aesthetic attractiveness of

the site. The presence of mountain pine beetle in the Citadel project area, along with beetles present near Iron Creek Lake, would increase the risk of infestation of currently healthy trees, including trees around and within the Iron Creek Lake 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 along with the potential for no fuels treatments on the private or National Forest System land near Iron Creek Lake would place 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. The campground and surrounding landscape would be at risk and the loss of those areas to a high-intensity fire would negatively impact the recreational experience at Iron Creek Lake.

If large areas of forest in the Citadel 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 Spearfish or the Iron Creek Lake store.

As the local population increases, use of forest roads and trails will probably continue to increase. Increased use in and around the project area, coupled with a lack of management in the Citadel area under the no action alternative, may result in increased dust, ruts, damage and vandalism if the roads and trails are not maintained at adequate levels.

Alternative A would not change the existing travel management direction for the project area and therefore would not contribute to cumulative effects.

Alternatives B and C

Both alternatives would have similar effects on recreation and will be analyzed for direct, indirect and cumulative effects concurrently.

Alternative B proposes 18 miles of new construction while Alternative C proposes 17 miles. Both alternatives propose 35 miles of reconstruction and 31 miles of decommissioning. All new roads would be closed following management activities. In the short term, the number of open roads in the area would increase, but following project completion there would be a net decrease in open road mileage if closures are effective.

Direct and Indirect Effects

Patterns of recreational use may change while management activities are occurring, but this effect would generally not last beyond project completion. Those who enjoy non-motorized activities may choose to recreate in another area until the management activities are complete. Dispersed recreation would be affected by the decommissioning of approximately 35 miles of existing unclassified roads in the project area. This would decrease motorized access while allowing non-motorized use.

Alternatives B and C propose approximately 18 and 17 miles of new road construction respectively to facilitate vegetation management activities. This would negatively affect the areas which are not currently easily accessed by a road. Although the roads would be closed when activities are completed, it is often difficult to effectively close roads in the Black Hills. The topography often allows vehicles such as ATVs and motorcycles to circumvent closures. Because the topography is fairly easy to navigate, users may find their way into areas that are technically closed without ever seeing a sign posting it as closed. Once a road template is in place, it is likely that the road will receive at least occasional use even if closed. This increased access to previously inaccessible regions of the project area may result in greater potential for illegal activities, resource damage, and user conflicts. If closures are less than 100% effective, negative effects associated with the new roads could continue.

The decommissioning of approximately 31 miles of unclassified routes would have an effect on the motorized community that uses these routes to drive for pleasure whether in four wheel drives, ATVs or motorcycles. Many of these routes that take them to favorite areas may no longer be available. Decommissioning of unclassified routes would have a positive effect for those who enjoy non-motorized activities. These roads, once decommissioned, could be used for horse back riding, mountain biking and hiking. Several of the proposed routes are located within one of the botanical areas. Removing these routes would likely decrease the motorized traffic into these areas, thus protecting the sensitive plants that exist there. One road proposed for decommissioning also leads directly into the Beaver Ridge Spur of the Crow Peak hiking trail. Decommissioning this route would decrease the motorized traffic and could potentially reduce conflicts between non-motorized and motorized users.

The proposed 35 miles of road reconstruction would improve safety conditions for all users by improving road conditions and clearing sight corridors.

Reduction of the fuel load in the project area could improve safety overall by lessening the likelihood of a wildfire threatening recreationists.

Guided activities may be displaced to other locations while management activities are taking place.

Guided mountain biking and hiking and the general public also engaging in the same activity may observe management activities from the trails. This would be temporary in nature and would return to normal after these activities are completed. In the areas adjacent to the Old Baldy Hiking trail, where management activities are taking place, it may be necessary to put out warning signs to ensure the safety of the public.

The Dakota 50 and Tinton Time Trial mountain bike races use several of the unclassified routes in the project area. The hydrologist also proposes obliterating FSR 626.1C, which is part of the event routes. Both of these events would be negatively impacted if their routes were obliterated or decommissioned. A reroute can be established for these events prior to the decommissioning or obliteration of these roads. The other unclassified roads used with this system should not be decommissioned, and although it is not marked on the ground with trail markers, care should be taken while doing vegetation manipulation not to pile debris on the trail.

The snowmobile trail system would continue to operate as it currently is. A special order is in effect yearly from December 15 through March 31 prohibiting wheeled vehicles on the snowmobile trails.

Management activities such as logging would cease operations requiring use of these roads on December 1 to allow a base of snow to accumulate so that grooming may begin on December 15.

Cumulative Effects

The closure of approximately 31 miles of existing unclassified roads may lead to some dispersed recreation users seeking other areas in which to recreate, causing effects to shift to the new areas. Closure of roads creates increased opportunities for violations of closures and vandalism of gates and signs. This could result in an increased workload for law enforcement and recreation management personnel.

The number of recreationists and local residents who use ATVs has increased in the last decade. Consequently, the level of usage on NFS land, whether in authorized motorized use areas or not, has increased. This has the potential to negatively impact natural resources and the non-motorized recreation experience. Closures to motorized vehicles are only as effective as the support they receive from the public and users. A moderate fraction of the roads in the project area are proposed for closure under Alternatives B and C, so future use would still involve motorized vehicles on and off of designated routes. Road closures proposed under Alternatives B and C could cause ATV users to move to other areas, which would cause enforcement and resource concerns in areas not currently impacted or increased impacts in areas that are currently affected.

3.5.2 Scenery

Introduction

Scenery is defined as the general appearance of a place and the features of its views or landscapes, the arrangement of predominantly natural features of the landscapes we see. The adjective “scenic” has to do with natural scenery, which affords beautiful views (USDA-Forest Service 1995c).

In 2003, a National Visitor Use Monitoring project was conducted on the Black Hills National Forest. Recreation use on the forest for the fiscal year was calculated at 1,252,175 national forest visits. As part of that project, visitors were interviewed to determine their satisfaction with the Forest. Of those interviewed, the most-used designated areas were, in order of highest use: 1) picnic areas, 2) scenic byways, 3) forest roads, 4) forest trails, and 5) developed campgrounds. The top four activities visitors participated in were: 1) viewing wildlife (62 %), 2) relaxing (57%), 3) viewing natural features (51%), and 4) driving for pleasure (39%). With regard to satisfaction of the recreation visitors’ experience in wilderness, developed day use areas, developed overnight (campground) areas, and general forest areas the highest importance and satisfaction rating was given for the scenery and condition of environment in each category. In addition, of those interviewed, 83% stated that recreating on this Forest was their primary trip destination. If they were unable to visit this national forest, 54% of those interviewed said they would go elsewhere for the same activity. Clearly the natural beauty that makes up the scenery of the Black Hills National Forest is one of the most important resources that draw our recreation visitors. Forest management practices directly affect people’s perceptions of scenic beauty.

Management Direction

Federal laws that require all agencies to consider scenery and aesthetic resources in land management planning include:

- National Trails System Act of 1968
- National Environmental Policy Act of 1969
- Environmental Quality Act of 1970
- Forest & Rangeland Renewable Resources Planning Act of 1974
- National Forest Management Act of 1976
- Public Rangelands Improvements Act of 1978

The Washington Office of the Forest Service provided implementation direction to use the Scenery Management System during Forest Plan revisions and project level planning on March 10, 1997. In addition, there was a "white paper" attached that provided guidance in this implementation. On May 2, 2003, the Forest Service manual direction was amended to provide further clarification to utilize the Scenery Management System in forest and project planning and implementation, including:

> 2382.4 – Applications to Project Management
>
> 5. Understand how fire can be a useful tool to achieve desired scenic integrity objectives and landscape character goals.
>
> 8. Determine how scenery management techniques and principles can be used to mitigate any land altering activity or introduced elements on the land, to achieve and maintain desired scenic integrity objectives and landscape character goals.

Forest Plan Direction
The Black Hills National Forest Plan included the Scenery Management System as the basis for analyzing the scenic resource.

Affected Environment

The Citadel project area is located in the northwest corner the Northern Hills Ranger District, immediately southwest of Spearfish, South Dakota. Recreationists and permittees travel through the project area from Spearfish and other nearby communities in both South Dakota and Wyoming on a daily basis. During the spring and fall, the area is well traveled by hunters.

There are approximately 138 miles of roads in the Citadel project area along with:

- 7.7 miles of designated non-motorized trails in the project area. This includes the entire Crow Peak trail, a majority of the Old Baldy trail system, and a small portion of the Big Hill system.
- 11.2 miles of designated snowmobile trails.
- No designated campgrounds or picnic areas are located within the project area.
- The only designated recreation sites are the Crow Peak and Big Hill trailheads.

Valued 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. For descriptions of this area and landscape character, see:

- Ecological Land Unit – Laccolith Mountains (1996 Forest Plan FEIS, Appendix B, pg. 47)
- Existing Land Use Patterns – Natural Appearing (1996 Forest Plan FEIS, Appendix B, pg. 49)
- Valued Landscape Character Unit (LCU) Overview (1996 Forest Plan FEIS, Appendix B, pg. 51)
- Mountainous/Mixed Forest Landscape Character Unit – Laccolith Mountains Portion. (1996 Forest Plan FEIS, Appendix B, pg. 53-54)

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) (USDA-Forest Service 1995c).

The higher the Scenic Class, the more important it is to maintain the highest scenic value. The inventoried Scenic Class Values on the Black Hills National Forest are 1 (Highest), 2, 3, and 4 (Lowest). The scenic class values demonstrate the importance of the views in different areas. Approximately 7% of the Citadel project area is designated as a Scenic Class 1, 70% in a Class 2, 17% in a Class 3, and 6% in a Class 4.

Inherent Scenic Attractiveness

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 (USDA-Forest Service 1995c).

Scenic Attractiveness classifications are: A - Distinctive, B - Typical, and C - Indistinctive. Class A 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. Class B refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use combine to provide ordinary or common scenic quality. Class C refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use have

low scenic quality. Often water and rockform of any consequence are missing in Class C landscapes. Approximately 43% of the National Forest System lands within the Citadel project area are in Class A, 31% in Class B and 27% in Class C.

Landscape Visibility

Landscape Visibility is the portion of landscapes visible from travelways and use areas that are important to constituents for their scenic quality, aesthetic values, and landscape merits. Travelways and use areas are identified and classified during the Forest-wide planning process, in order to determine which observer locations to use in the landscape visibility analysis and the importance of each. Sensitivity Level 1 travelways that lead to important scenic features, residential areas, resorts, recreation areas, unique natural phenomena, wilderness trailheads, national parks, and state or county parks attract a higher percentage of users having high concern for scenic quality, thus increasing the importance of those travelways (USDA-Forest Service 1995c).

No Sensitivity Level 1 travelways exist in the Citadel project area. However, approximately 22% of the NFS lands within the project area are viewed from Sensitivity Level 1 Corridors (where people have the highest concern for scenery) including Interstate 90. In addition, the planning area is immediately southwest of the community of Spearfish, South Dakota. The northeastern portion of the project area, Crow Peak in particular, forms the backdrop for the community of Spearfish.

Approximately 68% of the NFS lands within the project area are viewed from Sensitivity Level 2 corridors. Level 2 corridors within the planning area include Forest Development Roads (FDR) 134, 214, and 222. Level 2 corridors adjacent to the project area include FDRs 131, 801, County Roads 052 and 101, and County portions of FDRs 131 and 214. In addition, Old Baldy Trail 66 and Crow Peak Trails 64 and 64A are within the project area and provide extensive views of the surrounding landscape.

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 (USDA-Forest Service 1995c).

> <u>High</u>**:** Human activities are not visually evident. In High SIO areas, activities may only repeat attributes of form, line, color and texture found in the existing landscape character.
>
> <u>Moderate</u>**:** Landscapes where the valued landscape character “appears slightly altered”. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
>
> <u>Low</u>: 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**:** 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**:** 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.

Approximately 22% of the Citadel project area has a High SIO (predominantly in Management Areas 3.1 and 3.32), 51% a Moderate SIO, and 26% a Low SIO.

Existing Scenic Integrity

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 a mixture of hardwoods and conifers spread across a landscape of ridges and drainages; a rolling terrain with small meadows and exposed rock formations. Forested areas are populated by ponderosa pine communities on south aspects and white spruce communities on north aspects, with pockets of quaking aspen and other hardwoods interspersed across the landscape. Vegetation alterations are scattered throughout the area. Water features are limited to narrow, quiet, low-flow streams. Human alterations in the form of roads, homes, and mining activities are generally limited to ridge top areas. Main roads through the area have generally been accepted over time as part of the positive cultural landscape character attributes. The combination of topography and past management actions have combined to maintain a mostly natural appearance of the forest as a backdrop to the imbedded homes and communities.

Past vegetation management activities have occurred. In the foreground of major Forest Development Roads (FDRs), human activities are visually evident. The middleground of FDRs appear slightly altered (Moderate Scenic Integrity) due to past vegetation management activities. When the planning area is viewed from major highways and private land from outside the planning area (middleground and background), the planning area maintains a natural appearance. The existing scenic integrity of the Citadel project area is generally High when viewed in background, Moderate in the middleground, and Low in the foreground.

Desired Conditions

General Scenic and Landscape Character Goals and Objectives

Goal 1: The desired landscape character is a predominantly natural appearing forest with scenic quality that is sustainable over the long-term.

> **Objective 1 -** Mimic natural appearing openings in the characteristic landscape by: thinning conifers within encroached openings, prescribed burning to imitate & maintain natural openings, vegetation treatments that create openings in scale and shape.
>
> **Objective 2 -** Enhance aspen clones by: removing conifers in aspen clones, removing conifers around perimeter of existing aspen clones, creating openings to encourage suckering, prescribed burning.

Goal 2: Valued cultural and/or natural scenic elements are visible from forest roads and trails, and are sustained and enhanced through active management.

> **Objective 1 -** Enhance visibility to rock outcrops by: thinning conifers adjacent to rock outcrops.
>
> **Objective 2 -** Enhance visibility into the forest by: thinning conifers adjacent to roads and trails, manage for larger diameter trees, reduce slash (activity fuels) to natural levels.

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 Citadel project area, including: 1) Identify and describe the *landscape character;* 2) Describe the *scenic class, scenic attractiveness,* and *landscape visibility* of the area*;* 3) Compare the *existing scenic integrity* with the Forest Plan *Scenic Integrity Objectives* assigned to this area*;* 4) Utilizing steps 1, 2, and 3, evaluate and measure the expected level of *scenic integrity* and *scenic sustainability* to assess the effects of the alternatives on scenery. Where needed, determine mitigation measures to ensure Scenic Integrity Objectives are met. All National Forest System land within each planning area is analyzed following these steps.

Past, Present, and Reasonably Foreseeable Actions

Past activities within this area include road construction, cattle grazing, recreation uses (e.g. hunting, firewood gathering, and viewing scenery) and vegetation management (e.g. timber harvest, fuel reduction, and prescribed burning). Known large fires include the Iron Creek fire in 1899, whose size is not known but estimated at 20,000 acres. The exact location is also unknown but appears to have extended from Crow Peak to Beaver Creek (Mahoney 1998). The Boundary #2 fire occurred in 1985 and burned 1,388 acres. Approximately 25%, or 347 acres, of the fire burned within the Citadel project area.

Present actions include continuing recreation use, grazing, and any remaining vegetation treatments related to past timber sales and fuel reduction and prescribed fire treatments related to the Griggs Fuels Management project in the northeastern corner of the project area. Fire suppression and road maintenance activities are also ongoing as necessary.

Foreseeable actions include continuing existing recreation uses, cattle grazing, and vegetation management in and around the area. Fire suppression and road maintenance will continue into the future as necessary.

Alternative A (No Action)

Direct Effects

No direct effects would occur to the scenery resource under Alternative A because no management actions are proposed.

Indirect Effects

Existing conditions and natural processes of trees growing and regenerating would continue. Wildland fire is an essential ecological process in this ecosystem, and fires would continue to be extinguished as quickly as possible. The no action course of management would continue to limit the natural role of fire in the landscape. As a result, the forest would continue to become denser, reducing visible open space. Views into the forest would become more limited as the trees grow more dense which would reduce visual diversity, including wildflowers, shrubs, hardwoods, and open meadows. Should wildfires burn into dense stands of trees, smaller trees can act as ladder fuels moving the fire up into the crowns, resulting in groups of fire-killed trees. In this project area, hardwoods could quickly populate these openings.

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, entire hillsides of fire-killed trees could be expected. When these dead trees eventually 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 be similar in shape and size (scale) to meadows and other existing natural open areas in the landscape. Eventually seeds carried by the wind from the surrounding trees would land in the area and new trees would sprout as the process of regrowth begins.

In areas with a High or Moderate SIO, should fires occur or insect activity levels increase beyond natural levels, the forested landscape would move away from the desired future condition for more open park-like stands. In small areas, approximately 1 to 3 acres, where trees are killed a mosaic of tree sizes and openings would be maintained that would move toward the desired future condition. In some areas where insect attacks 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 throughout the project area. In these areas it is possible that a large amount of down trees, greater 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 and flowering shrubs. In

addition, an ever changing kaleidoscope of light and shadow, as well as a variety of sizes of vegetation, create an interesting and diverse visual landscape.

In areas where no disturbance occurs, the vegetation would grow into a dense forest with competition between individual trees for light, water, and nutrients. In some areas, the dense conifers are outcompeting the hardwoods for these necessary plant growth components. This dense vegetation provides the greatest potential for disturbance (through large fires or insect infestations) that could greatly change the visual appearance of the vegetation across the landscape. The dense vegetation may shade out shrubs, wildflowers and other low growing plants, consequently reducing visual diversity.

Cumulative Effects

There is no accumulation of effects to the scenery resource under Alternative A.

Effects Common to Both Action Alternatives

Direct Effects

Commercial Vegetative Treatments
Commercial treatment prescriptions result in the removal of overstory trees within a stand. Those treatments where more large trees remain can generally blend in to the characteristic landscape better. Those treatments that leave the least large trees can be the most visible. The following is a general scale depicting the range of treatments included in the Citadel action alternatives and their resulting appearance from more natural to least natural:

Most Overstory Trees Remaining	Hardwood Restoration
(generally more natural appearing)	Commercial Thin 60-80 BA
	Commercial Thin 40-60 BA
	Commercial Thin 20-40 BA
	Commercial Thin 10-20 BA
Least Overstory Trees Remaining	Meadow Restoration
(generally the least natural appearing)	Overstory Removal

How well commercial treatments blend into the characteristic landscape and meet the SIO, is based upon the slope, aspect, and vegetation remaining on the site. Reducing soil disturbance, uneven spacing of the trees remaining in the landscape, and cleaning up residual slash (branches and tree tops left when trees are commercially removed from the forest) to natural levels can result in an appearance that is in harmony with the landscape character, often resulting in achievement of a higher SIO.

Commercial treatment prescriptions result in the removal of overstory trees (9 inch and greater dbh) within a stand. 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 (orange & black bark on the tree boles), light and texture. When greater numbers of large 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 (shadows) and color differences can be the most evident.

Commercial Thin treatment methods generally meet a Moderate to High SIO. Commercial Thin treatments with a remaining basal area of 50 or more generally meet a Moderate to High SIO. Those with a residual basal area between 30 and 50 generally meet a Low to Moderate SIO, and those with a residual basal area below 30 generally meet a Low to Very Low SIO. In stands where there is a mixture of tree sizes, including the understory, random spacing and clumps of remaining trees can help maintain an appearance in character with the landscape and improve the SIO rating.

Overstory removals result in an open area with seedlings covering the majority of it, and 2-4 large (commercial-sized) trees per acre. There may be a few remaining trees as well. 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. In the months when the snow is not present, the form and color would be most evident. During periods when snow is on the landscape it would likely appear as large white forms with patches of dark vegetation (and corresponding shadow) when larger trees remain on the landscape. These units have the greatest potential to appear out of scale and character with natural vegetative patterns. Overstory removal treatments generally meet a Moderate to Low SIO, depending on how closely they appear in shape and size (scale) to mimicking the natural openings in the characteristic landscape. A Moderate SIO can be met if the size of the unit does not exceed the natural openings by more than 10%, otherwise it would likely meet a Low SIO. If the units do not borrow from the shape and size of the natural openings, an SIO higher than Very Low would not be expected.

Pre-commercial Vegetative Treatments

Pre-commercial treatment prescriptions result in the removal of understory trees (less than 9 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.

Pre-commercial thinning can result in a uniform appearance of the remaining forest stand (both in size and spacing). When pre-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 pre-commercial treatments blend into the characteristic landscape, and meet the SIO, is based upon the slope, aspect, soil disturbance, residual tree spacing, and residual slash clean-up. Often, reducing soil disturbance, uneven spacing of the remaining trees, and reducing the quantity of slash to natural levels would 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 other angular shapes). As most of the project area is covered with treatment units, pre-commercial treatments would extend over most of the area under a combination of treatments.

When activities are completed, pre-commercial thin treatment methods generally meet a Moderate to High SIO.

By-products of Vegetation Removal
By-products including residual slash and stumps would likely be evident throughout the treatment areas. As a result of the treatment, slash is typically present in quantities above natural levels creating strong contrasts (the slash reflects light) 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 of slash.

Slash Burning
When slash is piled, it is typically burned within 1 or 2 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 SIO 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 on sterilized sites. However, due to the wetter snow conditions found within this project area in the winter (when burning of piles occurs), the slash often is not fully consumed, leaving piles of blackened, partially burned slash, 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 is achievable.

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 up to three feet in height. These marks would fade over time; at three years they should blend with the bark. 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 1 or 2 growing seasons. An underburn would usually have the same effects.

Mechanical Slash Treatment
The mechanical slash and burn method employs the use of machinery to crush, masticate, chop, and flail the slash into small pieces down to ground level. By getting the slash to ground level, the moisture level stays higher than if it were uncompressed and air was easily able to move around it, consequently drying it out more quickly. This result is that the slash decomposes at a faster rate than if it were untreated. How quickly this method would meet the SIO can vary greatly; it is dependent on the volume of slash created and the moisture levels in the slash over time. Within one year of treatment the only evidence remaining would be scorched tree bark. This treatment should meet the assigned SIO throughout the project area.

Logging Systems
Skidding logs on, or across, steep slopes can remove vegetation and displace soil, leaving trails that can be very visible by creating lines or unusual color contrasts in the landscape. These skid trails would be evident until clean up activities 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. In locations where many logs are moved over the same path, ground

covering vegetation would grow relatively quickly but trees and shrubs take longer to colonize these skid trails.

Log Landings
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 (vegetation removed and soil displaced) varies by location, depending upon the type of logging system employed and the volume of logs being brought to that 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 1 to 4 years, depending upon the level of disturbance, any remaining debris (slash), and how quickly grasses recolonize the site.

Indirect Effects

Logging Systems
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 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, the natural appearance decreases. Efforts are made to minimize this potential, so it is difficult to predict where and how widespread this effect would 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.

Alternative B (Proposed Action)

Direct Effects

This alternative treats approximately 46% (13,035 acres) of the project area, of which 2,601 acres are in hardwood or meadow restoration, prescribed fire, and pre-commercial treatments. Approximately 10,541 acres are in commercial treatments.

Overstory removal treatments within MA 5.4 have High, Moderate and Low SIOs intermixed. These units were specifically designed to enhance big game forage. The edge treatment of these units was also specifically designed to transition from large trees to medium size trees and then to open forage areas. These treatments would be highly visible, but should maintain a natural edge appearance and thus appear as a natural opening, as well as providing an opportunity for the recreating public to observe big game from the opposite ridge.

Overstory removal treatments within MA 5.6 also have High, Moderate and Low SIOs intermixed, but the portions within High SIO areas are small and part of a landform treatment.

Along FDR 214 (a Sensitivity Level 2 road), overstory removal units 070804-8, 071005-4, 071005-24, 071005-25, and 071005-53 form one large contiguous unit of approximately 200 acres (portion visible from the FDR is Moderate SIO), and extends approximately 1 1/2 miles along the foreground of the road. Unit 070804-8, approximately 146 acres, treats the entire land form in keeping with a landscape approach. However, with the extended length of the contiguous

overstory removal treatment, two leave islands of trees should be left: one at the junction of the 214 and 214.1F roads and the other in the draw ½ mile southwest of the junction. The leave islands should be 6-10 acres in size.

The other treatments within the project area should all meet their assigned Scenic Integrity Objective. The mix of treatments should create a variety of vegetation sizes and spacing within the natural range of vegetative patterns. These treatments should also reduce the potential for destructive (large-tree killing) wildfires and insect attacks due to the thinning of dense tree stands.

Indirect Effects

There is the potential for hardwoods to increase (creating a greater amount of fall colors 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.

Cumulative Effects

An understanding of past, present and reasonably foreseeable actions is necessary to evaluate potential cumulative effects of the various alternatives. For the scenery resource, the methodology includes:

- Review activities that are known to have occurred, or are planned, within the project area.
- Review aerial photos of the area to compare areas where activities have occurred with areas that are not known to have been treated.
- Review past activities in the field and determine their effect on scenery.
- Review planned activities, on aerial photos and in the field, and then determine the potential cumulative effects.

The physical boundary for analyzing cumulative effects is primarily the area within the project boundary. This identified area is the landscape that is evident in the foreground and middleground from the main travel routes.

The time boundary for this analysis extends from 1980 to 2017, including known management activities and activities that are planned but have yet to be accomplished. 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 pre-commercially thinned by the Civilian Conservation Corp (CCC) in the 1930s and 1940s, however we do not know if that effort included any or all of the Citadel project area.

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 from seed (Cook personal communication). The resulting appearance of vegetation treatments would change little for the first 10 years after the treatments are completed. Any treatments would result in fewer trees across the landscape, reducing risk of mountain pine beetle infestation and fire hazard, but the level of reduction varies by alternative.

This alternative would treat approximately 13,035 acres, 46% of the National Forest System lands within the project area: 9% in prescribed fire, hardwood or meadow restoration and pre-commercial treatments, and the remaining 37% in commercial treatments.

Of the commercial treatments in this alternative, the overstory removal and seed cut treatments would result in a more open condition on approximately 3,034 acres, or 11% of the project area. Review of aerial photos of the project area shows previous treatments of approximately 2,000 acres or 7% of the project area in an existing open condition. Cumulatively, this results in approximately 18% of the project area in an open condition as a result of commercial treatments. Due to the rolling nature of this topography, these treatments would not be very visible from Sensitivity Level 1 or 2 roads outside the project area. Panoramic views are not evident within this project area. As a result, most treatments are viewed in a close-up foreground view, or limited middleground view. Roads are generally not evident in the landscape except in the immediate foreground view.

Past activities within this project area have included vegetation treatments, roads, and a few trails. Due to the gently rolling nature of the terrain, areas of past vegetation treatment cannot easily be seen in the distant middleground and background when viewed from other locations (including during the months when snow covers the ground).

Vegetation treatments would be evident from Sensitivity Level 2 roads and trails within the planning area. With approximately 18% of the area in an open condition, this is within the Forest Plan goals for Structural Stages 1, 2, and 3A for Management Areas 5.4 and 5.6 (USDA-Forest Service 2006).

The Citadel project area is used for trail riding, hunting, ATV riding, camping, firewood cutting, and snowmobiling by the recreating public. The level of concern for a natural appearing landscape would likely continue at the same level.

Alternative C (Preferred Action)

Direct Effects

This alternative treats approximately 63% (17,780 acres) within the project area, of which 7,697 acres are in hardwood or meadow restoration, prescribed fire, and pre-commercial treatments, while 10,445 acres are in commercial treatments.

The effects of the commercial treatments are similar to Alternative B, but 700 acres, scattered across the project area, would be treated to a more open condition.

In addition, the southwest portion of the project area would have the majority of hardwood restoration treatments that would have a landscape effect by improving the quantity and quality of the hardwood clones. This would result in a short and long term improvements in diversity, fall color, and overall beauty of this portion of the project area.

Hardwood enhancement can have a similar effect as a commercial thin but it is totally dependent upon the remaining number of hardwoods in the stand after the conifers are removed. The results can vary from an open stand to more dense stands with limited views into the stand. Within 3 years (depending upon moisture levels and health of the remaining hardwoods) these treatments often meet a High SIO.

Meadow enhancement treatments usually remove most trees, but some large diameter trees may be left. These remaining trees create a transition zone between open meadows and the surrounding forest and generally meet a Moderate SIO. Meadow enhancement treatments can also remove all trees, converting the treated area back to pure meadow. The remaining slash on

the ground, the number of residual stumps, the amount of side slopes and soil disturbance of the treated area affect how visible the unit is. These treatments can meet a range of SIOs from Moderate to Very Low.

This alternative treats an additional 5,202 acres with prescribed fire (as compared to Alternative B) across the planning area. A large portion of this additional activity would occur on Crow Peak (MA 3.32). The results of this prescribed burn would be highly visible from Interstate 90, the community of Spearfish, and surrounding private land. This burn should be similar to a natural underburn. Burning would be conducted to minimize damage to overstory trees, but given the steepness of the terrain, some torching of trees may occur. If less than 20%, in total, of the overstory trees are killed through these prescribed fires on the highly visible west, north and east sides of the mountain, an overall natural appearance would still be maintained and the High SIO for Crow Peak would still be met.

On the remaining south side, where the Crow Peak East & West Trails wind up to the top of the mountain, any patches of fire killed trees would be highly evident. If less than 10% of the overstory trees are killed, the treatments would meet a High SIO.

Cumulative Effects

This alternative would treat approximately 17,780 acres, 63% of the National Forest System lands within the project area: 26% in prescribed fire, hardwood or meadow enhancement and pre-commercial treatments, and the remaining 37% in commercial treatments.

Of the commercial treatments in this alternative, the overstory removal, seed cut, commercial thin to 20 BA, and patch clear cut treatments would result in a more open condition on approximately 3,703 acres, or 13% of the project area. Review of aerial photos of the project area shows previous treatments of approximately 2,000 acres, or 7% of the project area, in an existing open condition. Cumulatively, this results in approximately 20% of the planning area in an open condition following commercial treatments proposed under Alternative C. Evidence of these treatments, as noted in Alternative B, would not be readily evident from Sensitivity Level 1 or 2 roads outside the project area with the exception of the prescribed fire treatments on Crow Peak. Effects of these highly evident treatments should last only a few years before a natural appearance becomes evident over the long term. The increase in hardwood and meadow restoration treatments should improve the fall color and visual diversity across the planning area, especially in the southwest portion of the planning area. Otherwise, the effects of Alternative C are similar to Alternative B.

EFFECTS SUMMARY

Alternative A

There would be no change from the existing condition. The scenic integrity would stay the same until a natural event (e.g. insect infestation, disease outbreak, or wildfire) occurs.

Alternative B (Proposed Action)

Alternative B would modify the vegetation across the landscape so that management activities would be more evident. This alternative would treat 46% of the project area while moving only 11% of the area from a dense stand to an open forest (18% cumulatively). This change in

vegetative texture would be readily apparent; however, the results would be within the natural range in vegetation (Guideline 5611) had natural events/processes (e.g. fire, insect, wind and snow storms) occurred over time.

The variety of treatments would also create a variety of textural patterns and improve opportunities to view hardwoods and wildlife. Commercial treatments that create large open areas generally do not meet the High or Moderate Scenic Integrity Objective, however most units in MA 5.4 were specifically designed to enhance wildlife forage. In some locations, this alternative would treat entire landforms with a variety of treatments (Guideline 5605). Geometric patterns, created by treating some areas and not others, are a concern in this landscape. To avoid this, it would be critical to transition the number and size of trees between cut and uncut stands.

The removal of ponderosa pine around hardwood stands would reduce competition for nutrients and provide an opportunity for them to flourish and create a larger display of fall color. The removal of ponderosa pine from areas that were historically meadows would improve the visual diversity across the project area. These treatments should meet the assigned SIO. In addition, prescribed fire and pre-commercial thinning should meet their assigned SIO one to two years after all work and slash treatments are completed.

Alternative C (Preferred Action)

Both Alternatives B and C treat approximately the same number of acres through commercial treatments, 10,541 acres vs. 10,445 acres respectively. Of the commercial treatments in Alternative C, the overstory removal, seed cut, commercial thin to 20 BA, and patch clear cut treatments would result in a more open condition on approximately 3,703 acres, or 13% of the planning area. Review of aerial photos of the project area show previous treatments of approximately 2,000 acres, or 7% of the project area, in an existing open condition. Cumulatively, this results in approximately 20% of the project area in an open condition as a result of commercial treatments.

Both alternatives are expected to meet their assigned SIOs.

3.5.3 Heritage

Affected Environment

The Citadel 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.

Specific areas of concerns for heritage resources include the protection of NRHP eligible and unevaluated cultural resource sites, consultation with local American Indian groups; and the protection of culturally significant areas, traditional cultural properties (TCP’s), recent and historic graves. Currently there are no known TCP’s in the Citadel Project Analysis Area.

Of the total 32,217 acres of total land in the Citadel project area, 30,083 acres, including some private land 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.

BHNF Heritage Reports R2004020300080 (NH-36-04) & R2004020300081 (NH-19-04) document a complete Level I literature review and Level III inventory of all remaining acres of potential treatment inside the Citadel project area. These reports were prepared to assist in determining how many and what types of previously documented heritage resources are located within the Citadel project area perimeter. These complete reviews, inventories, and findings of additional historic properties are included in the *Archaeological Investigations of the Rubicon East Analysis Unit, Black Hills National Forest, Lawrence County, South Dakota* (Harding 2004) and *Cultural Resource Inventory of the Rubicon West Analysis Area, Northern Hills Ranger District, Black Hills National Forest, Lawrence County, South Dakota* (Rom 2004). The current analysis will help determine how future projects and natural erosion will potentially affect cultural resources within the Citadel project area. In addition, the BHNF has conducted tribal consultation to assess effects on Traditional Cultural Properties and other culturally sensitive areas within the analysis area. Scoping letters detailing the project and soliciting comments were mailed to appropriate Native American tribal representatives in May 26, 2006.

Two Level I and III Inventory Reports were submitted to the South Dakota State Historic Preservation Office (SHPO), the Cheyenne River Sioux Tribal Historic Preservation Office (THPO) and the Standing Rock THPO for review. Letters were received from the SHPO dated 03/30/2005 for report number R2004020300080 (SHPO Project # 050314001F) and 04/22/2005 for report number R2004020300081 (SHPO Project # 050322008F) SHPO concurred with the site eligibility determination and management recommendations provided by the BHNF for heritage resources within the analysis area. All NRHP eligible and unevaluated cultural resource sites discovered during these and subsequent inventories will be protected from effects related to management activities.

Heritage resource effects were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during commercial and noncommercial timber harvest, fuels reduction activity, prescribed fire, and travel management activities.

The Level I files reviews combined from both reports indicates that there are 30 cultural resource properties that have been evaluated as “eligible or are currently unevaluated” for nomination to the NRHP within the Citadel project area perimeter. There are three sites that are not eligible to the NRHP but are protected. These sites are either known burials or potential burials; South Dakota Codified Law 34-27 prohibits the disturbance of known human remains or funerary objects. An additional 101 properties located inside the Citadel project area perimeter have been evaluated as not eligible for nomination to the NRHP. Of the previously mentioned sites, 55 are related to the prehistoric time period, 68 are associated with historic times, and 8 contain both prehistoric and historic deposits.

Cultural sites are considered sensitive information and are consequently not displayed here. A listing of all documented cultural sites is located in the Citadel project file.

Environmental Consequences

Cumulative Effects Area

Most resource areas would utilize nine, seventh-level watersheds that overlap the project area for the cumulative effects area. The potential area of impact for heritage resources is defined using

both geography and known areas of past human interaction. It encompasses all National Forest System lands, adjacent lands and interspersed private land within the Citadel analysis area. The duration considered for cumulative effects is 10 years, the expected duration of project activities.

Past actions that fall within the Citadel analysis area are timber sales and associated KV activities, livestock grazing, road and utility maintenance, fuels management, fire suppression, water diversions for livestock, and recreational use. The principal recreation uses include snowmobile trails, hiking trails, hunting, all-terrain vehicle use of trails and roads, and recreational driving. Past effects to heritage resources are from road building, reconstruction and decommissioning; fire suppression, timber harvesting, residential development, livestock grazing, and recreation use. Previous ground disturbance in the project area includes historic and current mining activities, logging, homesteading, road and railroad construction, and building of water containment facilities.

Current Actions

Projects within or partially within the cumulative impacts area are the Crow, Rimrock, Maurice, and Seventy timber sales. These four timber sales total 3,400 acres to vegetative treatments. Griggs Fuels project adds an additional 2,340 acres of fuels treatments to the list of current projects.

Along with four current timber sales and one fuels project there are many other ongoing activities including firewood cutting, livestock grazing, mining activity, subdivision development, 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 recreational use. As the number of visitors increases, so will the Forest's need to inform and involve its users in its 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 wildfires.

Adverse cumulative effects to heritage resources on and around the Forest result from decay, erosion, and 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 BY ALTERNATIVE

Alternative A (No Action)

This alternative proposes no action or no change in existing condition from treatment.

Direct Effects

The no-action alternative would not directly affect any heritage resources.

Indirect Effects

Alternative A would not provide for any mitigation measures for resource protection, or stabilization of currently affected sites.

Cumulative Effects

There would be no immediate adverse effects to heritage resources. However, the long-term effects of forest deterioration would lead to increased soil erosion ultimately leading to vandalism and illegal collection of artifacts due to exposure of sites. Intense wildfires from neglected fuel loading could potentially burn out of control at extreme intensities potentially exposing buried archeological resources through defoliation of the understory vegetation and erosion resulting from reduction in small forbs and forest understory. A change in the depositional environment of an archaeological resource from erosion could result in a loss of scientific information that otherwise would have been available for future generations. A historic site such as a cabin constructed of wood could potentially be completely destroyed during a wildfire resulting in a loss of opportunities for restoration, interpretation and recreation.

Alternative B (Proposed Action)

A review of the Rubicon East and West Cultural Resource reports show that there are 131 cultural properties within the analysis area boundary. In the Alternative B treatment areas there are 89 cultural properties. There are 64 ineligible cultural properties that would not be affected by treatments due to their status of being not eligible to the National Register of Historic Places. There are 25 eligible or unevaluated cultural properties and two ineligible properties that have the potential to be affected by the treatments proposed in Alternative B. These culturally significant properties cited for protection are located within or adjacent to potential harvest units, fuel reduction areas, and planned road activities proposed under this alternative. These sites and associated mitigation measured are listed in the Heritage Specialist Report located in the Citadel project file.

The road construction required for Alternative B would have direct impacts to sites through new construction (two sites), decommissioning (two sites), and reconstruction (three sites). Avoidance with a 200 foot buffer is the only common mitigation addressed in the associated reports (Rom 2004 and Harding 2004). Sites that would be impacted by new construction, decommissioning, and reconstruction require mitigations in the form of avoidance (200 ft. buffer). Any other mitigation would require additional consultation with the SHPO, THPO's and other interested parties. Additional mitigations could include capping the site with Geo-Fabric and Gravel. Consultation regarding these undertakings and additional mitigations associated with them would be required before any new construction, reconstruction or decommissioning occurs under a decision associated with Alternative B. There are two sites within the seventeen miles of the Dakota 50 race course that fall within the Citadel boundary.

Direct Effects

Potential for direct impacts or effects to historic properties are: road construction, road reconstruction, road decommissioning; timber harvest with heavy equipment, skidding logs, timber landing, loading, and hauling. Fuels reduction activities can affect these resources in the form of tree, brush and grass removal with heavy equipment, piling burning, and mulching/chipping. Low, moderate and high intensity burns have the potential to affect cultural deposits. All direct effects mentioned have the potential to expose or disturb buried archaeological deposits. Archaeological resources, once disturbed, are no longer of value scientifically or for interpretive use. Effects from the Dakota 50 mountain bike race course are trail maintenance and erosion from both race and other recreational use.

Indirect and Cumulative Effects

Indirect and cumulative effects from road construction and reconstruction include potential erosion in areas of exposed road surfaces. Additional measures include vehicular access to the historic properties, which could promote future artifact hunting, and/or disturbance to contributing features and artifacts by vandals. Indirect and cumulative effects from timber harvest and fuels reduction activities are exposure of contributing cultural features and artifacts with the removal of vegetation cover. Exposing these areas could promote access of recreational vehicles and possibly vandalism. Additionally, removal of vegetation and cover within these areas may promote a change in conditions that could lead to additional erosion from natural elements. Indirect and cumulative effects from the Dakota 50 trail would be erosion from continued use of a non-system unmaintained trail; artifacts can be eroded out as the trail is cut down by bikes and as water becomes channeled down the trail.
Adequate intensive heritage inventories have been performed for all analysis acres in Alternative B. There would be no direct effect to heritage resources within the analysis area for Alternative B, provided that all eligible and potentially eligible/unevaluated properties, Traditional Cultural Properties, and culturally significant areas are avoided or have mitigations developed in consultation with the State Historic Preservation Office, Native American Tribes and other applicable interested parties.

Alternative C (Preferred Action)

Approximately 18 miles of road construction and 35 miles of road improvement would be necessary to access stands for Alternative C treatments. Off-road motorized travel would remain prohibited in the project area, but main system routes currently open to vehicle traffic would remain open. All newly constructed roads would be closed following the completion of management activities. In addition, 31 miles of non-NFS roads would be decommissioned.

The road construction required for Alternative C would have direct impacts to sites through new construction (two sites), decommissioning (two sites), and reconstruction (four sites). Avoidance with a 200 foot buffer is the only common design criteria addressed in the associated reports (Rom 2004 and Harding 2004). Sites that would be impacted by new construction, decommissioning, and reconstruction require mitigations in the form of avoidance (200 ft. buffer). Any other mitigation would require additional consultation with the SHPO, THPOs and other interested parties. Additional mitigations could include capping the site with Geo-Fabric and Gravel. Consultation regarding these undertakings and additional mitigations associated with them would be required before any new construction, reconstruction or decommissioning occurs under a decision associated with Alternative C. There are two sites within the seventeen miles of the Dakota 50 race course that fall within the Citadel boundary.

Direct Effects

Potential for direct impacts to historic properties are from road construction, road reconstruction, road decommissioning, timber harvest with heavy equipment, skidding logs, timber landing, loading, and hauling. Fuels reduction activities can affect these resources in the form of tree, brush and grass removal with heavy equipment, piling, burning, and mulching/chipping. Low, moderate and high intensity burns have the potential to affect cultural deposits. All direct effects mentioned have the potential to expose or disturb buried archaeological deposits. Archaeological resources once disturbed are no longer of value scientifically or for interpretive use. Effects from the Dakota 50 Mountain Bike Race Course are trail construction and erosion from both race and recreational use.

Indirect and Cumulative Effects

Indirect and cumulative effects from road construction and reconstruction include potential erosion in areas of exposed road surfaces. Additional measures include vehicular access to the historic properties, which could promote future relic hunting, or disturbance to contributing features and artifacts by vandals. Indirect and cumulative effects from timber harvest and fuels reduction activities are exposure of contributing cultural features and artifacts with the removal of vegetation cover. Exposing these areas could promote access of recreational vehicles and possibly vandalism. Additionally, removal of vegetation and cover within these areas may promote a change in conditions that could lead to additional erosion from natural elements. Indirect and cumulative effects from the Dakota 50 trail would be erosion from continued use of a non-system unmaintained trail; artifacts can be eroded out as the trail is cut down by bikes and as water becomes channeled down the trail.

Adequate intensive heritage inventories have been performed for all analysis acres in Alternative C. There would be no direct effect to heritage resources within the analysis area for Alternative C, provided that all eligible and potentially eligible/unevaluated properties, Traditional Cultural Properties, and culturally significant areas are avoided or have mitigations developed in consultation with the State Historic Preservation Office, Native American Tribes and other applicable interested parties.

EFFECTS CONCLUSION

Alternative A (No Action)

In considering no action for this 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 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 severe wildfires from increased fuel loading.

Alternatives B and C

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. Alternative A would result in no ground disturbance. As the amount of potential ground disturbance increases the potential for disturbance and adverse effects to heritage resources also increases.

Under Alternatives B and C, 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 under each alternative, provided the protection mitigations 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. Timber and underbrush removal, mulching, skid trails, temporary road use, landings, yarding of equipment, and piling and disposal of slash piles can adversely affect heritage resources. Additional affects 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. In comparing the alternatives, Alternative C would disturb the greatest number of acres, followed by Alternative B. Alternative A would result in no ground disturbance. As the amount of potential ground disturbance increases the potential for disturbance and adverse effect to heritage resources also increases.

Under Alternatives B and C, 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 under each alternative, provided the protection mitigations 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 which use barrier cloth and additional material fill can reduce damage to heritage resources.

In a review of the alternatives considered there is only a 1-mile difference in new construction, Alternative B proposes 18 miles and Alternative C proposes 17 miles. Both alternatives have a similar potential to affect heritage resources. Alternative A would result in the lowest potential to affect heritage resources. Both Alternatives B and C have the same amount of road improvements and road decommissioning. Alternative A would have no improvements and no decommissioning. Improvements to roads have the potential to impact heritage sites through grading and resurfacing of the existing native surface roads. Decommissioning has the potential to both impact and protect heritage sites. Sites may be protected through decommissioning by limiting access to destructive all terrain vehicles and potential artifact collectors. Sites have the potential to be adversely affected by decommissioning through disturbance of buried deposits

during re-contouring. The least invasive method of decommissioning to heritage resources would be closure via a gate or placement of large boulders.

Alternatives B and C contain areas planned for road construction, road reconstruction and road decommissioning activities, which have the potential to adversely affect significant historic properties. Specific design criteria were developed and addressed for these proposed road areas. The Forest would be in compliance with Section 106 of the National Historic Preservation Act under each alternative, provided the appropriate avoidance or mitigation measures are implemented.

3.5.4 Economics

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 5.004.45, USDA Forest Service, North Central Experiment Station, February 15, 2000). The financial analysis was done both from a short-term and long-term perspective. The complete analysis resides in the Citadel project file.

The objective of the analysis is to provide a relative comparison of the costs and revenues associated with implementing the three alternatives being analyzed. There are costs and benefits associated with activities occurring in the Citadel project area that are not included in this analysis (e.g., recreation management, fuel wood gathering). 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 action alternatives would not significantly change these other items.

This EIS discusses two action alternatives for managing the Citadel project area for the next ten to fifteen years. The financial analysis includes those actions connected to the vegetation treatment 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 generated for Alternative A because no actions are proposed under this EIS, so no costs or benefits would be generated.

The action alternatives described in this EIS are consistent with national initiatives and policy such as the National Fire Plan, Healthy Forest Initiative, and direction provided by the Forest Plan, Phase II Amendment, and associated economic assumptions. Any future project proposals will receive a separate environmental analysis, including financial or economic analysis, as appropriate. Table 3-32 displays the financial measures summarized by alternative.

Table 3-32. Financial Measures by Alternative

	Alternative A	Alternative B	Alternative C
Present Net Value (PNV)	0	-$5,098,797	-$7,606,081
Benefit/Cost Ratio (B/C)	0	0.41	0.32
Benefits (PV)	0	$3,568,708	$3,646,213
Costs (PV)	0	-$8,667,505	-$11,252,293

3.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics.

There are no **irreversible commitments** of resources associated with any of the alternatives analyzed.

Irretrievable commitments of resources include the following:

Soil productivity and **timber productivity** would be lost where road construction is planned under Alternatives B and C (about 18 miles for Alternative B and 17 miles for Alternative C).

3.7 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). For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics. Actions under Alternatives B and C would be implemented using design criteria that protect **soil productivity**. Any decrease in long-term soil productivity resulting from actions would be negligible.

As provided for by the amended Forest Plan, minimum management requirements guide implementation of the action alternatives. Adherence to these requirements ensures that long-term productivity of the land is not impaired by short-term uses. Monitoring specified in this EIS and the amended Forest Plan validates that the management requirements and mitigation are effective in protecting long-term productivity.

3.8 UNAVOIDABLE ADVERSE EFFECTS

The following is a description of adverse effects that are unavoidable with implementation of action alternatives. For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics.

Wildlife habitat for certain species would be adversely affected to varying levels with implementation of the action alternatives. The wildlife section of Chapter 3 of this EIS discloses those effects.

Air quality would be adversely affected on a temporary/seasonal basis as a result of proposed prescribed burning and dust from roads and activities.

Travel and recreation use on the part of some members of the public would experience some adverse effects in terms of what users are currently accustomed to doing versus changes resulting from implementation of the various alternatives.

Scenic quality would be affected adversely for some observers by the various levels of vegetation treatment and other actions proposed.

Fire/fuels hazard would be increased in the next five to ten years in some areas as a result of slash created by vegetation treatment. With proposed disposal treatments, this hazard would be reduced or eliminated. There exists a higher potential for catastrophic wildfire under Alternative A versus the action alternatives.

Soils could be eroded where vegetation and soils are disturbed. Compaction could occur where vehicles and equipment are used. Adherence to site-specific design criteria would minimize this effect.

Previously unknown or unrecorded heritage resources could be disturbed or destroyed where human or natural activities take place. If previously unknown heritage resources are discovered during project activities, project staff would stop ground-disturbing actions at the site and notify the District or Forest archaeologist before activities are resumed

Forest insects and disease would continue within the project area at endemic levels.

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6. GLOSSARY

90th percentile weather

Weather conditions (temperature, humidity, wind, etc.) that represent the upper 90th percentile of observations.

Active crown fire
A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread.

Basal area
The cross-sectional area of all stems in a stand measured at breast height and expressed in square feet per acre.

Best Management Practice
The set of practices in the Forest Plan which, when applied during implementation of a project, ensures that water related beneficial uses are protected and that State water quality standards are met. BMPs can take several forms. Some are defined by State regulation or memoranda of understanding between the Forest Service and the States. Others are defined by the Forest interdisciplinary planning team for application Forest-wide. Both of these kinds of BMPs are included in the Forest Plan as Forest-wide Standards. A third kind is identified by the interdisciplinary team for application to specific management areas; these are included as Management Area Standards in the appropriate management areas. A fourth kind, project level BMPs, are based on site specific evaluation and represent the most effective and practicable means of accomplishing the water quality and other goals of the specific area involved in the project. These project level BMPs can either supplement or replace the Forest Plan standards for specific projects.

Biological Assessment
An analysis conducted for major Federal construction projects requiring an environmental impact statement, in accordance with legal requirements under section 7 of the Endangered Species Act. The purpose of the assessment and resulting document is to determine whether the proposed action is likely to affect an endangered, threatened, or proposed species" (FSM 2670.5.2).

Biological Evaluation
A documented Forest Service review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species" (FSM 2670.5.3).

Board foot
A unit of timber measurement equaling the amount of wood contained in a board one inch thick, 12 inches long, and 12 inches wide.

Broadcast burning
A type of prescribed burning where contiguous blocks are burned at the same time. The goal is to have fire burn across most or all of the surface within the block

Canopy
The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Canopy bulk density
The mass of available canopy fuel per unit canopy volume.

Canopy closure
The percentage of the ground or sky covered by vegetation or branches. These are perceived from a human point of view perpendicular to flat ground.

Canopy fuels
The live and dead foliage, live and dead branches, and lichen of trees and tall shrubs that lie above the surface fuels.

Channel morphology
The physical configuration of a stream channel: width, depth, shape, etc.

Classified road
A road that is constructed, maintained, and intended for long-term vehicle use.

Closed road
A road that is closed to all vehicular traffic for more than one year.

Chipping
The process of feeding wood material (slash) into a chipper to produce chips, small pieces of wood.

Co-dominant
This term refers to trees that are approximately equal in height to the dominant trees in a stand.

Commercial thinning
Removing from a stand some trees that have reached sufficient size to be manufactured into a product in order to improve tree spacing and increase growth.

Commercial timber sale
The selling of timber from National Forest System lands for the manufacture of commercial products such as lumber, plywood, etc.

Condition class
Class 1 - For the most part, fire regimes (return frequency/severity) in fire condition class are within historical ranges. Thus the risk of losing key ecosystem components from the occurrence of fire remains relatively low. Maintenance management such as prescribed fire, mechanical treatments, or preventing the invasion of non-native weeds, is required to prevent these lands from becoming degraded.

Class 2 - Fire regimes on these lands have been moderately altered from their historical range by either increased or decreased fire frequency. A moderate risk of losing key ecosystem components has been identified in these lands. To restore their historical fire regimes, these lands may require some level of restoration through prescribed fire, mechanical or chemical treatments, and the subsequent reintroduction of native plants.

Class 3 - These lands have been significantly altered from their historical range. Because fire regimes have been extensively altered, risk of losing key ecosystem components from fire is high. Consequently, these lands verge on the greatest risk of ecological collapse. To restore their historical fire regimes – before prescribed fire can be utilized to manage fuel or obtain other desired benefits – these lands may require multiple mechanical or chemical restoration treatments, or reseeding. These lands should have the highest priority for treatment.

Council on Environmental Quality
An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover habitat
Cover is a general term that includes thermal and hiding cover. Thermal cover provides moderation of daytime highs in summer months and nighttime lows in winter months, helping animals maintain energy reserves despite extreme temperatures. Hiding cover provides security from human disturbance by screening animals from audible and visual disturbance and is most important along roads.

Cover type
The vegetative species that dominates a site.

Critical habitat
Under the Endangered Species Act: (1) The specific areas within the geographic area occupied by a federally listed species on which physical and biological features are found that are essential to the conservation of the species and that may require special management or protection; and (2) The specific areas outside the geographic area occupied by a listed species that are determined to be essential for the conservation of the species.

Crown base height
The vertical distance from the ground to the bottom of the live crown of an individual tree, or the average distance in a stand.

Crown bulk density
The mass of available fuel per unit crown volume.

Crown fire
Any fire that burns canopy fuels.

Crown fire hazard
A physical situation (based on fuels, weather, and topography) with potential for causing harm or damage because of crown fire.

Crowning index
The open 20-foot wind speed at which active crown fire is possible for the specified fire environment.

Crush
Break slash into smaller pieces by driving over it with mechanical equipment.

Cull
Trees, logs, or lumber rejected because they do not meet certain specifications of usability or grad.

Cultural (heritage) resources
The physical remains of human activity (such as artifacts, ruins, burial mounds, or petroglyphs) and conceptual content or context (such as a setting for legendary, historic, or prehistoric events or a sacred area of native people) of an area of prehistoric or historic occupation.

Cumulative effects
The combined effects resulting from sequential actions on a given area, including past, present, and reasonably foreseeable actions.

Decommissioned road
In this document, a decommissioned road is one that is permanently removed from the transportation system, revegetated, and made impassible or as nearly so as possible.

Direct attack
Fire suppression activities that take place immediately adjacent to the flaming front.

Direct effects
Effects that are caused by an action and occur at the same place and time.

Dominant
Trees that are the tallest in a stand.

Duff
Partially decomposed organic matter lying beneath the litter layer and above the mineral soil. It includes the fermentation and humus layers of the forest floor.

Ecosystem
A complete, interacting system of organisms considered together with their environment (for example; a marsh, a watershed, or a lake).

Edge habitat
The interface between two distinct habitat types. Elements of both habitats are typically present, increasing diversity.

Endemic
Naturally occurring in a particular location.

Environmental Assessment
A concise public document for which a federal agency is responsible that serves to: (1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; (2) Aid an agency's compliance with NEPA when no environmental impact statement is necessary; and 3) Facilitate preparation of an environmental impact statement when one is necessary.

Ephemeral stream
A stream or portion of a stream that flows only in direct response to precipitation, receiving little or no water from springs and

no long continued supply from snow or other sources, and whose channel is at all times above the water table.

Fire behavior
The manner in which a fire reacts to fuel, weather, and topography.

Fire frequency
The recurrence of fire in a given area over time. Sometimes stated as number of fires per unit time in designated area or how often fire burns a given area, often expressed in terms of fire return intervals.

Fire event
For the purposes of fuels analysis, a wildfire with a probability of occurrence that is modeled using representative weather inputs (usually the 90th percentile) for the purpose of effects analysis to compare alternatives.

Fire frequency (fire return interval)
A general term referring to the recurrence of fire in a given area over time. Sometimes stated as number of fires per unit time in designated area or how often fire burns a given area, often expressed in terms of fire return intervals.

Fire hazard
A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the ease of ignition and the resistance to control. A physical situation (fuels, weather, and topography) with potential for causing harm or damage because of wildland fire.

Fire intensity
The rate of heat release per unit length of fire front, including the additional heat released from postfrontal flaming and smoldering combustion.

Fire intensity level
A measure of fire behavior used in the Interagency Initial Attack Assessment Model (IIAA). It is based on the calculated flame length: FIL 1: 0-2 feet, FIL 2: 2-4 feet, FIL 3: 4-6 feet, FIL 4: 6-8 feet, FIL 5: 8-12 feet, FIL 6: greater than 12 feet. FIL is used in the IIAA model as an indicator of fire danger for dispatch purposes, to categorize rate of spread, and in the assessment of fire effects. Each FIL has an associated suppression cost.

Fire management plan
A strategic plan that defines a program to manage wildland and prescribed fires and documents the fire management program in the approved land use plan. This plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, prevention plans, and operational wildland fire use plans.

Fire regime
A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, seasonality, intensity, duration and scale (patch size), as well as regularity or variability.

Fire risk
The probability of an ignition occurring as determined from historical fire record data.

Fire rotation
The length of time necessary for an area equal in size to the project area to burn.

Fire severity
A qualitative measure of the immediate effects of fire on the ecosystem. Relates to the extent of mortality and survival of plant and animal life both above and below ground and to loss of organic matter.

Fire suppression
All work and activities connected with fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Firebreak
A natural or constructed barrier to stop or check fires that may occur, or to provide a control line from which to work.

Fireline intensity

The rate of heat release in the flaming front per unit length of fire front. Can be converted to flame length. (FL = 0.45*(I0.46)). This expression is commonly used to describe the power of wildland fires.

Flame length
The height of flames at the flaming front.

Floodplain
The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Foliar moisture content
Moisture content (dry weight basis) of live foliage, expressed as a percent. Effective foliar moisture content incorporates the moisture content of other canopy fuels such as lichen, dead foliage, and live and dead branch wood.

Foraging habitat
Areas used by wildlife to obtain food.

Fuel
The loose surface litter on the soil surface, for example, fallen leaves or twigs, needles, bark, cones, branches, grasses, shrub and tree reproduction, downed logs, stumps, seedlings, and forbs interspersed with or partially replacing the litter.

Fuel break
A natural or manmade change in fuel characteristics that affects fire behavior so that fires burning into them can be more readily controlled.

Fuel characteristics
Factors that make up fuels such as compactness, loading, horizontal continuity, vertical arrangement, chemical content, size, shape, and moisture content.

Fuel continuity
The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.

Fuel load(ing)
The oven-dry weight of fuel per unit area, generally expressed in tons per acre.

Fuel model
A tool to estimate fire behavior based on the amount and type of fuel per acre and the vegetative structure of the stand.

Fuel management
Management activities undertaken to alter the amount of fuel in treatment units.

Fuel treatment
Any manipulation or removal of fuels to reduce the likelihood of ignition and/or lessen potential damage and resistance to control.

Fuel wood
Wood used for conversion to some form of energy, for example, in residential use or in cogeneration plants.

Geographic Information System
A type of computer program used to store and analyze geographic data.

Ground fuel
Fuels that lie beneath surface fuels, such as organic soils, duff, de-composing litter, buried logs, roots, and the below-surface portion of stumps.

Habitat capability
The estimated ability of an area to support wildlife, fish or plant populations.

Habitat effectiveness
The percentage of available habitat that is usable by wildlife during the non-hunting season. This concept assumes that some portion of suitable habitat is not used to the fullest extent because of human disturbance. For example, big game species tend to avoid using otherwise suitable habitats near open roads.

Hand thinning
Removal of live or dead vegetation primarily by hand labor. For example, using chain saws to thin understory vegetation.

Hardwoods
Broadleaf trees or shrubs.

Hazardous fuel reduction
Removal of accumulations of fuel that could contribute to uncontrollable fire behavior.

Herbicide
A chemical compounds used to kill undesirable vegetation.

Hydrophobic soil
Soil that does not absorb water. High intensity fires can alter soil chemistry so that it is no longer capable of absorbing water, which quickly runs off the surface, often initiating excessive soil erosion.

ID team
A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.

Indirect attack
Fire suppression activities that take place some distance from the flaming front. This method is typically used when fire behavior is too intense for direct attack.

Indirect effects
Secondary effects which occur in locations other than the initial action or significantly later in time.

Infiltration
The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Intermediate
Trees that form an intermediate layer beneath the dominant tree canopy but above the understory.

Intermittent stream
A stream or a portion of a stream, that does not flow year-round but only when it (a) receives base flow solely during wet periods, or (b) receives groundwater discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources. See also Ephemeral stream.

Ips
A genus of bark beetle that feeds beneath the bark of pines, typically killing branches, tops, or entire trees.

Jackpot fuels
Fuel accumulations that are substantially higher than in the surrounding stand. Such accumulations can initiate torching or crowning fire behavior.

Ladder fuel
Combustible material that provides vertical continuity between vegetation strata and allows fire to climb into crowns of trees or shrubs with relative ease.

Landscape-scale
An event that occurs across large tracts of land.

Landing
Any place where round timber is assembled for further transport.

Large-scale wildfire
A stand-replacing wildfire, often covering large tracts of land and substantially changing the ecosystems it affects.

Late succession
Ecosystems distinguished by old trees and related structural features.

Litter
The top layer of the forest floor including freshly fallen leaves, needles, fine twigs,

bark flakes, fruits, matted dead grass, and a variety of miscellaneous vegetative parts that are little altered by decomposition. Litter also accumulates beneath rangeland shrubs. Some surface feather moss and lichens are considered to be litter because their moisture response is similar to that of dead fine fuel.

Lop and scatter
A term used in treating fuels during and after harvesting is complete where the unmerchantable portions of the tree (usually the smaller top of a tree and the limbs) are cut off and scattered about to reduce slash concentrations.

Management area
An area for which a single set of management prescriptions is developed and applied.

Management area prescription
A set of standards and guidelines that apply to a specific management area.

Management indicator species
Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important.

Mass movement
Down-slope movement of a portion of the land's surface, such as a single landslide or the gradual downhill movement of the whole mass of loose material on a slope face.

Mechanical fuel treatment
An activity that alters fuel loads using mechanical means.

Mechanized thinning
Removal of live or dead vegetation primarily by mechanized equipment.

Mitigation
Avoiding or minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact by preservation and maintenance operations during the life of the action.

Mixed severity fire regime
Regime in which fires either cause selective mortality in dominant vegetation, depending on different species' susceptibility to fire, or vary between understory and stand replacement.

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.

Nesting habitat
Habitats used by wildlife (birds) for nesting.

Noxious weeds
A plant specified by law as being especially undesirable, troublesome, and/or difficult to control.

Passive crown fire
A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fire encompasses a wide range of crown fire behavior from the occasional torching of an isolated tree to a nearly active crown fire.

Patch clearcut
The harvesting in one cut of all trees in an area not more than 10 acres in size.

Peak flow
The highest annual flow in a stream.

Perennial streams
Streams that flow continuously throughout most years.

Piling and burning
A fuels treatment method comprised of piling fuel into piles that are burned. Piling may be accomplished by hand labor or with large machinery such as bulldozers, depending on terrain, accessibility, fuels, and other concerns.

Population viability
The ability of a population to persist through time.

Pre-commercial thinning
Removing from a stand some of the trees that are too small to make a merchantable product in order to improve tree spacing and increase growth.

Prescription
Measurable criteria that define the conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Prescribed fire
Any fire ignited by management actions to meet specific objectives. An approved written prescribed fire plan must exist and NEPA requirements must be met before ignition. This term replaces management ignited prescribed fire.

Pre-settlement fire regime
The time from about 1500 to the mid-to late-1800s when Native American populations had already been heavily affected by European presence but before extensive settlement by European-Americans in most parts of north America, before extensive conversion of wildlands for agricultural and other purposes, and before fires were effectively suppressed in many areas.

Project design standards
Standards that are used in developing a proposed action. These are intrinsic to an action, as opposed to mitigation, which is developed to reduce the effects of an action that is already complete.

Proposed action
In terms of NEPA, the project, activity, or action that a federal agency intends to implement or undertake and which is the subject of an environmental analysis.

Rate of spread
The relative speed with which a fire increases in size.

Regeneration
The process where trees reproduce themselves by either artificial (hand planting of small seedlings) or natural (by seed) means. Often used to refer to the young trees themselves.

Riparian area
A transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is identified by soil characteristics and by distinctive vegetative communities that require free or unbounded water.

Road density
Miles of road per square mile of land.

Road prism
The portion of the road within the limits of excavation and embankment.

Roads analysis
A Forest Service specific process that is an integrated ecological, social, and economic science-based approach to transportation planning and addresses existing and future road management options.

Recreation Opportunity Spectrum
Provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. The settings, activities, and opportunities for obtaining experiences have

been arranged along a continuum or spectrum divided into three classes:

Rural - The Rural class setting is characterized by moderate to high levels of use on developed sites, roads, trails, and water surfaces. Contact with other users is lower away from these areas. Controls such as signs and barriers exist but to a lesser degree than in the urban setting and they tend to be in harmony with the man-made environment. (Examples of the Urban and Rural settings include cities, villages, farms, ranches, parks, and campgrounds near heavily populated areas).

Roaded Natural - This setting has moderate levels of human activities and structures. Regimentation and controls are noticeable but tend to blend with the natural environment. There is an equal probability of encountering other users and experiencing isolation from humans. Opportunities for both motorized and non-motorized forms of recreation are possible. (Examples of the Roaded Natural Appearing setting include improved highways, developed campgrounds, small resorts, ski areas, livestock grazing, and timber harvesting operations).

Semi-primitive - Both the Semi-Primitive Motorized and Semi-Primitive Non-Motorized classes are characterized by predominately natural or natural-appearing landscapes. The size of these areas gives a strong feeling of remoteness from the more heavily used and developed areas. Within these settings, there are ample opportunities to practice wildland skills and to achieve feelings of self-reliance. The most significant difference between the semi-primitive motorized, and non-motorized settings is the presence of absence of motorized vehicles. In the non-motorized settings, the presence of roads is tolerated, provided they are closed to public use, they are used infrequently for resource protection and management, and the road standards and locations are visually appropriate for the physical setting. In many cases, old roads are acceptable as non-motorized travelways so long as they do not reflect misuse or poor stewardship of the land. These roads would have motorized use in the semi-primitive motorized class, especially by ORVs. (An example of a semi-primitive non-motorized setting would be a backcountry area or trail where few other visitors are encountered and motorized use is prohibited. A semi-primitive motorized setting would likewise have few encounters with other users but motorized use may occur).

Salvage harvest
Removal of damaged, dead, or dying trees resulting from insect and disease epidemics, wildfire, or storms to recover logs before they have no commercial value for production.

Sanitation cutting
The removal of trees occupied by insect or disease pests to reduce pest populations and limit their spread.

Sawtimber
Trees suitable in size and quality for producing logs that can be processed into lumber; generally those with a diameter of 8 inches or greater.

Scoping
An early and open process designed to identify the environmental issues and significant factors to be addressed in the analysis process.

Secondary cavity nester
A bird that nests in cavities in trees that are constructed by other (primary) cavity nesters. Such birds are typically not capable of constructing their own nest cavities.

Seedtree cutting
A harvest method that leaves a small number of seed-bearing trees singly or in small groups to provide seed for regeneration of the site.

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 (a) population numbers or density, or (b) habitat capability that would reduce a species' existing distribution.

Shelterwood cutting
A harvest method that leaves a portion of the mature stand in place as a source of seed.

Silviculture
A scientific discipline devoted to management of forest resources.

Skidding
Moving logs from the stump to a collecting point.

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 trees.

Snag
A standing dead tree usually greater than five feet in height and six inches in diameter at breast height.

Soil compaction
The process by which the soil grains are rearranged, resulting in a decrease in void space and causing closer contact with one another, thereby increasing bulk density.

Soil map unit
An area with similar soil types and properties delineated for mapping purposes.

Soil permeability
The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water move downward through saturated soil.

Species diversity The variety and variability among living organisms and the ecological complexes in which they occur.

Spotting (spot fires)
A process where embers from a fire are lifted or blown ahead of the flaming front and start new fires.

Standards and guidelines
An indication or outline of policy or conduct. Standards have specific, quantifiable measures, while guidelines provide more general direction and flexibility of management options.

Stand-replacing fire
Fires that kill or top-kill aboveground parts of the dominant vegetation, changing the aboveground structure substantially. Approximately 80 percent or more of the aboveground dominant vegetation is either consumed or dies because of fires.

Stem density
The number of trees per unit area, typically trees per acre.

Stored road
In this document, a stored road is one that is closed year-round between periods of use for resource management (separated by years) using berms, rocks, or other barriers instead of a gate.

Stream flow regime
The pattern of water flow in a stream. Influenced by season, precipitation, and other factors.

Suppressed
Trees growing in the understory that are shaded by overstory (dominant and co-dominant) trees.

Surface fire
A fire spreading through surface fuels.
Surface fuels
Needles, leaves, grass, forbs, dead and down branches and boles, stumps, shrubs, and short trees.

System road
A road that is part of the official USFS transportation system.

Temporary roads
Those roads needed only for the purchaser or permittee's use. The Forest Service and the purchaser or permittee must agree to the location and clearing widths. Temporary roads are used for a single, short-term use, e.g., to haul timber from landings to Forest Development Roads, access to build water developments, etc. Temporary roads must be obliterated as part of a timber sale contract.

Torching
The transition of surface fire into the crown of a single tree, typically caused by ladder fuels, high flame lengths, or low crown base height. Torching often leads to crown fire behavior

Torching index
The open (20 foot) wind speed at which crown fire activity can initiate for the specified fire environment.

Tractor yarding
A method of moving logs to a landing on the ground using mechanical equipment such as a skidder.

Transitory range
Transitory range is an area that temporarily produces an increase in rangeland vegetation. These areas occur when the tree and sometimes shrub overstory are removed allowing the grass/forb component to take full advantage of available sunlight and moisture.

Unclassified road
A road that is not constructed, maintained, or intended for long-term highway vehicle use, or a travelway resulting from off-highway vehicle use.

Understory
The trees and other woody species that grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Values at risk
Include property, structures, physical improvements, natural and cultural resources, community infrastructure, and economic, environmental, and social values. They may be on- or off-site values.

Visual Management System
The VMS divides NFS lands into several visual categories based on variety class, sensitivity level, and distance zone. Variety classes are obtained by classifying the landscape into different degrees of variety. This determines those landscapes that are most important and those that are of lesser value from a standpoint of scenic quality. Sensitivity levels are a measure of the people’s concern for the scenic quality of the Forest. Distance zones describe distances from which the landscape is viewed. The VMS is used to define VQOs.

Visual Quality Objective
A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.

Preservation: Only ecological changes are allowed to alter the natural landscape.

Retention: Human activities are not evident to the casual Forest visitor.

Partial Retention: Human activities may be evident, but must remain subordinate to the characteristic landscape.

Modification: Human activity may dominate the characteristic landscape, but should appear as natural when viewed as background.

Enhancement: A short-term management alternative that is done with the express purpose of increasing positive visual variety where little variety now exists.

Water influence zone
A zone located on either side of a stream that is 100 feet or height of the tallest tree, whichever is greater, in width. Special management requirements are applied to the WIZ.

Watershed
A region or land area drained by a single stream, river, or drainage network.

Wetland
1. A transitional area between aquatic and terrestrial ecosystems that is inundated or saturated for periods long enough to produce hydric soils and support hydrophytic vegetation. 2. A seasonally flooded basin or flat.

Wildland-urban interface
The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Wildland fire
Any non-structure fire, other than prescribed fire, that occurs in the wildland. This term encompasses fires previously called both wildfires and prescribed natural fires.

7. LIST OF PREPARERS

Interdisciplinary Team	
Paul Bosworth	Engineer. Bachelor of Science, Civil Engineering, South Dakota School of Mines and Technology. Twenty-three years of experience with the U.S. Forest Service locating roads, designing roads and administrating road construction projects.
Brenda Bowen	Resource Information Specialist. Bachelor of Science, Resource Recreation and Tourism with a Minor in Wilderness and Nature Conservation, University of Idaho, 1994. Thirteen years of experience with the National Park Service in Wyoming, and the U.S. Forest Service in Washington and South Dakota leading interpretive programs, conducting stand exams and reforestation surveys, and as coordinator of district GIS and database programs.
Kerry Burns	Forest Wildlife Biologist. Twenty-two years experience in biology with the U.S. Forest Service in Colorado, Wyoming, and Alaska including eight years on the Black Hills National Forest.
Valerie Carlson	Wildlife Biologist. Bachelor of Science, Zoology, Oregon State University, 1996. Nine years of biological experience with the federal government, including: the National Park Service and U.S. Forest Service in South Dakota and the U.S. Fish and Wildlife Service and Bureau of Land Management in Montana. Conducted wildlife studies and surveys, managed a black-footed ferret captive breeding and reintroduction program, worked with Interdisciplinary Teams and Wildlife Working Groups, and wrote wildlife specialist reports for NEPA analysis.
Jeff Gies	Fuels Specialist. Bachelor of Science, Geography with Environmental Planning Emphasis, South Dakota State University, 1989. Seventeen years experience in land use, natural resource management, and environmental review, including: Fuels program administration and implementation for the South Dakota Division of Wildland Fire Suppression; and land use, wildland urban interface and environmental planning review (including NEPA project administration) for Pennington County, South Dakota and the U.S. Forest Service.
Les Gonyer	Hydrologist. Bachelor of Science, Forestry, minor in Hydrology, University of Minnesota, 1977. Thirty years of Forest Service experience at the district and forest level in Utah, New Mexico, Oregon, Idaho, Wyoming, California and South Dakota in watershed, timber, special uses, minerals, fire, engineering and environmental analysis. Red carded firefighter (FFT2). Burned Area Emergency Rehabilitation (BAER) team leader and hydrologist. Rapid Assessment Team (RAT) experience.
Hillarie Jackson	Lands Specialist. Bachelor of Agricultural Science, South Dakota State University, 1995. Seven years of experience with

	the U.S. Forest Service in South Dakota performing wildfire suppression, prescribed fire duties, fire dispatching, customer service, coordinating land use authorizations, managing real property, and writing specialist reports.
Bonnie Jones	Recreation Specialist. Bachelor of Science, Forest Biology, Colorado State University, 1986. Twenty three years with the U.S. Forest Service, the past four years in special uses and recreation management on the Northern Hills District. Manages developed and dispersed recreation, hiking and snowmobile trails, outfitter and guides, recreation events, front desk and travel management.
Jay Kinsman	Archaeologist. Bachelor of Arts, Anthropology, Western Washington University, 2001. Several years of experience with the Forest Service in South Dakota conducting surveys for archaeological resources, analyzing effects of management actions, and coordinating with State and Tribal officials.
Stephen Keegan	Landscape Architect - Bachelor of Science, Landscape Architecture & Environmental Studies, State University of New York - College of Environmental Science and Forestry (ESF), 1980; Bachelor of Science, (dual degree with ESF), Syracuse University 1980; Associates of Arts, Humanities, State University of New York - Onondaga Community College, 1978. Twenty-five years of Forest Service experience at the forest and zone level in Oregon, South Dakota, Montana, Idaho conducting: Scenic Resource Assessments for watershed analyses, vegetation and fuels management; recreation site & road design; and Scenic Byway coordination. Fire experience: Type 1-4 incidents with USFS (operations level), 30 years experience with City and Rural Fire Departments in New York, Idaho, Oregon and South Dakota (15 of those years at the Chief Officer level).
Rhonda O'Byrne	District Ranger. Bachelor of Science, Rangeland Ecology, Arizona State University, 1990. Sixteen years of experience with the U.S. Forest Service in Arizona, Montana and South Dakota performing rangeland management duties (7 years), planning and analysis duties (6 years) and district management and line officer duties (3 years).
Kaye Olpin	Recreation, Lands, Minerals Program Manager, Bachelor of Science in Forestry, University of Utah, 1994. Seventeen years experience with U.S. Forest Service in Idaho and South Dakota managing recreation, trails, travel management, minerals, lands, heritage and facilities programs.
Stephanie Shively	Wildlife Biologist. Bachelor of Science, Animal Ecology, Iowa State University, 1993. Twelve years of experience with the U.S. Forest Service in Colorado, Wyoming and South Dakota conducting wildlife and fisheries studies, habitat improvement projects, and writing Biological Evaluations/Assessments and specialist reports.
Tom Smith	Rangeland Management Specialist. Twenty-five years of federal

	Range and Fire Management experience in California, Colorado, and South Dakota including inventory and monitoring of rangeland resources, range analysis, grazing permit administration, allotment management planning, integrated pest management, NEPA planning, prescribed fire operations, and wildfire suppression.
Elizabeth Stiller	Certified Silviculturist. Master of Science, Ecosystems and Silviculture, University of Minnesota, 1987. Bachelor of Science, Forestry, University of Minnesota, 1982. Twenty nine years of experience with the U.S. Forest Service in South Dakota, Colorado, and Montana, Bureau of Land Management in Montana, and the State of Wisconsin, conducting stand examinations, identifying timber stand improvement activities, developing timber sale prescriptions performing wildfire suppression, support, and prescribed fire duties, and writing planning documents.
Chris Stores	ID Team Leader. Bachelor of Science, Wildlife Biology, The University of Montana, 2000. Three years of experience with the U.S. Fish and Wildlife Service in North Dakota, Montana, Washington, and Idaho and four years with the U.S. Forest Service in California and South Dakota conducting wildlife studies, performing wildfire suppression and prescribed fire duties, and writing planning documents.
DeWayne Thornburgh	Supervisory Forester. Bachelor of Science, Forest Management, Iowa State University. Sixteen years of experience with the U.S. Forest Service in Montana, Alaska, South Dakota and Minnesota as Forester and Forestry Technician in support of timber and vegetative management activities and project area planning for the Forest.
Jim Williams	Fuels Technician. Bachelor's degree in Natural Resource Management with a major in Forestry, Oklahoma State University, 1997. Began working for the U.S. Forest Service in Idaho in 1997 and have spent the last nine years with the Forest Service working in Idaho, Indiana, Illinois, Missouri, and South Dakota. Experience includes timber layout and marking, forest inventory, and fuels management including measuring inventory plots, implementing prescribed fire, assisting with fire suppression, implementing manual and mechanical treatments, and planning fuel treatments within project areas.
Katherine Zacharkevics	Botanist. Bachelor of Science, Environmental Studies, Concentration in Ecology, State University of New York at Binghamton, 1992. Fifteen years of field experience in botany and ecology with the U.S. Forest Service. Positions include: 8 years on the Black Hills National Forest working in the sensitive plant species program, 2 years on the Prescott National Forest in the ecology program assessing ecosystem condition, and 6 seasons on the Bighorn National Forest conducting rare plant surveys, range monitoring, and riparian classification work.

8. RECIPIENTS OF PLANNING DOCUMENTS

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Black Hills Forest Resource Association (Aaron Everett)

Black Hills Land Analysis (Rob Mattox)

Butte County Commissioners

Martin Davis

Eric Hunt

Lawrence County Commissioners

Charles Nicholas

Donovan Nicholas

Pope and Talbot, Inc. (Bill Coburn)

Pope and Talbot, Inc. (Jim Hoxie)

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National Agricultural Library
USDA

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Region 8
Environmental Protection Agency

Office of Federal Activities
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